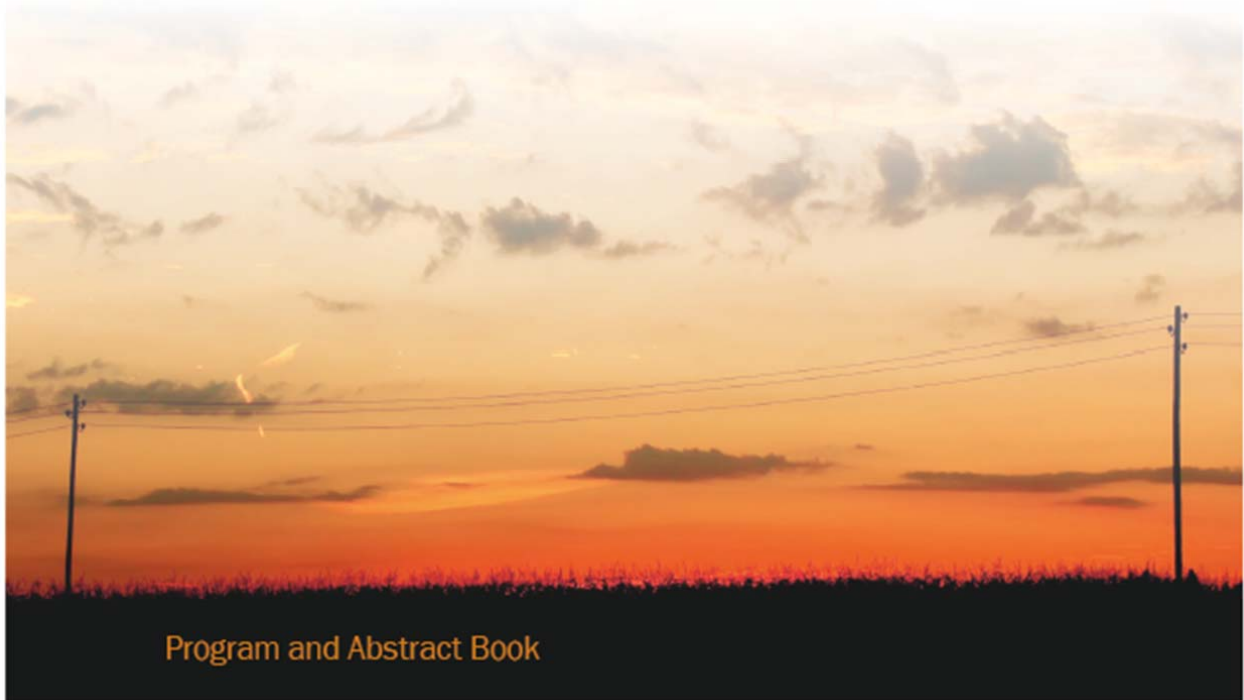


WSF
2015

5th World Sustainability Forum

7 – 9 September 2015

Zentrum für Lehre und Forschung
Basel, Switzerland



Program and Abstract Book

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Welcome by Johann N. Schneider-Ammann

I warmly welcome you to the *5th World Sustainability Forum*. This Forum takes place at a promising moment from a sustainability perspective. The intergovernmental negotiations on both Financing for Development and the 2030-Agenda for Sustainable Development have just been concluded successfully. This opens the way for the official adoption of the 2030-Agenda for Sustainable Development by heads of state and government on the margins of the UN General Assembly later this month. Switzerland welcomes this universal framework for sustainable development, which guides our efforts between now and 2030.

Switzerland has played an active and substantive role in the elaboration of the 2030-Agenda. The 2030-Agenda acknowledges that global challenges such as extreme poverty, environmental degradation and climate change can only be solved if all countries and stakeholders contribute jointly to implement the so-called Sustainable Development Goals, while taking into account the interactions between the social, economic and environmental dimensions of sustainable development. Now that the framework is defined, let us set our sights on its implementation. Switzerland intends to implement it through activities at home and abroad, independently and with partners. The whole government supports the 2030-Agenda in a number of ways.

For instance, the economic cooperation and development of my ministry provides technical assistance to support developing countries in creating better tax systems. As a result, these countries can better raise domestic resources to finance sustainable development. This support is fully aligned with the 2030-Agenda, which underlines that domestic resources are central to the pursuit of sustainable development. Another example involves various ministries: REPIC (Renewable Energy and Energy Efficiency Promotion in International Cooperation) is a platform to support renewable energy and energy efficiency projects by offering seed money and capacity development for promising initiatives run in collaboration with local entrepreneurs in developing countries. In Tajikistan, for example, REPIC is supporting a small hydropower initiative in a remote village, by providing technology and know-how transfer. These examples illustrate how we can contribute to implementing the 2030-Agenda.

As all of us prepare to implement the Agenda for Sustainable Development, I commend you for choosing sustainability as the focus of your work and wish you well in exploring how your efforts can contribute to sustainable development.

Johann N. Schneider-Ammann
Federal Councillor
Basel, 7 September 2015

Welcome by Max Bergman

Most projections turn out to be incorrect, but I know beyond a shadow of a doubt that things will not remain the way they are now. Not even close. For example, what will it be like, only two to three decades from now, to live in a world, where the global population has increased by two to three billion people? What effects will this growth have on national and international economic and social development, especially given that this population growth will not be distributed evenly across regions and nations? What about the environment, or our natural resources? Does this projection spell doom for all, can we prepare for this growth, or are there also opportunities for many individuals, regions, and societies?

The period marked by the UN Millennium Development Goals will end in December 2015. As part of the post-2015 development agenda, the international community has been working intensely on a new set of goals, the UN Sustainable Development Goals, to be adopted at the 70th Session of the UN General Assembly in the second half of September 2015. The new goals, despite their similarity, go beyond the MDGs in that (a) the formulation and focus of the goals are more encompassing, explicitly requiring active participation from wealthy and poor nations alike, and that (b) the overall focus is shifting away from ameliorating the situation of poor and underdeveloped regions and societies toward improving the sustainability of global economic and social development while concurrently protecting the environment.

In the name of the executive committee, the international scientific advisory board, the journal *Sustainability*, and MDPI, it is a great pleasure for me to welcoming you to the World Sustainability Forum in Basel. The World Sustainability Forum aims to be a platform for researchers to present and engage with research-relevant stakeholders on issues relating to sustainability. We seek to contribute to policy-relevant, change-oriented, and transdisciplinary research and collaboration. As part of the output of the Sustainability Forum, we will publish a special issue in *Sustainability*, and we will launch an edited book series, entitled *Frontiers of Sustainability*. With this Sustainability Forum, we, the University of Basel in collaboration with MDPI and our regional, national, and international partners, hope to make a small contribution toward a cultural change toward global sustainability. We thank you, the presenters and participants of this year's Sustainability Forum, for your hard work, interest, and support, and we are looking forward to welcoming you in February 2017 to the next World Sustainability Forum in South Africa.

Max Bergman
Chair, World Sustainability Forum
July 2015

Welcome by Edwin C. Constable

It is a pleasure and an honour to write a word of welcome and introduction to this collection of presentations at the 5th World Sustainability Forum held in Basel 7th-9th September 2015. It is a pleasure because the themes resonate so well with my own areas of interest, and an honour because this event is to be held at the University of Basel.

The year 2015 will be an important one as it marks a significant change and strengthening of the United Nations stand on sustainable growth with the transition from the UN Millennium Development Goals to the new UN Sustainable Development Goals. The emphasis on global involvement of all partners, developed and less developed, in evolving a sustainable development strategy, that at the same time preserves the environment, is an important step forward. Nevertheless, one should also use the occasion to look back 50 years and note that although the Brazilian Government enacted the Brazilian Forests Act in 1965 to protect the Amazonian forests, this piece of legislation has neither been passed into law nor enforced. Sustainable Development requires not only legislation and the passing of UN motions, but also the good will and engagement of all involved partners!

Countries with high standards of living such as Switzerland are the end users of many of the commodities arising from the devastating non-sustainable development in many parts of the world, and must robustly support these proposals in both word and deed.

I am proud to say that the University of Basel identified "Energy and Sustainability" as one of its five focal themes in its strategy paper 2014-2021. In particular, we identified the broad and disparate expertise we have in the themes that define this conference: (i) Sustainable Science, Technology, and Energy, (ii) Sustainable Consumption, Lifestyles, Mobility, and Cities and (iii) Sustainability in Economics, Business, and Management. The recognition that interdisciplinary approaches are critical to success has taken longer than one might anticipate. Scientific advance is not technology deployment, and technology deployment without social acceptance is not possible. Economic sanctions and economic models need to be appropriate to their target populations. Not only do different disciplines need to work together, but also different players need to interact and collaborate. I hesitate to use the much used and abused term Public Private Partnership, but for success, academics, national and multinational organisations, NGOs and Governments need to work intimately and cohesively to implement goals.

One of the criticisms of sustainability research is that it resembles Paul's Epistle to the Corinthians in being "all things to all men". We have to ensure that the diversity of interpretation and understanding does not lead to a dilution and trivialization of the discipline.

I have had the opportunity to read through the abstracts in this book, and I am both inspired by the breadth and engagement of the visions presented and also encouraged that so many first class researchers and organisations are committing to the cause of sustainable development in its broadest sense.

I take this opportunity to wish all those involved in the organisation of the Forum and all those who have participated the very best in their future research, legislative and implementation activities and look forward to hearing the first successes of the UN SDGs at the 6th World Sustainability Forum.

Edwin C. Constable
Vice Rector, University of Basel
July 2015

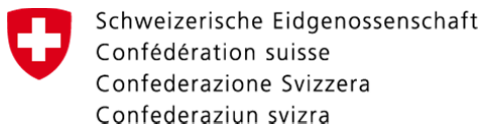
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1

General Information

The 5th World Sustainability Forum (WSF5) will be held from the 7th to the 9th of September 2015 in Basel, Switzerland. It will comprise five streams to cover the most exciting aspects of the UN Millennium Development Goals (MDGs) and the new set of goals, the UN Sustainable Development Goals (SDGs), to be adopted at the 70th Session of the UN General Assembly in the second half of September 2015.

1.1 Conference Topics

- Sustainability in Economics, Business, and Management
- Lifestyle, Consumption, and Mobility
- Environmental Sustainability
- Urbanization and Cities
- Policy and Planning

1.2 Conference Venue

Universitätsspital Basel
Zentrum für Lehre und Forschung (ZLF)
Hebelstrasse 20,
CH- 4031 Basel, Switzerland

1.3 Registration Desk

7th – 9th September 2015
07.30-17.30

Direct Telephone Line: +41 61 265 26 10

1.4 Wireless Internet Access

To connect to the WLAN, select the network "USB_guest_wlan", and open a new browser:
The following page will open, follow the instructions

WILLKOMMEN
USB WLAN FREE INTERNET SERVICE

Besitzen Sie einen gültigen Account, dann klicken Sie auf folgenden [Link](#).

Hier können Sie ein SMS-Account erstellen der für 7 Tage gültig ist.

Captcha: 6P33R

Captcha-Text:

Mobiltelefonnummer:

Senden

Universitätsspital
Basel

1.5 Directions and Map



1.6 Switzerland and the Tri-Region

Basel lies in the heart of Europe, on both banks of the Rhine. The city is the center of the idyllic border triangle of France, Germany and Switzerland—lying between the Swiss Jura, Germany's Black Forest and the Vosges in Alsace.

Basel is so easy to get to. Only a 10-minute drive from the city center, Basel's EuroAirport is served by a number of international airlines. Together with neighboring Zürich Airport, it enjoys connections to all European airports and to more than 200 intercontinental destinations.

Located in the center of Europe, Basel is a major transportation hub. Its three railway stations not only offer excellent connections to far and wide, but are also all situated in the very heart of the city.

Source: www.basel.com

1.7 Basel

Where the Rhine, one of Europe's most important waterways, bends north and flows out of Switzerland towards the North Sea lies the charming city of Basel. This exceptional location at the heart of the three-country-triangle that joins Germany, France and Switzerland is what lends Basel its openness, economic strength and cultural diversity.

Source: www.bs.ch

1.8 Best Connections

As far back as the Middle Ages, Basel became a major transportation hub thanks to its location on the Rhine and in the center of Europe. And still today, there is no way around Basel: The city lies at the intersection of the German and French rail and road networks. The trinational EuroAirport Basel-Mulhouse-Freiburg and the Rhine port connect Basel with the world.

Source: www.bs.ch

1.9 Dynamic Economy

Again thanks to the Rhine, Basel developed into a prosperous center for commerce and trade fairs early on. Today, this city with a total area of only 37 square kilometers, inhabited by 200,000 people from 160 countries, is at the heart of the most dynamic economic region in Switzerland.

Source: www.bs.ch

1.10 Fair Weather City

Next to the rich cultural offerings (museums with a global reputation, theater and concert halls, renowned architecture), the weather adds to the high quality of life: Nestled comfortably in the Rhine valley, Basel enjoys many more days of sunshine than the towns in central Switzerland.

Source: www.bs.ch

1.11 The University of Basel

The University of Basel has an international reputation of outstanding achievements in research and teaching. Founded in 1460, the University of Basel is the oldest university in Switzerland and has a history of success going back over 550 years.

As a comprehensive university offering a wide range of high-quality educational opportunities, the University of Basel attracts students from Switzerland and the entire world, offering them outstanding studying conditions as they work towards their bachelor's, master's or PhD degrees. Today, the University of Basel has around 13,000 students from over a hundred nations, including 2,700 PhD students. The University of Basel has seven faculties covering a wide spectrum of academic disciplines. At the same time, the university has positioned itself amidst the international competition in the form of five strategic focal areas: Life Sciences, Visual Studies, Nanosciences, Sustainability and Energy Research and European and Global Studies. In international rankings, the University of Basel is regularly placed among the 100 top universities in the world thanks to its research achievements.

Source: www.unibas.ch

1.12 The Department of Biomedicine

The Department of Biomedicine (formerly "Department of Biological and Clinical Sciences") was founded in the year 2000, with the idea to create a department that unites the entire laboratory research of the Faculty of Medicine. The founding members in the year 2000 were the University of Basel, the University Hospital Basel, and the University Children's Hospital Basel. The intention was to abolish the barriers and intensify the interactions between the "pre-clinical" and "clinical" research units and to promote excellence in biomedical research. To reflect the tight connection between basic and clinically oriented research, we adopted a new name, "Department of Biomedicine", which since December 2007 replaces our previous name.

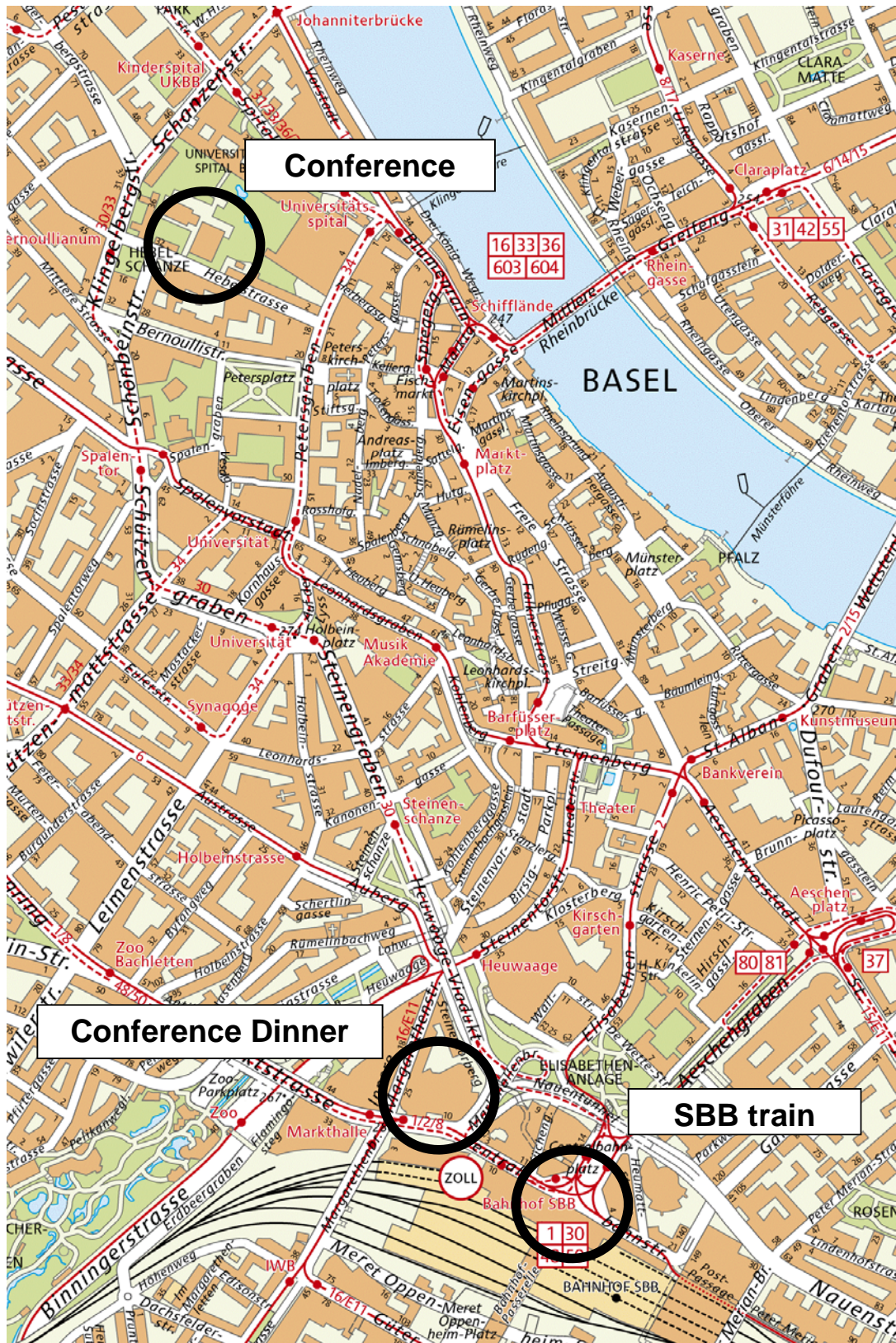
To define the direction, in which future investments should be made, the Faculty of Medicine designated five key (focal) research areas, of which four, Oncology, Immunology, Neurobiology and Stem Cells and Regenerative Medicine, are represented in the Department of Biomedicine. By providing a bridge between basic science and clinical medicine, the Department of Biomedicine is an important component in the University of Basel's strategic plan for Life Sciences.

Key to the success of the Department of Biomedicine is the willingness of our scientists and clinicians to communicate and to strive for excellence. Several core facilities have been established, two of them as a joint venture between our Department and the Biozentrum from the Faculty of Natural Sciences; these provide access to key technologies, such as genomic micro-arrays and knockout mice. The Department's research groups obtain a large proportion of their research funds from competitive grants by foundations in Switzerland, the EU and other countries. More than 60% of the members are supported by third party funds.

The DBM with its five different institutes is situated in the heart of Basel in the vicinity to the downtown and the Rhine. You can reach us by plane (via EuroAirport Basel-Mulhouse-Freiburg), by train (via railway stations Basel SBB or Basel Badischer Bahnhof) or by car.

Source: www.biomedizin.unibas.ch/about-us

1.13 Location



1.14 How to Reach the Venue

Directions Public Transport

From EuroAirport Basel Mulhouse Freiburg to University Hospital Basel Bus 50 to SBB Railwaystation, then take Bus 30 in direction Badischer Bahnhof, leave at station Bernoullianum.

From SBB Railwaystation to University Hospital Basel Bus 30 in direction Badischer Bahnhof, leave at station Bernoullianum.

From Badisch Bahnhof DB train station to University Hospital Basel Bus 30 direction Bahnhof SBB, leave at station Bernoullianum.

By Car

From the A2/A3, follow the signs

Basel-Süd/City

Exit Basel-Süd/West Universitätsspital

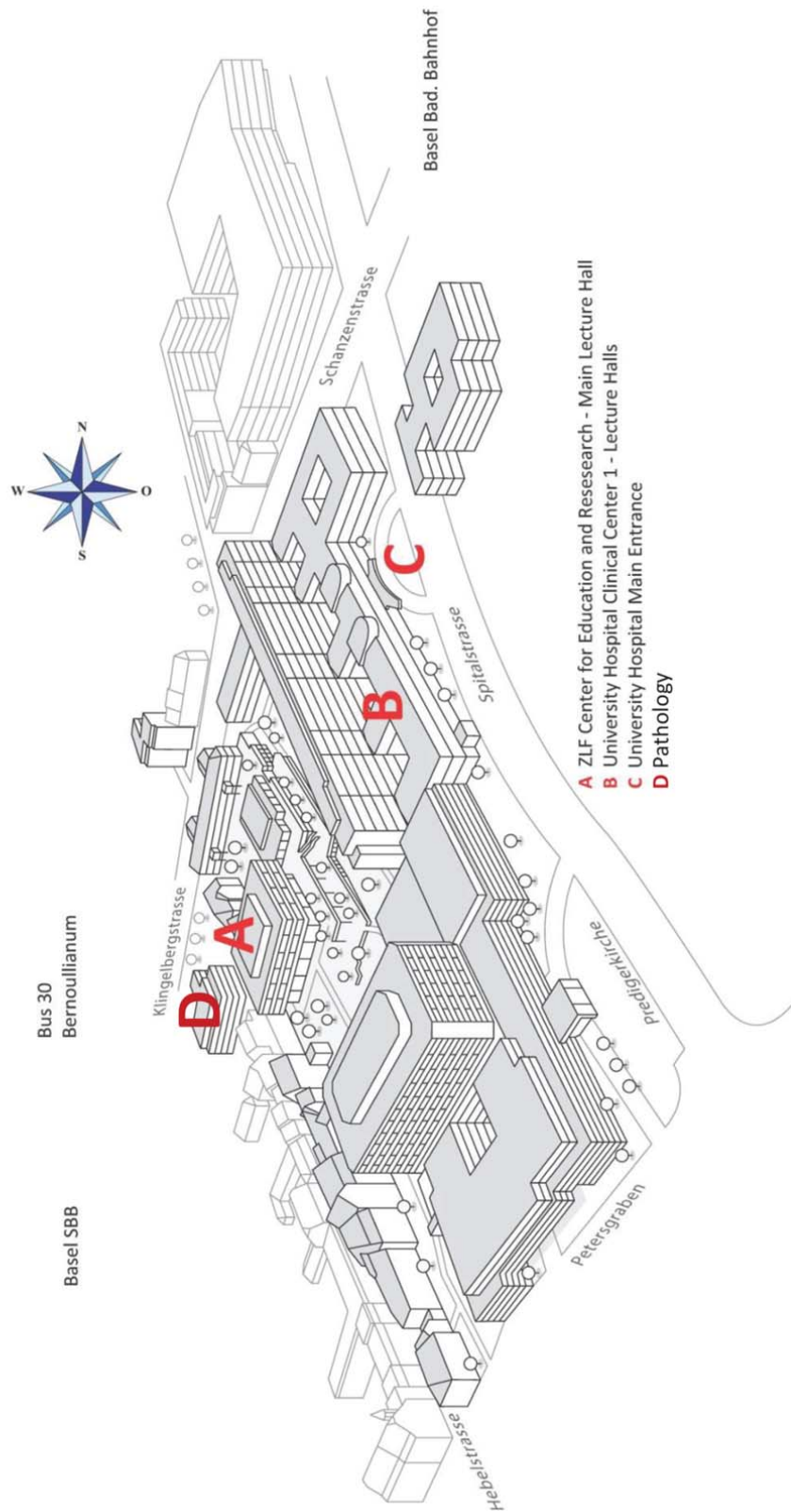
Universitätsspital

City-Parking

GPS: Parkhaus City, Klingelbergstrasse, Basel

Source: <https://www.unispital-basel.ch/en/patients-visitors/how-to-find-us/>

1.15 Inside the Venue



1.16 Visiting Basel and Dining Out

It is not easy to describe Basel in a few words. Descriptions for example such as “cultural city of Switzerland” or “University town” are merely an attempt to give some sort of impression of the wealth of culture, history, relaxation and enjoyment to be found in the city. Whether it is a visit to one of the numerous museums, a dip in the Rhine or an evening at the theater, allow yourself to be inspired by the joys that await you. We hope you have a fantastic time here in Basel.

Art and Culture

Fondation Beyeler—www.fondationbeyeler.ch

In building Renzo Piano’s museum in 1997, the Fondation Beyeler made its collection accessible to the public. The 250-odd works of classic modernism reflect the views of Hildy and Ernst Beyeler on 20th-century art and highlight features typical of the period: from Monet, Cézanne and van Gogh to Picasso, Warhol, Lichtenstein and Bacon. The paintings appear alongside tribal art from Africa, Oceania and Alaska.

Museum Tinguely—www.tinguely.ch

Situated directly on the Rhine, the Museum Tinguely, built according to plans by the Ticinese architect Mario Botta, houses the greatest collection of works by Jean Tinguely (1925–1991), one of the most innovative and important Swiss artists of the 20th century. The permanent exhibition presents a survey of his oeuvre spanning four decades. Special exhibitions show a wide range of artists and subjects including Marcel Duchamp and Kurt Schwitters who influenced Tinguely significantly, companions such as Arman, Niki de Saint Phalle, Yves Klein as well as current art trends along Tinguely’s ideas.

Vitra Design Museum—www.design-museum.de

The Vitra Design Museum numbers among the world’s most prominent museums of design. It is dedicated to the research and presentation of design, past and present, and examines its relationship to architecture, art and everyday culture. In the main museum building by Frank Gehry, the museum annually mounts two major temporary exhibitions. In conjunction with our alternating exhibitions, the Vitra Design Museum offers a variety of workshops and guided tours. Source: www.basel.com/en

Suggestions of Restaurants in Basel—www.basel.com

***Kohlmanns*—www.kohlmanns.ch**

It smells of fire, wood and freshly baked goods. The restaurant with its modern oak furniture is extremely cozy and is situated right at the Barfüsserplatz. *Kohlmanns* offers hearty Swiss and surprising regional specialties.

***Brasserie au Violon*—www.au-violon.com**

Lively brasserie with traditional and seasonal French cuisine served in a former prison.

***Zum Braunen Mutz*—www.braunermutz.ch**

The traditional tavern with bar and restaurant. Here you will meet original Basel locals of all generations.

***Der vierte König*—www.weinwirtschaft.ch**

In the restaurant *Der vierte König* you will find freshly cooked meals and a fine selection of bottled wines from all over the world—also available by the glass.

***Kunsthalle*—www.restaurant-kunsthalle.ch**

The traditional restaurant *Kunsthalle*, where “Tout Bâle” feels at home serves seasonal delicacies.

***Käfer Stube cuisine des alpes*—www.kaefer-schweiz.ch**

Gourmet restaurant with regional products from all the alpine countries.

***Cheval Blanc*—www.lestoisrois.ch**

Refined seasonal cuisine and a selected wine list. Awarded with 19 points Gault-Millau and two Michelin stars. Summer terrace with a great view of the Rhine.

***Chez Donati*—www.lestoisrois.com**

For more than 50 years, the *Chez Donati* is an esteemed institution and the essence of fine Italian table culture in Basel.

***Brasserie Les Trois Rois*—www.lestoisrois.com**

The relaxed atmosphere and Swiss and French brasserie specialties make the city restaurant in the *Les Trois Rois*, a 5-star-superior deluxe hotel, a popular all-day rendezvous.

***Atelier (Der Teufelhof)*—www.teufelhof.com**

The restaurant charms by its modern and inspiring ambience. Enjoy a modern international cuisine with predominantly Swiss and regional products.

***Les Quatre Saisons*—www.lesquatresaisons.ch**

Treat yourself to some culinary delights in the newly renovated Restaurant *Les Quatre Saisons*. Head chef Peter Moser and his team apply a fresh sense of inspiration and a high level of commitment to their dishes, bringing together all of the elements necessary to create their unique cuisine—ingredients fresh from the market, original recipes and a great deal of passion.

Suggested Events

Disney The Lion King—www.thelionking.ch

Be transfixed by powerful African rhythms, the warm glow of the Serengeti and timeless hits including «Circle of Life» and «Can You Feel the Love Tonight» by Sir Elton John and Sir Tim Rice. Experience the magnificent musical about Simba and his adventurous journey from innocent lion cub to King of the Pridelands in its English original production.

Holbein. Cranach. Grünewald. Masterpieces from the Kunstmuseum Basel – www.kunstmuseumbasel.ch/en


If the Kunstmuseum Basel enjoys global renown today, this is essentially due to its collection of works by Hans Holbein the Younger, the world's largest in a single museum. It was in Basel that Holbein's genius achieved full realization. The treasure of pictures he left behind also inspired the city's residents who successively enlarged the collection with masterpieces of the late Middle Ages and the Renaissance.

Cézanne to Richter. Masterpieces of the Kunstmuseum Basel— www.kunstmuseumbasel.ch/en

Basel's public art collection is of outstanding importance, especially in terms of the late 19th century and classical modernism.

The large Oberlichtsaal and adjacent rooms of the Museum für Gegenwartskunst (Museum of Contemporary Art) is staging masterpieces from Paul Cézanne to Gerhard Richter. This wide-ranging overview vividly illustrates the main artistic developments in European painting up to the 1970s. The chronology serves as a guide to the 70 or so works which are less a didactic sequence of artistic movements and more a simultaneity of otherness that characterizes the modern period. The first works are by French artists who were seeking new visual languages beyond academic painting. The work by Paul Cézanne stands as an example of dogged artistic research.

1.18 Emergency Information

	Notruf Appel d'urgence Numeri di emergenza Distress call	112		Feuerwehr Sapeurs-Pompiers Vigili del fuoco Fire	118
	Polizei Police Polizia Police	117		Sanität Service sanitaire Emergenza sanitaria Ambulance	144

Other useful numbers

Medical Emergency Center +41 (0) 61 261 15 15

REGA air rescue service 1414

2

Conference Program

2.1 Program by Streams

Stream 1 – Policy and Planning

Monday, 7 September 2015

08:30–09:00	Welcome: Prof Ed Constable and Prof Max Bergman
09:15–10:15	Environmental Policy Coffee Break
10:45–12:15	Environmental Policy (continued) Lunch – Poster Sessions
18:00–19:00	Keynote: Jeffrey Sachs, The Earth Institute, Columbia University

Tuesday, 8 September 2015

13:30–14:30	Keynote: Klaus Leisinger, Global Values Alliance Foundation: <i>Corporate Sustainability, Global Values and Pluralistic Societies: What can we know? What ought we to do? What may we hope?</i>
17:30–19:00	Urban Policy
19:00	Conference Dinner

Wednesday, 9 September 2015

08:30–09:30	Keynote: Marc Rosen, University of Ontario Institute of Technology, Canada: <i>Potential Contributions to Sustainability of Net-zero Energy Buildings and Communities</i>
09:45–11:15	Developing Appropriate High Level Capacity in Africa to Achieve Sustainable Development
09:45–10:45	Funding Mechanisms for Sustainability Practices Coffee Break
11:15–12:45	Funding Mechanisms for Sustainability Practices (continued) Lunch – Poster Sessions
14:00–15:00	Keynote: Aldo Stroebel, National Research Foundation, South Africa: <i>Towards Impact and Resilience: Innovative Funding Partnerships for Sustainable Development in Africa</i>
15:15–16:45	Energy Policy and Forecasting Coffee Break
17:15–18:15	The Elusive Search for Sustainable Anti-Corruption Strategies: What have we Overlooked?

Stream 2 – Urbanization and Cities

Monday, 7 September 2015

08:30–09:00	Welcome: Ed Constable and Max Bergman Coffee Break
11:15–12:45	Sustainable Life-Cycle Analysis of Buildings Lunch – Poster Sessions
13:30–15:30	Sustainable Retrofitting of Buildings [and] Sustainable Construction Methods Coffee Break
16:00–17:30	Transformational Solutions for Sustainable Future Cities [and] Climate Change and Urban Form
16:15–17:45	The Challenges and Opportunities of Rapid Urban Development
18:00–19:00	Keynote: Jeffrey Sachs, The Earth Institute, Columbia University

Tuesday, 8 September 2015

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10:30–12:30	Urban Planning Lunch – Poster Sessions
13:30–14:30	Keynote: Klaus Leisinger, Global Values Alliance Foundation: <i>Corporate Sustainability, Global Values and Pluralistic Societies: What can we know? What ought we to do? What may we hope?</i>
14:45–17:00	Urban Planning (continued)
19:00	Conference Dinner

Wednesday, 9 September 2015

08:30–09:30	Keynote: Marc Rosen, University of Ontario Institute of Technology, Canada: <i>Potential Contributions to Sustainability of Net-zero Energy Buildings and Communities</i> Coffee Break
11:15–12:45	Time and Space Studies Lunch – Poster Sessions
14:00–15:00	Keynote: Aldo Stroebe, National Research Foundation, South Africa: <i>Towards Impact and Resilience: Innovative Funding Partnerships for Sustainable Development in Africa</i>

Stream 3 – Environmental Sustainability

Monday, 7 September 2015

08:30–09:00	Welcome: Ed Constable and Max Bergman
09:15–10:15	Farming Coffee Break
10:45–11:45	Farming (continued) Lunch – Poster Sessions
14:00–15:30	Optimizing Farming [and] Potential of Payments for Environmental Services to Improve Livelihoods of Small-scale Farmers Coffee Break
16:00–17:30	Sustainable Agricultural Production
18:00–19:00	Keynote: Jeffrey Sachs, The Earth Institute, Columbia University

Tuesday, 8 September 2015

08:30–09:30	Food Sustainability
08:30–10:00	Alternative Energy Sources Coffee Break
10:00–13:00	Enhancement of Ecosystem Services Governed by Soil through Sustainable Management
10:30–11:30	Alternative Energy Sources (continued) Lunch – Poster Sessions
13:30–14:30	Keynote: Klaus Leisinger, Global Values Alliance Foundation: <i>Corporate Sustainability, Global Values and Pluralistic Societies: What can we know? What ought we to do? What may we hope?</i>
14:45–15:45	Socioecological Metabolism and Sustainability
14:45–16:15	Developing Sustainable Water Systems Coffee Break
16:45–18:15	Water Insecurity [and] Assessment of Small Island Developing States Vulnerability-Resilience Face to Global Changes
19:00	Conference Dinner

Wednesday, 9 September 2015

08:30–09:30	Keynote: Marc Rosen, University of Ontario Institute of Technology, Canada: <i>Potential Contributions to Sustainability of Net-zero Energy Buildings and Communities</i>
9:45–11:15	Farming Practices (Water) Coffee Break
11:30–13:30	Waste-Water Management Lunch – Poster Sessions
14:00–15:00	Keynote: Aldo Stroebel, National Research Foundation, South Africa: <i>Towards Impact and Resilience: Innovative Funding Partnerships for Sustainable Development in Africa</i>
15:15–17:15	Ecosystem Conservation [and] Natural Resources Coffee Break
17:15–18:15	Livestock
17:45–18:45	Irrigation

Stream 4 – Lifestyle, Consumption, and Mobility

Monday, 7 September 2015

08:30–09:00	Welcome: Ed Constable and Max Bergman
09:15–11:15	Engaging the Public: Renewable Energy
09:15–10:45	Global Health and Sustainability: Ensuring People and Ecosystems Health Coffee Break
11:45–12:45	Individual Behaviour & Sustainability Lunch – Poster Sessions
13:30–15:00	Attitudes, Behaviours, and Lifestyle Coffee Break
15:30–17:30	Transitioning towards Sustainability
18:00–19:00	Keynote: Jeffrey Sachs, The Earth Institute, Columbia University

Tuesday, 8 September 2015

08:30–09:30	Health-Related Consumption and Lifestyle Coffee Break
10:00–11:30	The Quest for Theoretical and Conceptual Frameworks in Sustainable Lifestyles and Consumption Lunch – Poster Sessions
13:30–14:30	Keynote: Klaus Leisinger, Global Values Alliance Foundation: <i>Corporate Sustainability, Global Values and Pluralistic Societies: What can we know? What ought we to do? What may we hope?</i>
14:45–16:45	Mobility Systems Coffee Break
16:15–17:45	Cultural Values and Sustainability
17:15–18:45	Mobility and Access
19:00	Conference Dinner

Wednesday, 9 September 2015

08:30–09:30	Keynote: Marc Rosen, University of Ontario Institute of Technology, Canada: <i>Potential Contributions to Sustainability of Net-zero Energy Buildings and Communities</i> Lunch – Poster Sessions
14:00–15:00	Keynote: Aldo Stroebel, National Research Foundation, South Africa: <i>Towards Impact and Resilience: Innovative Funding Partnerships for Sustainable Development in Africa</i>
15:15–16:45	Case Studies on Sustainable Consumption

Stream 5 – Sustainability in Economics, Business, and Management

Monday, 7 September 2015

08:30–09:00	Welcome: Ed Constable and Max Bergman
09:15–10:15	Technological Innovation Coffee Break
10:45–12:15	Sustainable Manufacturing Lunch – Poster Sessions
14:45–15:45	Managing Business Impacts on Sustainable Development – Corporate Responsibility and the SDGs Coffee Break
16:15–17:45	Managing Business Impacts on Sustainable Development – Corporate Responsibility and the SDGs (continued)
18:00–19:00	Keynote: Jeffrey Sachs, The Earth Institute, Columbia University

Tuesday, 8 September 2015

08:30–10:30	Corporate Management and Sustainability Coffee Break
11:00–12:30	Corporate Management and Sustainability (continued) Lunch – Poster Sessions
13:30–14:30	Keynote: Klaus Leisinger, Global Values Alliance Foundation: <i>Corporate Sustainability, Global Values and Pluralistic Societies: What can we know? What ought we to do? What may we hope?</i>
14:45–16:45	Economic Assessment of Sustainability Coffee Break
17:15–18:45	Assessing Sustainability
19:00	Conference Dinner

Wednesday, 9 September 2015

08:30–09:30	Keynote: Marc Rosen, University of Ontario Institute of Technology, Canada: <i>Potential Contributions to Sustainability of Net-zero Energy Buildings and Communities</i>
09:45–11:15	The Role of Private Enterprise Coffee Break
11:45–13:15	(Contrasting) Approaches to CSR
11:45–13:15	Sourcing and Material Flows Lunch – Poster Sessions
14:00–15:00	Keynote: Aldo Stroebe, National Research Foundation, South Africa: <i>Towards Impact and Resilience: Innovative Funding Partnerships for Sustainable Development in Africa</i>
15:15–17:15	CSR Principles and Guidelines Coffee Break
17:45–18:45	CSR principles and Guidelines (continued)

2.2 Program by Day

Monday, 7 September 2015									
Stream 1	Time	Stream 2	Time	Stream 3	Time	Stream 4	Time	Stream 5	Time
		Welcome: Ed Constable and Max Bergman							08:30-09:00
Pathologie Hörsaal oben		Universitätsspital Hörsaal 1		Universitätsspital Hörsaal 2		ZLF Sitzungszimmer PSR		Pathologie Hörsaal unten	
Environmental Policy	09:15-10:15	Global Health and Sustainability: Ensuring People and Ecosystems Health [Stream 4: <i>Lifestyle, consumption, and mobility</i>]	09:15-10:45	Farming	09:15-10:15	Engaging the Public: Renewable Energy	09:15-11:15	Technological Innovation	09:15-10:15
		Coffee Break							
Environmental Policy (continued)	10:45-12:15	Sustainable Life-Cycle Analysis of Buildings	11:15-12:45	Farming (continued)	10:45-11:45	Individual Behaviour & Sustainability	11:45-12:45	Sustainable Manufacturing	10:45-12:15
		Lunch – Poster Sessions							
		Sustainable Retrofitting of Buildings [and] Sustainable Construction Methods	13:30-15:30	Optimizing Farming [and] Potential of Payment for Environmental Services to Improve Livelihoods of Small-scale Farmers	14:00-15:30	Attitudes, Behaviours, and Lifestyle	13:30-15:00	Managing Business Impacts on Sustainable Development – Corporate Responsibility and the SDGs	14:45-15:45
		Coffee Break							
The Challenges and Opportunities of Rapid Urban Development [Stream 2: <i>Urbanization and Cities</i>]	16:15-17:45	Transformational Solutions for Sustainable Future Cities [and] Climate Change and Urban Form	16:00-17:30	Sustainable Agriculture Production	16:00-17:30	Transitioning towards Sustainability	15:30-17:30	Managing Business Impacts on Sustainable Development – Corporate Responsibility and the SDGs (continued)	16:15-17:45
		Keynote: Jeffrey Sachs, The Earth Institute, Columbia University							18:00-19:00

Tuesday, 8 September 2015

Combined Streams	Time	Combined Streams	Time	Stream 3	Time	Stream 4	Time	Stream 5	Time
Universitätsspital Hörsaal 1		Pathologie Hörsaal oben		Universitätsspital Hörsaal 2		ZLF Sitzungszimmer PSR		Pathologie Hörsaal unten	
Food Sustainability [Stream 3: Environmental Sustainability]	08:30-09:30	Urbanization [Stream 2: Urbanization and Cities]	08:30-10:00	Alternative Energy Sources	08:30-10:00	Health-Related Consumption and Lifestyle	08:30-09:30	Corporate Management and Sustainability	08:30-10:30
Enhancement of Ecosystem Services Governed by Soil through Sustainable Management [Stream 3: Environmental Sustainability]	10:00-13:00	Coffee Break		Alternative Energy Sources (continued)	10:30-11:30	The Quest for Theoretical and Conceptual Frameworks in Sustainable Lifestyles and Consumption	10:00-11:30	Corporate Management and Sustainability (continued)	11:00-12:30
Lunch – Poster Sessions									
Keynote: Klaus Leisinger, Global Values Alliance Foundation: <i>Corporate Sustainability, Global Values and Pluralistic Societies: What can we know? What ought we to do? What may we hope?</i>									
Socioecological Metabolism and Sustainability [Stream 3: Environmental Sustainability]	14:45-15:45	Urban Planning (continued) [Stream 2: Urbanization and Cities]	14:45-17:00	Developing Sustainable Water Systems	14:45-16:15	Mobility Systems	14:45-16:45	Economic Assessment of Sustainability	13:30-14:30 14:45-16:45
Cultural Values and Sustainability [Stream 4: Lifestyle, Consumption, and Mobility]	16:15-17:45	Coffee Break		Water Insecurity [and] Assessment of Small Island Developing States Vulnerability-Resilience Face to Global Changes	16:45-18:15	Mobility and Access	17:15-18:45	Assessing Sustainability	17:15-18:45
Conference Dinner									
									19:00

Wednesday, 9 September 2015

Stream 1	Time	Combined Streams	Time	Stream 3	Time	Combined Streams	Time	Stream 5	Time	
		Keynote: Marc Rosen, University of Ontario Institute of Technology, Canada: <i>Potential Contributions to Sustainability of Net-zero Energy Buildings and Communities</i>								
Pathologie Hörsaal oben		ZLF Sitzungszimmer PSR		Universitätsspital Hörsaal 2		Pathologie Hörsaal unten		Universitätsspital Hörsaal 1		
Funding Mechanisms for Sustainability Practices	09:45-10:45		09:45-11:15	Farming Practices (Water)	09:45-11:15	Developing Appropriate High Level Capacity in Africa to Achieve Sustainable Development [Stream 1: Policy and Planning]	09:45-11:15	The Role of Private Enterprise	09:45-11:15	
Funding Mechanisms for Sustainability Practices (continued)	11:15-12:45	Coffee Break	11:15-12:45	Waste-Water Management	11:30-13:30	Sourcing and Material Flows [Stream 5: Sustainability in Economics, Business, and Management]	11:45-13:15	(Contrasting) Approaches to CSR	11:45-13:15	
Lunch – Poster Sessions										
Keynote: Aldo Stroebe, National Research Foundation, South Africa: <i>Towards Impact and Resilience: Innovative Funding Partnerships for Sustainable Development in Africa</i>										
Energy Policy and Forecasting	15:15-16:45	Case Studies on Sustainable Consumption [Stream 4: Lifestyle, Consumption, and Mobility]	15:15-16:45	Ecosystem Conservation [and] Natural Resources	15:15-17:15	CSR Principles and Guidelines	15:15-17:15			
The Elusive Search for Sustainable Anti-Corruption Strategies: What have we Overlooked?	17:15-18:15	Livestock [Stream 3: Environmental Sustainability]	17:15-18:15	Irrigation	17:45-18:45	CSR Principles and Guidelines (continued)	17:45-18:45			

3

Oral Presentation

Abstracts

Stream 1:
Policy and Planning

Evaluating Development Policies Presence in Mass Media: Understanding the Communication Breach in the Global South Discussion

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The present paper focuses on the Millennium Development Goals (MDG) and climate change policies as key concepts in order to analyze the development hegemonic framework. For that, a collection of documents was first retrieved from the Internet, using different keywords and Internet engines. The documents were analyzed in a first round in order to collect an update the keyword list, in line with the objectives. A classification of the documents was done, in order to assess their relevance based on content analysis. These keywords were then used in a second round, by studying the frequency of associations between the concepts of development and climate change and selected countries. This part was done both manually (supervised search) as well as automatically (non-supervised search). Subsequently the data was classified by repetitions weights, and correlated with the financial support in these countries by the main development agencies including Development Agency of France (AFD), European Union, Finnish Department for International Development Co-operation (FINIDA), Spanish Agency for International Cooperation and Development (AECID), Swedish International Development Cooperation Agency (SIDA), United Nations, USAID, and World Bank Furthermore, hegemony development framework theory was quantitatively analyzed: the differences between the hegemony discourse centers in the global North and the South are analyzed in the frame of the global discussion on climate change and development goals. The results revealed a high concentration of policy discussions (hotspots) in developed countries, certain emerging countries, and several areas of Central and South America. The analysis performed showed that there was a certain degree of correlation between the data retrieved automatically from the Internet and the amount of ODA for each country. Climate change is more present in northern media while the global south appears to be more focused on MDGs. Maps using this data for performing indices and correlations were created and discussed. How ODA influences development hegemony is also contrasted with previous research. Although more periodical repetitions are possibly needed to get more solid conclusions, the methods and results of this paper can serve as a basis of further research, in order, to understand ODA impact on policy discussion and hegemony in the global media.

*attendance not confirmed

Implementation of Sustainability in Municipal Governments by an Actor and Process Centered Approach

Clotilde Jenny, Gerhard Schneider

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A number of recent studies show that Local Agenda 21 did not really succeed in catching on in local governments, or came to a standstill, and has to be revived and to find its way into everyday political practice.

In the Swiss context, Schneider *et al.* published an inventory of organizational practices in terms of sustainability approaches, including an overview of achievements obtained and obstacles encountered. The sample chosen represented 14% of French-speaking municipalities of Western Switzerland using a sustainability approach.

The results reveal a waning of Local Agenda 21; principle reasons being:

1. A general lack of integration of the approach into municipal management,
2. A number of individual methods and instruments without integration or links between them,
3. A lack of thread and strategy, and
4. A great number of heterogeneous and punctual actions, sometimes without any link between them, and in all cases without any evaluation of what had been achieved.

The present study has its focus on two distinctive objectives:

5. A confirmation of the above results on a national level,
6. Development and evaluation of the feasibility of a new and innovative approach in order to integrate sustainable development in the heart of municipal management, in a pilot study with a small number of municipalities.

That new approach is centered on the activities, processes and actors of municipal government and will permit:

- to identify and categorize principal activities and processes of municipal management, their actors, and their environmental impact,
- to choose and prioritize the activities where an optimization of environmental performance is possible and
- to identify the indicators and the conditions that permit a successful integration of sustainability into the activities and decisions of the actors concerned.

Policy and Planning
Environmental Policy

In the pilot study, only environmental performance will be taken into consideration, as evaluation of environmental performance seems to be an easier quantity to measure in a first step.

Within a small sample of municipalities of both principle lingual regions in Switzerland, one activity is chosen in each municipality, its environmental impact determined, and criteria and indicators developed in order to improve the environmental performance. The criteria and indicators developed in one municipality are tested by the other municipalities.

Power Dynamics of Domestic and Donor Bureaucracies Due to Effects of Internationally Induced Sustainable Forest Management Policies in Bangladesh

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This research analyses the effects of internationally induced sustainable forest management policies on the power of the main domestic and donor bureaucracies in Bangladesh. In our analytical framework, we combine concepts from *power theory of development policy analysis* (Krott et al., 2013), the theory of *bureaucratic politics to increase organization power*, and the *problem-solving policy and policy process*. We analyze the power dynamics of domestic and donor bureaucracies using policy data (122 policies) from 1992-2014 on sustainable forest management issue in Bangladesh. Each policy was analyzed employing the qualitative content analysis method and identified the strategic tasks; power elements resulting from these tasks, the assigned state bureaucracies responsible for implementing the task, and the policy year. A strategic task for one bureaucracy consists of task on each of the three problem-solving policy cycles (*i.e.*, formulation, implementation and monitoring) under distinctive policies. All strategic tasks identified were further categorized into types of tasks and related power features in order to make the tasks comparable and of equal importance. The analysis identifies powerful domestic (e.g., Bangladesh Forest Department, Ministry of Environment and Forests, Department of Environment and Planning Commission) and donor bureaucracies (e.g., Asian Development Bank, World Bank, United Nations Development Program and United States Agency for International Development) in terms of dominant information, incentives and coercion power elements they hold on sustainable forest management issues. The results suggest that the power elements vary for different bureaucracies and that the bureaucracy either gains or loses power over time. The findings can help other national and international actors to find the most suitable bureaucracies and form a coalition that is truly interested in policy formulation and implementation. The policy makers may also intervene appropriately in distributing/redistributing tasks among the actors to achieve sustainability. The methodology developed in this research would be useful for comparative studies with other countries on various land use issues.

The Exclusive Nature of Inclusive Growth in Rural Northern Ethiopia

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In the last couple of decades, notions of inclusive growth and productive employment dominate development policy. From this perspective, the informal sector as a whole is condemned for not being sufficiently productive, that is, for failing to lift household income above a measurable poverty threshold. However, the poor undertake a range of non-marketed activities that are highly productive in their contribution to household and community self-reliance. Some of those activities will be devalued and undermined when inclusive growth attempts to bring the entire informal sector into the fold. This paper therefore asks how the agenda of inclusiveness will affect the various economic activities undertaken by households, and how households in different economic strata might respond. Our case study takes place in Tigray, one of the nine regional states of Ethiopia. Participatory wealth rankings were undertaken in four *tabia* (the smallest administrative units) and were followed by semi-structured interviews with households from the different wealth groups. Their activities were recorded and classified according to a conceptualization of different forms of work, based on the work of Gorz, Illich, Wheelock, and others. Preliminary results show the heterogeneous character of informal work and shed light on the meaning of productivity. Such interpretations are essential to the formulation of development goals, as there is a risk that inclusiveness may be achieved by replacing activities that count with activities that can be counted.

The Blue Plan: An Environmental Action for Sustainability. The Reconquest of a Waterfront Through Coastal River Decontamination (Oued El Harrach), Algiers, Algeria

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² *Professor, Polytechnic School of Architecture and Urbanism, Algiers Algeria.*

The rehabilitation strategy of Algiers aims to transform the capital into a "pearl of the Mediterranean". The master plan for this strategy, which goes from 2009 to 2029, is divided into four stages, of five years each. The first of these phases, 2009-2014, is mainly focused on the recapture of the capital's waterfront. This plan fits within the framework of the development plan of Algiers bay, and complies, for the first time, with a global vision, over the very long term; the plan aims to organize, in a progressive but sustained way, the city of Algiers. The most important action to consider in this project is the clean-up of a coastal river (Oued El Harrach), which causes a real problem for the capital's environment. In fact, the foul odors that emerge from this place are a nuisance to the bordering residents, passengers, and motorists (especially during the summer season). The river is partially responsible for the negative and stereotyped image of Algiers as a dirty place; this stereotype has, for a long time, been conveyed in the imaginations of the capital's inhabitants. The river's location occupies a privileged place in the urban framework of the capital and overlooks the sea, among other vistas. Many factors require special attention and a new approach for dealing with space, so as to enhance Algiers' ranking as a resort center for tourism and relaxation. Thus, one has to allow for the emergence of an ecological system in the inner city, as opposed to living with the polluted status quo. This article will explain, through an analytical approach using data, how a new strategy based on urban renewal policy will participate in achieving sustainable targets, so as to meet environmental requirements in the first place. This article will also concern how such an operation is keen to provide the capital with a new image as a new Metropolis in the context of the Mediterranean basin.

The Potential of Large-Scale Forestry Projects to Contribute to an Equal Rural Development: An Evaluation of Camellia Forestry in China

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While internationally, large-scale, forestry projects have gained in importance for climate change mitigation, poverty alleviation and in reversing loss of environmental resources, the implementation of projects, particularly in regions with smallholder forestry like Southeast and East Asia, faces various obstacles. One important obstacle is that large-scale projects cannot directly reach down to smallholders, but that “project implementation regimes” need to be established in which intermediaries set up the project together with smallholders. These implementation regimes have important consequences for the access to a project and in how much smallholders will (equally) benefit from the project. Equality is a key element of sustainable development (Brown and Corbera 2003), and once equality is provided, large-scale forestry projects can contribute to poverty alleviation among those living in mountainous areas, being one of the most vulnerable regions. Using the example of two (inter)national camellia plantation projects in China, this research analyzes the effects of different forestry project implementation regimes on the access and distribution of project benefits. Empirical research was undertaken in thirty villages in three counties of the Jiangxi province, China, applying semi-structured stakeholder interviews and a survey among 308 smallholders. Results show that five implementation regimes can be distinguished, varying in their stakeholder constellations and institutional set-up. Those regimes that are carried out by individuals or a limited number of individuals do not perform well in terms of project access and an equal distribution of benefits. However, in regimes that are carried out by a village community, village leaders and participating companies may seize substantial benefits from the project, reducing the benefits for marginal smallholders. Results inform policy by identifying different types of implementation regimes and their potential to support an equal rural development.

The Global Convergence of Resource Consumption Levels through Resource Use Reduction Policies in Developed Countries

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Human environmental impacts are exponentially increasing, along with the rapid growth of the scale of economic activities. It has been pointed out that the scale of our economic activities has already surpassed some planetary boundaries. At the same time, we face serious under-consumption problems in terms of extreme poverty, in spite of international efforts, such as the Millennium Development Goals. Achieving sustainable consumption and production, so as to not exceed planetary boundaries, is crucial for addressing challenges for both developed countries, which are supposed to be in over-consumption (from the perspective of environmental capacity) and developing countries, which suffer from under-consumption. This study contends that equity of resource use is an important aspect of sustainability (in addition to resource efficiency), and that resource use reduction in developed countries could facilitate the convergence of resource consumption at the appropriate level. This study employs a resource cap on iron ore use, as implemented through a resource tax in developed countries, and demonstrates the possibility of a strong decoupling of welfare improvement from resource use, based on a quantitative policy impact assessment using the global recursive dynamic computable general equilibrium model. Simulation results show that the aggregate equivalent variations of policy implementing countries (*i.e.*, developed countries) increase, and that consequently, a strong decoupling between welfare level and resource use at the aggregate level is achieved. In addition, this policy mitigates international resource competition and promotes the convergence of iron ore consumption, while allowing emerging/developing countries to increase resource use.

The Strategic Aspects of an Eco-Logistic Chain Optimization

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The result of ecological aspects being taken into consideration in human activities, with the aim of optimizing delivery chains, is an intention to close the loop of deliveries. One way to achieve this aim is to apply the concept of eco-logistics. While waste constitutes one of the main elements of eco-logistics, it poses the most serious threat to the natural environment. The Polish state's ecologic policy for 2002–2010 was a document that supported the activities of communes aimed at environmental protection. Long-term objectives are to be realized within the framework of the Strategy of the Sustainable Development of Poland by the Year 2025. In this article, an attempt was undertaken to critically interpret American and European views in this area. This paper also provides an evaluation of the functioning of eco-logistics in a selected commune (a case study) as well as a projection of an optimization of an eco-logistic chain model.

Lake Drying and Livelihood Dynamics: Unravelling Limits to Sustainable Livelihood Security in the African Small Lake Chad

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Ecosystem services of lake systems are critical to human livelihoods. Little is known about how lake depletion fits among the suite of stressors confronting agricultural populations in conflict-prone regions and whether locally-evolved responses are suggestive of locally-adapted solutions that enhance well-being. This study draws on empirical, mixed-method field research to: 1) understand the influences of the Small Lake Chad on farming, fishing and pastoral livelihood groups in relation to livelihood drawbacks and opportunities, and the major mechanisms that have shaped these influences; 2) identify the diverse suite of stressors affecting households and where the Small Lake Chad fits among these; and 3) unpack the diverse portfolio of responses and whether they reflect locally adapted solutions. We find that the dynamics of the Small Lake Chad have influenced all livelihood groups resulting in low asset profiles, reduced productivity and limited opportunities to accumulate assets. Conflict, climate variability and institutional instability are already having negative impacts on livelihoods. Adaptive responses are wide-ranging and driven by local knowledge of the opportunities presented by seasonal trends. Findings indicate that households are not adapting well to changing conditions. Increased deprivation, limited access to external support, and frequent aggressive behaviours constrain human well-being. Allowing water scarcity to escalate challenges of increasing climate impacts, conflict events and governance challenges, will create barriers to human well-being in resource-limited regions and block pathways out of deprivation. Interventions need to minimize the major mechanisms through which water depletion limits livelihood opportunities. Addressing the manner in which lake environments act as a cover for extremists activities will help to enhance livelihood security, creating an enabling context of cooperation rather than conditions conducive to conflict.

Learning to Adapt Sustainably to Environmental Risk

Douglas K. Bardsley

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Adaptation to environmental risk will involve some fundamental re-adjustments of vitally important socio-ecological systems. However, many of those dominant modern systems are already in crisis. Case study examples from research across global, continental, and regional scales are used to argue that gaps between sustainability goals and outcomes are already significant. Analyses of global food security and lost diversity; human migration in Asia; and natural resource management systems in core and remote regions of Australia, all indicate that climate change forms only part of a failing relationship between people and the environment. There is a need to transform socio-ecosystems so that they become resilient in the context of broader learning on environmental uncertainty, variability, change, and risk. Such transformations to a second modernity will occur both *in situ*, to ensure that local environments are not further degraded or people entrenched in failing systems, and *ex situ*, as people, systems, and infrastructure become increasingly mobile to deal with changing circumstances. Generating such new types of learning necessitates important shifts in research approaches and education systems, and those shifts need to be explicitly supported by institutions and policies that acknowledge the universal scale and scope of the new risk and understand that transformations are both vital and achievable.

Master and Action Plans Countering Climate Change in Cities Around the World

Yosef Jabareen*

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The devastating effects of Hurricane Sandy, as well as many other environmental hazards that confront numerous cities around the world, provide a significant opportunity to examine the resilience levels of cities and to determine how they will act in the future to confront climate change impacts and hazards. This paper aims to analyze and assess the planning policies designed to counter climate change impacts and environmental disasters in NYC and to illuminate how NYC has prepared itself in recent years through planning and urban public policies to counter the impacts of climate change and natural disasters. More specifically, this paper assesses the NYC planning policies and analyzes why it was unable to adequately confront Hurricane Sandy. Especially, this paper examines how NYC's planning efforts address the challenges of global climate change in urban contexts through its recent plan, PlaNYC 2030: A Greener, Greater New York. This paper concludes that, although the City of New York has a plan for countering climate change impacts, and although it has begun implementing its plan's projects, the city appears to be less resilient and unable to cope with future serious climate impacts. Apparently, as the impacts of Hurricane Sandy revealed, the major and critical shortage of the plan is the adaptation measures for coping with environmental hazards. Unfortunately, Sandy uncovers the sad fact that the current institutional and spatial settings of our cities are not resilient and become risky places for their residents during hazardous events. This paper concludes that cities around the world, including the most pioneering among them, still fail to utilize comprehensive and spatial planning in their fight against climate change.

From Scenarios to Action—Facilitating a Low Carbon Urban Transition in a Chinese City

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Today more than 50% of China's population live in urban areas, which has inevitably imposed various pressures on the environment. At the same time, urbanization also provides fertile ground for developing innovative and local-tailored solutions. Against this background, within the Low Carbon Future Cities (LCFC) project, a Sino-German initiative, we developed an integrated low carbon strategy for the Chinese city, Wuxi, which is a regional industry center in the Jiangsu province.

This paper aims to introduce the systematic and trans-disciplinary process of developing this strategy and to reflect on key lessons learnt. We followed a step-wise approach. Firstly, we identified challenges and needs across and within the key sectors in Wuxi, based on a series of robust scientific analyses such as a comprehensive greenhouse gas inventory and long-term low carbon scenarios until 2050. These assessments were carried out by way of intense dialogues with municipal and industrial stakeholders from Wuxi. Secondly, we developed strategic approaches to address these challenges and selected good practice examples in Germany, which could help to implement the strategic approaches in Wuxi. The stakeholders were provided the opportunity to discuss these examples with German experts who are involved in their implementation. Furthermore, Wuxi representatives were linked up with Chinese and international organizations who have experience in piloting these practices in China. Finally, we provided concrete recommendations for facilitating a transfer of the examples. Lessons learnt through the design and implementation of such a process include, for example, how to integrate city stakeholders into the research process, how to combine quantitative scenarios with qualitative institutional analyses, and how to integrate resource use assessments and low carbon scenarios. The methodology presented would also be applicable in other cities that are pursuing the low carbon path.

Management Guide for Sustainable City Planning

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In times of global urbanization, the focus of current certification systems is on the development of cities. Environmental, economic, social, procedural and technical criteria are to be assessed holistically. The resulting comparability increases the pressure on the main actors of city developments—municipalities, investors, planners and others. However, could these systems help to structure lengthy and complex developments from a management point of view? With the background of experience in the development of the assessment system and of monitoring the pilot phase of the DGNB certification profile "new city districts", the author sketches possible action steps for the most optimal setting in land-use planning and its implementation. The result is a guide for city planning in five steps with relevance for various stakeholders.

Sustainable Economic Development through Building Adaptive Capacity for Sea Level Rise: A Case Study of Incheon, South Korea

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Sea level rise (SLR) is a crucial issue in coastal areas. Although SLR is not as urgent as storm surge or flooding, in the longer term, it will affect livelihood and economies. Especially, where it threatens port cities as they are hubs of international and domestic trade and directly connected to economic growth. In order to be prepared for SLR, it is important to know how vulnerable each city is. Vulnerability has three main components: exposure, sensitivity, and adaptive capacity [1-3]. One possible intervention is enhancing adaptive capacity. Adaptive capacity is the ability of a system (including individual actors) to adjust its conditions in order to mitigate hazardous impact of climate change [4]. Although knowing and building adaptive capacity is critical, it can be omitted as a policy priority because SLR may not be perceived as an immediate threat. Then how can adaptive capacity be integrated with economic development policies or strategies? How can economic development be achieved by enhancing adaptive capacity? These questions can be answered by discovering which adaptive capacity can contribute to the economic development of a city. For this study, Incheon, South Korea, has been chosen. South Korea is a peninsula; this means that 86 coastal cities where 14 million people live are exposed to SLR. Potentially affected area can be sum up to 42,000 km², which is 42% of the territory [5]. Incheon is in particular one of the most vulnerable cities [5]. The SLR rate for Incheon in the period from 1999 to 2008 was 3.0 mm per year [6], and it is a hub of international trade and transportation. It has the biggest port in South Korea and an international airport. The objectives of this study are: (1) to identify generic and specific adaptive capacity of Incheon and South Korea; (2) to find out which adaptive capacity has the potential to contribute to economic growth; and (3) to integrate an adaptive capacity building mechanism with economic development.

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The Ecological Footprint of Mediterranean Cities: Awareness and Policy Implications

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Ecological Footprint is a biomass-based resource accounting tool used by resource management experts and has been successfully communicated to the public over the last 15 years. The National Footprint Accounts (NFA) are a system of national accounts that can be regionally scaled using additional analytical tools, such as environmentally-extended multi regional input-output analysis (EE-MRIO), to derive the Ecological Footprint for major consumption categories at the household level for a given region, province, city, or urban agglomeration. A few city Footprint assessments have been performed during the last few years. City councils have used the results in awareness raising campaigns for the benefit of the local public, often in support of resource efficiency measures they were introducing in their jurisdictions. The most prominent examples are analyzing the efficiency of the transport system or improvements in building codes. However, these studies have used different approaches, rendering comparability among studies challenging. Here, we present an approach to consistently track the Footprint of cities and apply it to the Mediterranean region. In many instances, a gap is observed between per capita Footprint values at the national and city levels. This finding can be used as positive reinforcement, either to sustain the collective achievement of higher resource efficiency (compared to the national average), or to brace the city community to bridge the remaining gap in efficiency. There is a yet-to-be-tapped potential to use the city Footprinting, broken down by consumption categories (e.g., housing, transportation, food, education, or recreation), to monitor dedicated resource efficiency policies. We then analyze differences in resource consumption between a nation and some of its cities, as well as differences among cities from different countries. This analysis provides us with a baseline to analyze the impacts of future policies by city councils. Finally, based on a review of already implemented policies we derive future policy recommendations, which will be reviewed and eventually implemented by city councils. Once city councils have implemented a new resource efficiency policy we can directly analyze the effect through follow up impact analysis.

Technical Knowledge and Problem-Focused Research: What is the Needed Mix for the Next Generation of Agricultural Scientists?

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The problems facing the next generation of scientists, whose collective job will be to ensure that the global food system meets the food requirements of the world's population, are daunting: an additional two billion people must be fed by 2050, climate change likely will reduce food production in areas that already have food deficits, and almost 30% of all children under 5 today suffer from either stunting or obesity. Ensuring that tomorrow's scientists have the needed mix of technical expertise and practical problem-solving capacity is essential if the food system problems are to be addressed. There are a few givens about agricultural post-graduate education: the time spent to earn a doctoral degree must remain constant or decrease, significant increases in spending per student for post-graduate training are unlikely, and demand for people with doctorates will increase due to faculty retirements, expansion in demand for university education and greater demand from the private sector. Given these constraints, what changes are needed to ensure that newly-minted Ph.Ds. are appropriately trained? None of us wants to undergo surgery with an inexperienced cardiologist or to consume water from an engineer's first water treatment plant without assurances that these professionals are technically competent. How much technical training is enough is difficult to answer because of the rapid expansion of knowledge and technology. At the same time, we need people who have sufficient practical experience to identify and prioritize problems and sufficient understanding of the system to know which elements must be considered in devising solutions. This paper will wrestle with these issues in the context of Cornell University's experience working on interdisciplinary programs with several African universities.

An Agricultural and Skills Improvement Framework to Support Agricultural Transformation in Africa

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Africa's leaders are convinced that sustainable economic development for the continent will require substantial improvement within the agricultural sector. *Sustaining the Comprehensive African Agricultural Development Program (CAADP) Momentum* (2013), the new CAADP Results Framework, has intensified efforts to rally the desired political buy-in, technical and financial resources for a rapid expansion and re-orientation of human capacity enhancement within African agriculture. Specifically, *Sustaining the CAADP Momentum* calls for an overarching *Framework for Agricultural Education and Skills Improvement (AESIF)* to coordinate and stimulate a common agenda for the advancement of human capacity development aligned with goal 2 of the SDGs. The *Science Agenda for African Agriculture (S3A)* serves as coordinating mechanism, while AESIF is an exercise in advocating for *out-of-the-box thinking, a call for grounding, a search for complementarity and an effort at consolidation*. The overall success of Africa's agricultural innovation system in the context of *Sustaining the CAADP Momentum* is to be determined by the effective interplay between numerous programmatic frameworks. International benchmarking analysis reveals a series of important lessons for AESIF. Both Asian and Latin American experience suggests that investment in robust country-level institutions is essential to the development of agricultural education and training (AET) at all levels. The Asian experience also confirms the necessity of sustained public funding. Experiences from China point to the importance of developing new and expanded postgraduate programs to invigorate agricultural research. Learning in Vietnam, India and Japan underscores the benefit to smallholder farms of an AET system that takes seriously their needs and aspirations. In the US, Japan and India, land grant-style institutions have led AET transformation and agricultural development impact. The framework recognizes the need to strengthen and transform the AET system across all levels to cater for the learning and skills development requirements across all levels—from the unemployed youth in need of informal, experiential training through the vocational and technical training components, to the higher education component.

Inter-university Collaboration in Research and Education to Promote a Higher Skills-Base for Africa's Sustainable Development

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Africa has been the region lagging furthest behind in the global economic convergence trend, although many countries have recently been experiencing significant economic growth. Concerns remain that this growth may be fueled by the liquidation and export of natural capital, and that the benefits of this growth are shared unequally. The continent continues to face multitudinous and deep-rooted sustainability challenges. There is a consensus emerging that African countries need to build their capacities to cope with these challenges and that, for this purpose, their higher education institutions need to drastically improve their education and research programs, so as to produce adequately-trained professionals and leaders for sustainable development. The role of higher education in Africa's sustainable development is crucial and concerted efforts should be made to promote African universities' international collaborations, so as to enhance the role of higher education. Most African universities today, however, lack the resources, capacities, and institutional bases even to maintain their existing operations, and the international collaboration they have sought with industrialized country donors and universities have not assisted in redressing this unsatisfactory situation. Given the global shift in development discourse and international cooperation, universities in African countries should respond seriously and positively to these shifts by instituting internal reforms, so as to encourage intra-university and international collaborations, thereby increasing their contributions to sustainable development. As a step toward addressing the lack of inter-university collaboration in Africa, eight leading African universities, together with the United Nations University and Japanese universities, have partnered in the Education for Sustainable Development in Africa (ESDA) project to elaborate post-graduate programs in support of sustainable development in Africa. After four and a half years of solid work by the partner universities, the project now has expanded Masters-level education programs covering three areas—Sustainable Integrated Rural Development, Sustainable Urban Development, and Management of Mineral Resources. These programs aim to contribute to the development of a higher-skill base for sustainable development in Africa. In addition, the ESDA-Next Generation Researchers Group that brings together young scholars from partner universities has been established to spearhead long-term research perspectives on emerging concerns in sustainability science in support of the ESDA Master's degree programs. Their biggest challenge may well lie in sustaining this inter-university collaborative initiative and aligning with the development needs of Africa.

The Significance of Doctoral Education and Training for Development in Sub-Saharan Africa

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Africa's per capita income growth has recently been among the highest in the world. Current growth on the continent support predictions that Africa (rather than Asia) will be the fastest growing continent, with more than a fifth of its fifty-four countries growing at an annual rate of 7% or more. But Africa is also home to fourteen of the least competitive countries in the world, and is the continent with the highest incidence of poverty. With present trends in economic and social development, few African countries are likely to achieve the MDGs this year. Ultimately, to strengthen sustainability on the continent and to achieve high levels of economic competitiveness, science must be a sound, reliable, and cutting-edge driver of change. Research and knowledge production are core activities that are central to higher education. However, universities in developing countries, particularly in sub-Saharan Africa (SSA), are unable to fulfill this mandate effectively. In the past two decades, the rate at which scientific papers are produced globally has doubled. SSA contributes only 0.7% to the world scientific output. There are too few institutions that can produce doctoral graduates; moreover, growth in enrollments remains low. Despite significant growth in enrollments in higher education, participation in doctoral education lags well behind the participation rates of developed countries. It is estimated that only 1% of students in higher education within the SADC region are enrolled in doctoral programs. The PhD is universally accepted as a key driver for capacity development that will shift the current status quo. The following aspects are important for needed interventions in SSA. First, substantial increases in both the rate and quality of PhD production are required. Second, achieving the ambitious and requisite targets for PhD production on the continent is an immense task and cannot be achieved singularly by organizations operating in isolation. Third, a focus on gender and capacitating women will remain a priority in meeting the need for high-level skills. Finally, capacity development interventions must aim to "achieve the pipeline imperative" by strengthening capacity from the stage of identifying talented students early on until the point where a corps of committed, established researchers participate actively in an ever evolving knowledge economy.

Can Fuzzy Regression Analysis Identify and Predict Hurdle Rates in Low Carbon Technology Investments?

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The techniques used for evaluating the opportunity costs of investments are generally based on traditional methods, such as the Weighted Average Cost of Capital (WACC). The WACC is a combination of the cost of equity and the cost of debt, the former being generally estimated using the well-known Capital Asset Pricing Model (CAPM), which can be regarded as the rate of risk-free securities plus a risk premium.

This procedure has already been suggested for investments in the generation of energy from renewable energy sources [1]. However, the resulting discount rates have turned out to be substantially lower than the minimum rates of return (hurdle rates) that most companies are willing to accept when considering low carbon investments. Several reasons have been put forward to explain this larger value of the discount rate; these reasons are mainly based on some perceived project-specific idiosyncratic risk (such as compliance problems or changeable regulations) for which additional compensation is required [2].

While the underlying reasons can generally be identified, it is difficult to develop quantitative techniques for relating generically specified factors to the well-defined values of the opportunity cost.

In this communication, we propose a fuzzy regression algorithm originally proposed by Tanaka *et al.* [3] in order to attain the above objective. Indeed, fuzzy regression analysis appears to be the most suitable method for relating poorly defined variables to some measurable factor.

To assess the soundness of the procedure, we have considered evidence and data available in the public domain.

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The Great Potential of Crowdfunding in Sustainable Development and Climate Change Mitigation

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Crowdfunding has seen tremendous growth in recent years, fuelled by attractive projects and exciting new business models. Especially the area of crowd investing, where funded projects or start-ups provide a financial return to investors, grows ever more attractive, given the current record low interests paid on regular financial markets.

Beside the financial component, there is often also an emotional aspect to crowd investing, as investors tend to identify with the project they are contributing to. This identification makes crowd investing especially suitable for consumer products and services, but also for projects around sustainability that provide both profitability and purpose.

This paper identifies the current and future potential of crowdfunding and crowd investing for climate change mitigation. The study is based on three claims that are investigated in detail:

First, we show that potential projects that could contribute to climate change mitigation often lack funding. Our approach examines a number of long-term profitable greenhouse gas abatement activities and discusses respective investment hurdles. We focus on projects outside the Clean Development Mechanism.

Second, we investigate how the crowdfunding community takes up this challenge and identify the hot spots of the global clean-tech crowdfunding activity. We research the scope, reach, volume, and financial instruments of current clean-tech crowdfunding and crowd investing platforms.

Third, we examine whether climate change mitigation projects offered to the crowd are more successful if they are designed to be “bankable”, *i.e.*, providing long-term stable returns on the initial investment. Bankability is not a necessary factor for successful crowd-based fundraising, as various start-up campaigns suggest. However, projects in the areas of renewable energy and energy efficiency particularly have this characteristic and may be especially valued by the crowd.

Water and Sustainability: Where Nature and Markets Come Together

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Water is the most essential of all commodities; it is also the most sustainable and recyclable of essentials, even if saline, contaminated and mixed with human waste. However, to make water safe, secure, affordable and relatively abundant for all, we need market signals of costs, scarcity and excess (floods), as well as incentives to treat, pipe, transport and conserve.

If we treat water as a free good in nature that comes from the sky, the ground, rivers and catchments, then we miss the fundamental point. For most people most of the time, the costs of having secure and safe water supply are in the dams, pipes, treatment plants and other infrastructure at the local and regional level.

An absence of funding mechanisms, and charges for access and usage, means that many cannot get water services efficiently and end up having to truck or carry water from village wells. “The poor pay more” is certainly the case in many developing countries—the tragedy is that, invariably, the source of undercharging for water is government and, surprisingly, agencies such as the UN. While Special Adviser Professor Jeffrey Sachs makes a profound point when he says: ‘By separating nature from economics, we have walked blindly into tragedy’, he needs to add and address the fact that, in most of the UN documents on water scarcity and sustainability, the UN fails to make any significant reference to the need for market and economic systems if we are to deal with water in the context of population growth.

This paper reviews metropolitan and regional water security and sustainability issues arising from population growth. While the study has developed from a major project on drought and desalination in Australia following the Millennium Drought, our points are not restricted to the case of desalination—which is not universally relevant, particularly to low income countries for whom access to seawater does not necessarily create affordable freshwater options during drought, as in Australia and many places in the Middle East.

Desalination options are seen to secure bulk water supply in metropolitan regions threatened by drought and where demand growth is dominated by population trends. The case of desalination investment in Australia follows the worst drought recorded in Australian history. However, the key is that drought-related tariffs, and tariffs that adjust to scarcity, are central to enabling the financing of desalination investment.

Just as some water access and usage charges in many developing countries enable safe water connections to be offered and water supply to be secured, so does chronic water shortage result from government and regional policies suppressing water charges allegedly in the name of affordability and anti-poverty programs. The most fundamental point is that suppressing the capacity to invest in water infrastructure in developing countries is a cause of water shortage at the household level—and forms part of the human tragedy resulting from a failure to apply economics to the challenges from nature—as Jeff Sachs eloquently stated.

The question for the coming centuries is how many countries can benefit from ocean-sustainable solutions. The paper argues that desalination is increasingly sound “water insurance” as part of economic management. The use of reverse osmosis for seawater and wastewater treatment is growing in countries in the Middle East and highly populated parts of Australia, China, South America, USA and other countries with ocean access.

The Australian experience, and lessons from water pricing and trading across regions, suggest that desalination and wastewater treatment including through reverse osmosis, are integral elements of sustainable water-dependent economies.

The recent declines in unit cost of reverse osmosis technology confirms rising scope for sustainable use of oceans as a source of fresh water, supported by increasingly cheap solar energy.

It is shown, based on our published and current research for the National Centre of Excellence in Desalination in Australia, that viability of desalination also depends on using efficient water institutions and incentive structures in water-short regions.

River-based regional agriculture can experience higher water security and valuable premium food production as a result of increasing the urban capacity to draw on oceans for potable water, using regional dams, rivers and aquifers for agriculture.

We use over 100 years of rainfall data, and cost data for dams, rivers and rainfall-based storages, to demonstrate that desalination is increasingly a logical part of water security and sustainability in regional economies sharing scarce rainfall and storages.

Use of abundant ocean water increases water security in agriculture and inland areas that might otherwise find water resources to be reduced. However, pricing and allocating water with drought-related scarcity tariffs is also needed to sustain supplies and regional water treatment as the population increases.

Joint supply and demand side pricing measures can assure efficient capital and energy use, and enable water connections to poorer areas to be financed. So-called “free” water in many developed and developing countries ends up reducing the capacity of water utilities to connect remote and poor communities—undermining the sustainability and development of

many communities. This undermines water security as population growth reduces per capita water resources from rainfall sources.

The sustainability, almost infinite expandability and modularity and low land usage requirements are making desalination increasingly cost effective relative to dams and catchment dependence of rain-dependent rivers and aquifers.

This growing relative cost effectiveness is even more marked in relation to the drought and emergency situations, which are increasingly severe given population growth, catchment and aquifer vulnerability.

The transition from evaporative to membrane filtering technology, in Australia, the driest populated continent on earth is instructive of benefits from trading and pricing water across water grids. The paper draws on System Dynamics modeling of desalinated supplies within grids of dams, rivers and aquifers, with mixed technologies.

The applications follow the worst drought in recorded history across Australia—the driest populated continent on Earth, as reflected in over 100 years of rainfall data characterized by high variability.

The added pressures of population and economic growth have increased the water supply challenges. The 1997–2009 Australian drought caused storage levels reached critically low levels (around 30%). The critical storage levels were a trigger for Government decisions to build desalination plants.

We assess future supply options and optimal choices for water supply efficiency. The portfolio approach considers long term expanding of water trading including rivers, aquifers, desalination, recycled stormwater and wastewater. Crucially, using System Dynamic Modeling we conduct the cost analysis of each option including augmentation costs of dams, pipelines, desalination and water recycling capacities. The future simulation strategies are based on historical data on population growth, water availability, spiking prices during droughts, and state policies including water use restrictions.

The paper draws on several papers prepared for the National Centre of Excellence in Desalination in Australia. We investigate long-term future supply options for mainland cities such as Adelaide, Brisbane, Melbourne and Sydney over the next 100 years. The papers comprehensively investigate the costs of each option to provide a water supply portfolio to achieve an optimal mix of security and costs including adequate water security level (storage capacity to demand ratio), water sources options (portable and non-portable) and scarcity pricing.

Summary points towards a sustainable water supply and wastewater treatment

1. When something is scarce, like clean water, communities and regions need to use market instruments for dealing with scarcity—incentives to conserve, treat, transport, price and achieve security of water supply.
2. Talking about sustainability and needs, but not applying the instruments for dealing with scarcity and allocation, means, quite tragically, that organizations and governments are inadvertently creating water shortages often on a massive scale.
3. In general, there is no absolute scarcity of water—total rainfall levels are changing very little by historical standards. It is population that is the main source of growing scarcity. While patterns of rainfall appear to be shifting significantly in many countries, possibly as a result of changes in climate patterns, this market and investment solutions under sound planning.
4. The alleged aggregate shortages of water are not evidence of unsustainability of water supply. Any shortage is hard to define when most water is used and consumed, by households and irrigators, at zero or negligible charges. This causes waste of consumption and inadequate conservation, and an illusion of fundamental un-sustainability.
5. Water rights, and rights to trade and exchange water, need to be clearly defined with a view to conservation, efficient and valued usage, exchange, trading and storage. In many countries this requires a substantial education and schools' campaign.
6. Villages with no secure water connections pay about 10 times as much for water as those with piped connections. Thus, by investing in pipes—financed by access and volumetric charges—we generally lower the costs of water very substantially. However, “free water” often means no water, or expensive truck or carry-and-treat-it-yourself water.
7. Water rights and trades and wastewater discharge all need to be priced according to scarcity, quantity and quality—to deal with what is called negative externalities.
8. In the case of discharge of wastewater into drains and oceans, treatment obligations need to be enforced where failure to do so causes un-necessary risks and particularly contamination and wastage of recyclable waste and storm water.
9. While water rights and water access and other “gifts from nature” are in a sense free, that nevertheless requires efficient economic and market systems to guide and help finance the investments in infrastructure, catchments, conservation and distribution of water.
10. By creating a greater availability of water where most needed and valued, communities create the wealth and income to subsidize those unable to pay for needed water.
11. The inconsistent application of incentive and market arrangements to food but not water is a primary source of food and water shortages.

An Advanced Demand-Side Energy Efficiency Scheme for the GCC Countries

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To date, only a small number of DSM projects have been implemented in the GCC countries. Barriers have prevented large-scale deployment. A mandatory Energy Conservation Obligation (ECO) enforced on energy companies sustained by a market for Tradable White Certificates (TWC) could overcome these barriers and substantially contribute to end-use electricity efficiency and energy conservation. White certificates refer to the certification of project-based energy savings and the possibility to trade these certificates. The various existing national schemes differ from each other and have a varied number of characteristics. Typically, major energy players (retailers or distributors of electricity and/or other fuels) are obligated to achieve a certain amount of energy savings every year (ECOs). They can choose to directly achieve the target savings or to delegate part or all of their obligations by purchasing tradable certificates (TWCs) from other entities, such as Energy Services Companies (ESCOs) or major end-users. TWC schemes can include many mechanisms and measures. Increased end-user electricity efficiency, load shifting, and raising awareness can be eligible measures under such schemes. Apart from direct energy cost savings accruing to the end-users and/or ESCOs, financial gains arising from the reduction of subsidies, the avoidance of peak power purchases, and the addition of generation capacity, can make such a scheme a valuable tool for policy makers in GCC countries, where savings alone are often insufficient to trigger energy conservation initiatives--due to low (heavily subsidized) energy prices. We conduct a comparative analysis on a number of policies and scheme, with a focus on the TWC schemes and ECOs. Several TWC schemes have been implemented in European countries. Past experience of the UK, France, and Italy will be analyzed. Differences and similarities, together with lessons learned are highlighted and assessed from the viewpoint of applicability to a utility-based ECO/TWC scheme. Clearly, no design modalities from other trading schemes should be simply copied. A number of steps would be required prior to successful introduction of such a scheme. Of particular interest to us is the development of an effective and efficient framework and the identification of interactions with other policy instruments. In particular, a trading mechanism will be developed and validated in a generic case. Implementation and interactions will be discussed. We will focus on the cost effectiveness and cost recovery, design modalities, interactions of the scheme with other policy instruments and the institutional framework. From a research point of view, this study is motivated by the fact that the existing scientific literature does not examine the possibility of deploying energy saving certificates in a typical GCC country.

Determinants of Financial Sustainability for Farm Credit Applications—A Delphi Study

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Farmers often depend on credit from commercial credit providers to finance production activities. Commercial credit providers have to predict the financial sustainability of the enterprise to ensure that the borrower will have the ability to repay the loan. A Delphi study was conducted to explore what factors are good indicators of loan -repayment ability, and, hence, also financial sustainability of farming enterprises in South Africa. The objective was not only to identify factors that are currently considered, but also to identify other personal attributes that may improve the accuracy in predicting the repayment ability of potential borrowers. The Delphi was applied to a panel consisted out of nine credit analysts and credit managers from one of the commercial credit providers in South Africa. The results indicate that the current and past financial performance; account standing; collateral; and credit record of the farm are very important in the assessment of applications in terms of financial performance. Experience of the farmer and the success factors compared to competitors were found to be important, while age and education/qualification are regarded as less important in predicting repayment ability. The results also show that, although not currently objectively included in credit evaluations, credit analysis regards leadership and human relations; commitment and confidence; internal locus of control; self-efficacy; calculated risk taking; need for achievement; and opportunity seeking as important indicators of the ability of potential borrowers to repay their loans. Thus, credit analysts and managers also regard management abilities and entrepreneurial characteristics of potential borrowers to be good indicators of repayment ability. Results from this research, thus, provide information that can be used to extend existing credit evaluation instruments in order to more accurately predict whether or not a potential borrower will be able to repay the loan, and, hence, continue operating the enterprise in a financial sustainable way.

Undermining Effectiveness: The Effects of Volatility, Unpredictability and Poor Coordination on Health Aid Effectiveness

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The last quarter century has seen a massive increase in development assistance for health, from \$5.74 billion in 1990 to \$28.2 billion in 2010 (IHME 2013). Since 2010, aid levels have continued to increase, albeit more slowly, reaching \$31.3 billion in 2013 (IHME 2014). The increase in aid has been accompanied by increasing international attention to ensuring that aid is used effectively (OECD 2008). Numerous studies highlight the complex challenges health aid poses to national health systems and the potential negative consequences it can have for health system functioning and sustainability (Bräutigam and Knack 2004, Biesma, Brugha *et al.* 2009, Vallaincourt 2009, Lu, Schneider *et al.* 2010, Moon and Omole 2013). Potential problems arise due to, among others, the complexity of the health aid sector, which includes a large number of donors, increasing chances of poor coordination, and the unpredictability and volatility of aid flows. While recent large-N cross-national studies suggest that health aid has a small positive impact on health outcomes overall (Mishra and Newhouse 2009), with increasing returns seen in more recent decades (Bendavid and Bhattacharya 2014), no studies to date examine the impact poor coordination, volatility and unpredictability have on this relationship. Drawing on health aid data from the OECD and the Institute for Health Metrics and Evaluation (IHME), I examine how health aid's impact on health is affected by problems of donor coordination and by unpredictability and volatility in aid flows. I use number of donor projects per country-year as proxy poor coordination, under the assumption that poor coordination is more likely as the number of projects increases. I measure aid predictability by comparing aid commitments to aid disbursements. Finally, following Bulir and Hamann (2003), I measure volatility by calculating the variance of de-trended aid flow data.

Willingness to Pay for Improvements of MSW Disposal: Views from Online Survey

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Rising amount of MSW every day, maximizing material diversions from landfills via recycling is a prefer method to land dumping. Characteristics of Thai MSW are classified as 40- 60 per cent compostable wastes, while potentially recyclable materials in waste streams are composed of plastics, paper, glass and metals. However, the rate of material recovery from MSW, excluding composting or biogas generation, in Thailand is still low. Thailand's recycling rate in 2010 was only 20.5 per cent. The central government, as well as local governments in Thailand, have tried to curb this problem by charging some of the MSW management fees to the users. However, the fee is often too low to promote MSW minimization, as observed by Beatty, Berck, and Shimshack (2007), Bulte, Gerkingb, List, and Zeeuw (2004), and Lee and Paik (2011). The objective of this paper is to identify levels of willingness-to-pay (WTP) for MSW recycling in different social structures, with expected outcomes of sustainable MSW managements for different town settlements to maximize MSW recycling pertaining to each town's potential. The method of eliciting WTP is a payment card. The questionnaire was deployed using an online survey during December 2012. Responses were categorized into respondents living in Bangkok, living in other municipality areas, or outside municipality areas. The responses were analyzed using descriptive statistics, and multiple linear regression analysis to identify relationships and factors that could influence high or low WTP. During the survey period, there were 168 filled questionnaires from 689 total visits. However, only 96 questionnaires could be used. Among respondents in the usable questionnaires, 36 respondents lived in within the boundaries of the Bangkok Metropolitan Administration, while 45 respondents lived in the chartered areas that were classified as other municipality but not in BMA. Most of respondents were well off, as 75 respondents reported positive monthly cash flow (77.32%), 15 respondents reported neutral monthly cash flow (15.46%), while seven respondents reported negative monthly cash flow (7.22%). For WTP data, including a WTP of 0 baht with valid responses, ranking from the highest means of WTP to the lowest WTP of respondents by geographical locations for good MSW management were: Bangkok (196 baht/month), municipalities (154 baht/month), and non-urbanized towns (111 baht/month). In-depth analysis was conducted to analyze whether there is additional room for a further increase of MSW management fees from what each correspondent is currently paying. The result from multiple-regression

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analysis suggests that the following factors could impact upon the increase or decrease of WTP: income, age, and gender. Overall, the outcome of this study suggests that survey respondents are likely to support improvement of MSW treatments that are not solely relying on landfilling techniques. Recommendations for further studies are to obtain larger sample sizes in order to improve statistical powers and to provide better accuracy of the WTP study.

Delivery Models for Sustainable Energy Technologies—What are Feasible Approaches in Developing Regions?

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The period of 2014–2024 has recently been declared to be the “United Nations Decade of Sustainable Energy for All”, stressing the importance of energy access for sustainable development, especially in rural areas of developing regions. This ambitious target needs not only viable technologies and resources, but appropriate management schemes and implementation approaches. The objective of this paper is to create a better understanding of the concepts behind different types of delivery models and highlight key common success factors, as well as challenges to be considered. Moreover, the paper describes the findings gathered during project implementation of an energy support program in the current scientific and political discussions. The study is based on: (a) a literature review on delivery concepts; and (b) analysis of practical implementation models supported under WISIONS initiative supporting scheme. In a third step, (c) the results will be compared, providing valuable knowledge for future projects. Ten projects, implemented between 2006 and 2013, have been selected for a detailed analysis on the practical experience of a variety of implementation and management models under different social, economic and environmental conditions. The first findings show that under specific conditions, appropriate delivery models can help to overcome social, cultural and financial barriers that prevent delivering energy access to the poor. However, the transfer of these models to other regions is, in most cases, difficult to achieve. Even for projects within the same country, further model adjustments can be essential. Thus, one “miracle model” with low risks and “success guaranteed” for the energy poor, which is requested by the policy and project funders, is not a realistic vision. The consideration of a portfolio of concepts by experienced and committed implementation organizations is still key to accomplishing positive impacts and long-term sustainability of the installed appliances.

Indicator-Based Sustainability Assessment of the German Energy System

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The objective of the energy transition in Germany is to provide energy in a sustainable way and to use it efficiently. At the same time, the classic goal triangle of security, economic affordability, and environmental soundness of energy supply plays an important role in energy policy debates. Nevertheless, the key shortcomings of many existing approaches to monitor the German energy transition consists of focusing on classic techno-economic and ecological aspects, and in underweighting the importance and complexity of socio-economic, socio-technical, and societal aspects. Against this background, the Integrative Concept of Sustainability developed by the German Helmholtz Association was applied to derive a set of sustainability indicators for a comprehensive assessment of the German energy system and its transition. This set includes several “standard” indicators, such as the share of renewable energy, energy efficiency or greenhouse gas emissions. Beyond that, ecological indicators were selected focusing on the use of natural resources, especially since the energy transition also leads to an increasing demand for scarce or critical resources. In contrast to established approaches, the set particularly addresses the socio-technical and socio-ecological interfaces. Examples for according indicators are the “acceptance of different energy technologies in the neighborhood”, being an important factor in successful transition processes, the “number of energy co-operatives”, which provides information about the support of the transition in society, or the “energy expenditure of low-income households compared to their expenditure for basic energy needs”, which addresses the highly relevant and controversial topic of “energy poverty”. By applying the indicators to evaluate the German energy system, sustainability aspects which have so far been politically neglected are identified, such as possibilities for participation and acceptance in the transition, as well as conflicting targets of goals, such as the target to increase the share of renewable energy and of sustainable land use.

The Medium and Long Term Forecasting of the Energy and Electricity Demand in China

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Electricity is the most vital energy resource in modern society, while energy constitutes the material foundation of the existence and development of the human race. Posterior to the Reform and Opening-up, China has become the largest energy consumer with long-term rapid economic growth and dramatic increase in energy consumption. Meanwhile, besides the issues of environment pollution and energy security, the energy sector is faced with more new problems and challenges as the resource and environment constraint has intensified and the energy conservation situation has aggravated. It is the leading orientation of energy development to establish a safe, stable, economical and clean modern energy industry system, to reform the energy production and utilization, to optimize the energy structure, and to support the sustainable economic development. Scientific forecasting of the energy and electricity demand provides the basis of precise formation of energy plan and energy policy, which is endowed with important strategic significance for supporting the sustainable development of the economy and society in China. In this paper, the multi-agent technology is used to build the forecasting model of energy and electricity demand based on the Agent Response Model. The model is composed with six kinds of agents, including Government Agent, Residents Agent, Bank Agent, Market Agent, Energy Industry Agent, and General Industry Agent. The interactions between agents are able to imitate the operation of economic systems and industries, and to acquire the energy and electricity demand of various industries. First, the model validity is verified through the test of forecasting accuracy based on the published historical data from 2011 to 2014. Second, the energy and electricity demand of 2015 is forecasted and the changes in the structure of energy consumption are analyzed. Finally, the energy and electricity demand from 2016 to 2020 is predicted.

The New Utility Business Case

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There is a belief that the current electric utility energy delivery model will be outmoded within our lifetimes. With the advent of more efficient distributed renewable generation, as well as storage, there is the opportunity to enable microgrids, community energy, as well as off-grid applications never previously thought accessible or viable to even the smallest consumer. This presentation strives to look into the future and assess how smart grid technologies will change the current utility business model. Once the forward looking vision is established, we will track the history of smart grid benefit definition and realization, identifying along the way how the utility smart grid technology investment profile has changed. While the vision and trends presented may seem far reaching for the typical North American distribution company, case studies in Europe and Asia will identify how the traditional regulated monopoly of the distribution business is being challenged. A primary goal of the presentation will be to create an awareness of the trends such that participants can consider how to future proof their current investments.

Civil Society as Warrantor of Sustainable Governance Reform?

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With the shift from the Millennium Development Goals (MDGs) to the Sustainable Development Goals (SDGs), the importance of the governance context for sustainable development is increasingly recognized. This is reflected in the suggested objective 16 of the SDGs, namely to “promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels”; thus, the SDGs explicitly address the issues of rule of law and the principles of good governance.

However, to date, despite decade-long efforts to improve governance in fragile states through institutional reforms and the introduction of anti-corruption mechanisms, coherent evidence of what helps to facilitate sustainable change is missing: Why does anti-corruption reform succeed in some states while better governance remains an elusive ambition in others, even where new governments are in power?

Focusing on institutional reforms, a key element of transition processes that features prominently in various legal approaches, such as transitional justice and anti-corruption reform, as well as in political science research in the context of state-building, this paper identifies (1) the standards that are promoted as good practice for better governance in fragile states and (2) how these standards are contextualized to enhance monitoring and implementation.

Based on a comparative analysis of state-building missions in fragile states, and starting from the assumption that participation in governance implies a duty to meet standards of governance, such as the upholding of human rights and the provisioning of effective structures for contestation and transparency, this paper sheds light on the involvement of NGOs in setting and applying these norms when they contribute to governance in the context of fragile states.

Communities Against Corruption: What Makes Social Accountability an Effective Approach for Improving Public Service Delivery?

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This presentation will discuss the findings of research conducted within the framework of the ANTICORRP research consortium, which were later on refined through a collaboration with UNDP. The refinements concerned the determinants for successful social accountability interventions that are aimed at combating corruption. The discussion will center on how effectiveness depends on how participatory interventions are contextualized in order to respond to the needs, expectations, and social customs of the intended beneficiaries. The arguments will be illustrated by referencing experiences from Mexico, Tanzania, the Philippines, and Serbia.

Transnational Constructions of Sustainable Development and Corruption Control: European Union Funding in Romania and Ukraine

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Ever since the inception of the European Union (EU), one of the most important issues faced by the European leaders has been sustaining the EU's expanding agenda and development policies encompassed in EU funding while protecting its financial interests. European leaders have been seeking to link the distribution of EU funds to sustainable reform, the improvement of legal and political domestic frameworks, enhancement of social, medical and educational prospects, and economic development. Historically, at the transnational level, the anxieties associated with EU funding misuse have materialized in heightened regulations based on vocabularies of crime and corruption implemented at the national levels, especially after the Second Eastern Enlargement (2007). However, even though transnational entities and the states proved their potency by imposing regulatory control over the EU funding economy in Romania and Ukraine, the question that remains is: has EU funding helped develop the institutions in these countries in such a way that corruption remains an exception or, conversely, has EU funding helped to reinforce the old solidarity networks that facilitate corrupt exchanges among trusted members?

In order to answer this research question, the paper examines, comparatively and historically, the setting, use and control of EU funds in Romania and Ukraine between 2000 and 2015 with a particular focus on emerging vocabularies of crime related to the protection of the financial interest of the EU. It situates EU funding in the drastic economic and social changes that have been inflicted on Romania and Ukraine during transition from socialism to capitalism. The research is based on secondary data analyses and interviews with key stakeholders (e.g., grant recipients, police officers, judges, civil servants).

Stream 2:
Urbanization and Cities

Sustainable Architecture: What Is the Appropriate Approach for Algeria?

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Sustainable architecture (HQE buildings in France, Green Buildings in the United States, and Sustainable Buildings in Northern Europe) is a profound change in the act of building. The main objective of sustainable architecture is none other than the application of the concept of sustainable development in the construction sector. This architecture is characterized by a new multi-criteria vision: the integration of environmental parameters in the overall process of architectural production during all stages of the life cycle of a building, from its programming to its eventual demolition. Considerations also encompass the various intermediate stages of design, implementation, and finally, management and operation. A few years after the introduction of the concept of sustainable development, and from the beginning of the 1990s, environmental concerns in the construction sector have resulted in the appearance, in many countries, of various strategies for minimizing the negative impacts of buildings on the external natural environment and for improving the comfort and quality of life of the building's occupants; the approaches varied with their origin and with the physical and cultural conditions of the country from where they grew. These international initiatives involving multi-criteria are characterized by contextuality, flexibility, and scalability. What strategy should be developed for sustainable buildings in Algeria? This is the fundamental question for which we try to provide some answers. On the basis of a thorough study of the Algerian context, we aim to present the foundations of an approach to sustainable building that would be adjustable to different regions of the country and whose peculiarity lies in the consideration of the major concerns of our country and its specificities. Such concerns include, for instance: seismic risk, the socio-cultural practices of the population, and the diversity that characterizes the climatic and geographical data of the entire national territory. We account for such concerns by following current national legislation, regulations, and standards. Such an approach would thus enable Algeria to join the ranks of the leading countries in this field.

The Parametric Design of a Low-Cost Apartment in Bandung, Indonesia

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Urban slums in most big cities within developing countries are comprised of overly dense settlements on illegal land, with inappropriate sanitation and infrastructure. Our discussion about density provides a broad perspective concerning the potential attributes of dense neighborhoods, such as their positive qualities, including those concerning building forms and massing (including building height, the space between buildings and green coverage), as well as negative qualities, such as pollution and low quality living areas. Low-cost apartments are one solution to the challenges posed by urban slums, which result from the limited quantities and high-prices of land. This paper addresses the need for low-cost apartments that accommodate their environment. The rapid design method, using a parametric design, provides an integrated solution; for example, one can use the Grasshopper program, using Ladybug and Honeybee as plugins. Ladybug imports standard EnergyPlus Weather files (.EPW) in Grasshopper and provides a variety of 2D and 3D designer-friendly interactive graphics to support the decision-making process during the initial stages of design. The tool also provides further support for designers to test their initial design options for implications concerning radiation and sunlight-hours analyses. Honeybee is a tool for connecting Grasshopper3D to EnergyPlus and Radiance, which can be used for analyzing illumination or radiation. These tools can produce a UTCI for outdoor thermal comfort value, based on the geometry and weather files that have been simulated in the Grasshopper environment. The integration of the aforesaid plugins with Grasshopper allows for an almost instantaneous feedback for design modifications, because these plugins run within the design environment; thus, information and analysis are interactive. There were 28 building groups utilized as assessment models. We firstly determined the level of conformity of the PMV with the ENVI-met via the UTCI. The Grasshopper program was also utilized to optimize the building form and massing considerations, so as to reach the expected outdoor thermal comfort.

A Methodology for Assessing Energy Consumption and Carbon Dioxide Emissions in a Nigerian Residential Building Context

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Against the background of residential buildings' impacts on the environment, this paper used a life cycle assessment framework to profile the energy and carbon emissions content of publicly procured residential buildings in Lagos, Nigeria. The paper underscores the importance of life cycle assessment as an environmental management tool and demonstrates such assessments' applicability in the study area. Specifically, the study addressed the operational and embodied energy of the buildings and their associated carbon dioxide emissions. A survey research method was combined with the life cycle assessment framework and international energy and emissions protocols to provide answers to our research questions. The study found that at 21,570 MJ/m², operational energy intensity dominated embodied intensity, which was 7,378 MJ/m². The study also found that while direct fuel combustion dominated operational energy and carbon intensities, initial and recurring materials accounted for the bulk of embodied impact. The above findings imply that energy efficiency and carbon mitigation strategies should target the operational and embodied aspects of the buildings.

Sustainability Assessment of a School Building in Iceland Using Life Cycle Analysis

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Buildings play a key role in our lives and society as a complex system. However, in the age of climate change, energy use in buildings is one of the main sources of anthropogenic greenhouse gas (GHG) emissions. Furthermore, the GHGs from the building sector have more than doubled globally since 1970. Iceland provides an interesting case since, in the whole country, the energy demand is mostly supplied by geothermal and hydroelectric resources which produce very low emissions compared to fossil fuels. At the same time, however, the majority of all goods consumed in Iceland, including a large share of construction materials, are imported and do not utilize local energy. Thus the predominant share of all the GHGs caused over the lifecycle of a building very likely relate to the GHGs embodied in the materials, which are also outsourced from Iceland. Despite this interesting situation, we found a gap in literature on the impact of materials used for construction in Iceland in terms of embodied GHG emissions.

Life cycle assessment, or LCA, has become an accepted tool to performing sustainability assessment of various systems including buildings, therefore we decided to apply it to develop a framework that enables us to make estimates of the climate change impacts of a school building in Iceland, over the total span of construction and use. We capture the contribution of different materials and building components in the whole picture, from “cradle to grave”. The results enable us to make comparisons with similar studies in other countries and identify specific opportunities to improve the sustainability of buildings in Iceland. Also, this analysis provides new insights to the bigger puzzle of international sustainability of the built environment.

The Impacts of Modern Transitions on Vernacular Villages: The Case Study of Qingyong in China

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Qingyong village, a rural community in East China, was a flag of egalitarianism in the Mao era, possessing collective ownership of land and equal free allotment of houses. Constructed in the 1970s, these houses, interestingly resembled 19th century English terrace houses and had uniform materials, form, layout, and internal configuration. The transitions in housing architecture are evident in the past several decades, due to modern social and construction practices; for example, there is the evolution of three housing types: the original rubble house, refurbished houses with external concrete slabs and ceramic tiles, and new courtyard houses with brick walls and large glazing.

This research takes Qingyong as a case study for investigating the impacts of modern transitions on vernacular villages. Our work focuses on the following major aspects: thermal comfort, life cycle energy, architecture, and socio-cultural transformation. The thermal analysis includes a thermal sensation survey for the three types of houses and a Fanger's predicted mean vote (PMV) analysis. The energy analysis tries to explore the energy consumptions of the three housing types from a life cycle perspective. In contrast to the original rubble terrace houses which, as tokens, were used to reflect the ideology of egalitarianism and public ownership, the new courtyard houses demonstrate private and personal aspirations. Many Chinese vernacular villages are transitioning towards adopting modern social and construction practices. This research, by examining these transitions from the case study, can helpfully shed some light on future rural sustainability planning and design.

Evaluating the Long-Run Savings from Retrofit Plans in Residential Buildings Accounting for the Rebound Effect

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The rationale for changing our current energy path and reducing emissions of greenhouse gases is convincing. Energy efficient and low-carbon technologies will play a crucial role in the energy revolution needed to make this change happen. The building sector is the largest energy-consuming sector, accounting for over one-third of final energy consumption globally and an equally important source of carbon dioxide emissions.

In the Nordic countries, the buildings sector used 1527 petajoules of energy in 2010, or about 33% of total energy use, which is similar to the worldwide share of energy use despite cold climates. The Nordic countries have progressively reduced the role of fossil fuels in the buildings sector as well as increased the energy efficiency of buildings, by implementing various policies including financial incentives, awareness campaigns and energy certificate systems. Because building stock turnover is slow (in the order of 1% per year in the Nordic countries), the majority of opportunities to improve efficiency over the next several decades will be in existing building stock, most of which are constrained by old equipment, aging infrastructure, and inadequate operations resources. However the potential is significant, and the challenge is to “unlock” that vast potential and realize the benefits of a built environment that is comfortable, efficient, and cost-effective.

This study presents a dynamic simulation model that captures the impacts of physical processes such as aging, as well as social processes such as familiarity of households with retrofitting. Applying the model to Danish conditions, five policy scenarios are compared to a base case focusing on energy consumption and emissions. Our results illustrate the impact of early scrappage policy as well as aggressive retrofit package. However, in the long run, the majority of efficiency gain will be compensated by the direct rebound effect.

Homeowner Targeted Policy Instruments to Overcome Barriers for Energy Efficiency Retrofits in Residential Buildings in Germany

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As identified by several investigations and stated in the German national energy revolution strategy, the energy consumption for heating purposes in residential buildings forms a considerable share of greenhouse gas (GHG) emissions. The identified emission reduction potentials could be reached by investing in technically sound energy efficiency retrofits which promise neutral, or even profitable, returns compared to a conventional refurbishment. Hence, local authorities formulated their own climate protection concepts which commonly focus on the energy-efficient retrofitting of residential buildings. In spite of these favourable circumstances, the actual retrofit rate remains low. Barriers to intensifying energy efficiency retrofit activities result from the heterogeneity of the stakeholders involved, as well as from omnidirectional policy guidelines and support programmes. Thus, the homeowners' socio-economic status, their incentives and opportunities to perform retrofits are not directly addressed. To tackle this problem, a novel approach is developed within a current research project that involves six German cities. The objectives are to identify the different needs and households' characteristics in the context of energy-efficient retrofitting and to derive environmental political policy guidelines at the local (municipal) and national level. In the first phase, a comprehensive survey of private households in the six cities is performed, followed by face-to-face interviews. Simultaneously, a residential buildings' and households' dynamics simulation model of the German residential building stock is utilised to simulate the paths of building stock development. This model uses a bottom-up approach based on micro data and on the identified homeowners' characteristics. Moreover, it allows assessing environmental political instruments via quantifying retrofit activities and the corresponding financial burden for the stakeholders, as well as GHG emissions. This paper depicts the approach of the research project and explains how the results are transferred from a local level to the national level.

Minimum-Invasive Energy Retrofit Approaches for Owner Communities in Multi-Occupancy Residential Buildings

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The main goal of the presented project is the development of a planning process and tool for the sustainable energy supply of residential multi-ownership building blocks.

The Fraunhofer-Institute for Building Physics IBP is developing a toolkit that will, overall, provide a step-by-step guide to retrofitting multi-occupancy buildings, including all relevant resources, guidance and information. The outputs of its work will provide a comprehensive 'one-stop-shop' resource for households, building managers and energy agencies to negotiate the complexities of retrofitting multi-occupancy housing.

As a final step of the process, a catalogue of the needed measures is being formulated, in order to offer the optimal planning and implementation course for the building complex, noticing all of the relevant stakeholders. The expected result is an intelligent flexible energy efficiency improvement process, which should be applicable in many other different cases.

Meanwhile, intelligent solutions for the residential buildings energy supply are omnipresent, however their use is hindered frequently: mostly not by technological hurdles, but by complex stakeholder constellations and objections. The envisaged method aims to implement an enabler for such sustainable energy supply of settlement complexes via delivering a reliable decision basis. It combines technical, juristic and economical topics, in order to offer a strong tool—a solution for project developers, engineers and each other type of stakeholders in the intelligent planning process. A sustainable building and spatial development is possible!

A Comparative Benefit and Cost Analysis of Conventional and Sustainable Construction Methods

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This paper examines conventional and sustainable construction methods and whether there are significant differences between these two types of construction based on benefit and cost. The rationale for the examination is the general belief among stakeholders that, although there is an increasing need to provide sustainable and affordable buildings for both housing and commercial purposes, buildings procured using sustainable construction initiatives are significantly more expensive than those constructed through conventional construction approach. The study adopted a quantitative research approach using semi-structured questionnaires in eliciting objective and subjective benefit and cost information on sustainable and conventional construction practices used by purposively selected construction industry stakeholders in South Africa. The study results indicate that there were perceived cost advantages in the use of both conventional and sustainable construction practices. The results also suggest that the cost difference between both sustainable and conventional construction methods is less significant than perceived by construction stakeholders and this challenged previous ideas about a significant cost difference between both construction methods. The study, thus, concludes that since the cost difference between the two construction methods is insignificant, the government should encourage sustainable construction practices through incentives and legislation because of its ecological advantage. The results of the study are limited by the smallness of the sample size, which is due to the fact that stakeholders who have experience in the use of both sustainable and conventional construction methods are few and are not, therefore, normally distributed in the target population. A wider study, which will confirm the findings of this research, is recommended.

Hybrid Fiber Reinforced Self-Consolidating Concrete using Qatar's Municipal Wastes

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Qatar's waste generation rate is about 1.8 kg/day/capita, which is one of the highest rates in the world and produces more than 2.5 million tons of municipal waste per year. About 60% of this amount is organic, and the remaining 40% is composed of recyclables i.e. plastic (14%), paper (12%), metal (9%) and glass (5%).

In this study, two different waste materials obtained from Qatar's municipal solid waste were utilized to develop concrete specimens. These wastes are polyethylene (PE) fibers and municipal solid waste incineration fly ash (MSWI fly ash). To fabricate hybrid fiber reinforced concrete, various volume combinations of steel and polyethylene (PE) fibers were used and the total volume fraction of fibers was kept constant at 2.0% in each design.

The results of mechanical tests indicated that a synergistic effect was developed when combinations of fibers were used together which improved the mechanical properties of concrete compared to single fiber reinforced concrete specimens.

Low Carbon Technology Innovation: An Integration Analysis with Countermeasures in Construction Industry

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This article explores the literature research status of technology innovation from the perspective of system management, and then defines the system integration of low carbon technology innovation. It analyzes the characters of multi-technologies integration, multi-participants and multi-objective integration of low carbon technology innovation in construction project life cycle, and points out that low carbon technology innovation management in construction industry is involved with the management of multidisciplinary, multiple departments and professional knowledge in different fields. This paper puts forward the corresponding countermeasures on low carbon technology innovation management for construction industry, which offers the certain theoretical reference for low carbon technology innovation project management under the background of low carbon economic transformation in China.

Towards Diverse and Sustainable Governance in Cities

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Today, more than half of the global population lives in urban regions. To meet the needs of future generations, to support social cohesion, and to enable healthy living environments, cities are the main arena where sustainable solutions have to be developed. Especially, urban green spaces can support to meet these needs. The diverse urban nature provides many benefits for residents. However, increasing populations, densification, and global climate change causes major problems for maintaining the sustainability of cities. Cities can be seen as a cultural and biological *rendezvous*, providing many situations for diverse associations within and between culture and biodiversity. Cultural practices of urban policies and citizens can threaten urban biodiversity, and diminishing the impacts of these practices calls for the understanding and negotiating of these practices. Meanwhile, cultural values held by inhabitants also create opportunities for developing innovative approaches towards biodiversity conservation. We need a new way of thinking to support transformative urban governance. One promising concept in the debate regarding a more transdisciplinary assessment of urban biodiversity, in relation with green space governance, is biocultural diversity (BCD). The concept of BCD has been advocated in international committees and policy circles in the context of developing countries. What can BCD contribute to the urban biodiversity conservation? Within the examples of 20 European cities, we will discuss how to contribute towards a better understanding of the multiple manifestations of BCD in European cities, and find a way of working towards strategies to live sustainably with nature, in cities. Preliminary explorative studies on BCD assessment in 20 European cities, in the GREEN SURGE project, indicate that the interconnection between biodiversity and culture varies from consuming to a close bonding in place-making or in urban gardening. Co-management of nature by public agencies, together with citizens, can result in novel biocultural creatives who intertwine biological and cultural diversity.

Transitions towards More Sustainable Practices in Mobility: A Case Study from Finland

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The growth of consumption in our society has led to unsustainable overuse of natural resources. My study aims at finding the most effective ways to reduce the environmental effects of our everyday mobility which is, in addition to housing, the most resource-demanding area of consumption. I use data from interviews, diaries and questionnaires, collected from 19 households in 2014, to understand the prevailing practices in mobility in Jyväskylä, Finland. Five of these households were also involved in a one-month experiment period, during which they tested different ways to reduce their use of natural resources. The reductions were quantified by using the MIPS (material input per service unit) method that estimates the amount of resources used in different consumption areas. In practice (the theoretical approach), everyday routines are formed from different, interconnected elements. I study how these elements were changed during the study. I also use calculations on natural resource use in order to quantify the environmental impacts of these changes. My aim is to concretize the conflict that occurs when material or mental elements of practices are changed during transitions towards more sustainable practices, but social or cultural ones are not. My preliminary results show that it is possible to make significant reductions in natural resource use of mobility in a relatively short time period. In many cases, improving knowledge and material elements help the households to make more sustainable choices in their everyday lives. However, when it comes to permanence of these new practices, social aspects proved to be critical. Hence, transitions towards sustainable mobility require that more attention is paid to both individual and structural aspects of consumption.

Urban Form and Climate Change: Assessing the Global Warming Effect on the Built Environment in Northern Chile

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Climate change could affect enormously our lifestyle in the coming years. The latest IPCC report underlines that, in Chile, the temperature increase could be up to 6 degrees in 2100, especially in the northern part of the country. This paper explores the relationship between the urban disposition of buildings and the energy consumption changes that could happen due to global warming. Two different points of view are adopted: on one hand the possible energy consumption is assessed by using modified weather data for 2050 and 2080. On the other hand, the influence of the urban matrix on the urban ventilation is considered as a possible counteracting force facing higher temperatures. Nine different urban matrix scenarios are considered, and we search for a better way to dispose the buildings in order to reduce future cooling energy demand by using natural ventilation in the city of Antofagasta, a large coastal city of the Atacama Desert. Results show that a correct building disposition could reduce the urban temperatures up to 3 degrees. For example, if the first line of buildings facing the Ocean were designed to conduce the breeze and not to block it, the entire city would benefit by the cooling power of natural ventilation. This fact should be taken into account in the new master plan; however, real-estate business in Antofagasta, Iquique and other coastal cities of the North of Chile are very interested in the first line of the coast, because of the soil value, which is higher than in the other sectors of the cities. This study suggests the creation of a protected zone in front of the sea, with limitations in the buildings' heights and a mandatory plan to maintain the continuity of the city image. This action could generate benefits in many ways: maintaining the right of views, avoiding an increased heat effect on the island, and the above-explained better image of the city's generation and breeze cooling power use.

Urban Form and Climate Change: Spatial Regression Analysis of Heat Hazard Factors in Santiago de Chile

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Climate change will have a high impact in urban areas. The frequency and intensity of extreme heat events will increase, especially in maladapted metropolitan areas. In Latin America, the impacts and possible policy measures for coping with heat waves are still out of the scope of policymaking and urban planning. At the same time, urban form has a relevant effect on urban temperature. Thus, climate improved urban planning can help in diminishing heat hazards. In this presentation, the relationships between specific urban form features, such as the amount of open space, population density, built up intensity, among others, with heat hazard are explored through a set of urban form indicators that have been analyzed in a spatial regression model. The aim is to ascertain the weight of those urban form features in terms of their contribution to increasing/diminishing heat hazard. This analysis can provide spatially explicit insights for policymaking in Santiago de Chile, where currently, heat hazard is out of the scope of climate change policies. The results can feed specific urban planning instruments that can control urban development; the results thus hold the potential to diminish heat hazards, especially when climatic aspects are not currently included.

Effects of urbanization on carbon dioxide emissions in China: Accounting for Population Migration

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The effects of urbanization on carbon dioxide emissions (CO₂) have been discussed in previous literature; however, the results are inconsistent and the characteristics of urbanization may play an important role in the effect on CO₂ emissions. This paper examines the effects of urbanization on carbon dioxide emissions for China's provincial panel data from 2000 to 2012. Three urbanization indicators are employed to investigate the effects of urbanization on CO₂ emissions in China; those indicators thoroughly consider the evolutionary process of urbanization. Using the Stochastic Impacts by Regression on Population, Affluence and Technology (STIRPAT) model and dynamic panel generalized method of moments (GMM) estimation technique, the findings suggest that the effects of urbanization on CO₂ emissions varies widely, resulting from the structure of the urban resident population and the characteristics of population migration in China. Urbanization increases CO₂ emissions when measured by urban resident population. Conversely, urbanization decreases CO₂ emissions when measured by urban household registration population. The estimated coefficient on peri-urbanization is statistically insignificant. The implications of this study's results for carbon emission reduction policy are discussed.

Energy Efficiency and CO₂ Emissions in Colombian Cities: An Evaluation Using Data Envelopment Analysis and Data Panel Techniques

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Nowadays, cities account for half the world's population and two-thirds of global energy demand, and, in the coming decades, it is estimated that energy use and associated levels of greenhouse gas (GHG) emissions will continue unabated in cities especially in developing countries. Therefore, the urban development agenda is fundamental to the improvement and mainstreaming of energy-efficient and low-carbon urban pathways that curtail climate and environmental impacts without hampering urban development and growth. Thus, a better evaluation of urban energy use is necessary for decision-makers at various levels to address energy security, climate-change mitigation, and local pollution abatement. Therefore, this paper measures and evaluates energy efficiency and CO₂ emissions in Colombian cities as a case study of a developing country with the aim to set appropriate policies and strategies without adverse effects and impacts on economic growth and development. This study applies Data Envelopment Analysis and traditional indicators to measure energy efficiency in Colombian cities. As a complementary step, data panel techniques have been used in order to determine variables that influence the trends of energy efficiency and CO₂ emissions. Results from DEA suggest that Colombian cities have an excellent potential to improve energy use and reduce CO₂ emissions, and several cities have experienced gains in productivity, growth in efficiency, and improvements in innovation through new technologies. Second-stage panel data techniques show that energy prices, economic conditions and production structure have effects in the trends of energy use and CO₂ emissions. These results indicate several policy implications with regard to energy conservation, efficient use of energy, and reduction of greenhouse-gas emissions, and the importance to increase research on energy patterns in the context of cities, especially those of developing countries.

How Far Can We Go in Eating up Our Best Land? Past Analysis and Modeled Projections of Urban Growth and Energy Demand in Italy

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The uncontrolled spread of the built up environment into surrounding rural and natural land, and the consequently increasing urbanites' demand for natural resources, are among the most important causes of the dramatic consequences of global environmental change in many parts of the world. This study investigates soil consumption due to urbanization in the last few decades in Italy, which has undergone relevant urban expansion. However, this expansion was not coupled with a comparable population growth, thus suggesting that the degree of urban expansion may be unjustified. The study also aims to present different forecasts for soil consumption, the loss of agricultural potential, and the increase in energy demand for the coming future. The methodological framework features past trend data analysis, coupled with modeled projections; the data used is a fusion of archived thematic maps, classified satellite imagery, census data, and forecast data from the cellular automata model (SLEUTH). The authors analyzed urban and population growth through the evolution of spatially explicit data over time, according to three scenarios: business as usual, "booming expansion", and "fostering conservation". The results of this study provide realistic figures of future land cover change in Italy, estimates which regions are likely more prone to urbanization, and where urban growth will likely feature a sprawled pattern. Furthermore, the study discusses the potential risks related to the projected soil and energy demand, and how these risks may be avoided. In conclusion, the study aims to provide policy makers with useful tools and information to support and favor resilient and sustainable development.

Urban Growth and Agricultural Loss: Soil Consumption Quantitative Estimates for a South-Italy Case Study

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Dynamics regulating temporal evolution of landuse and landcover transitions (LULC change) is a subject widely and thoroughly investigated, especially regarding the pressure exerted by human activities on natural and other land. This research focuses on the deleterious consequences of build-up development for one particular case study; the main aim is to present a coupled analysis of LULC change historic trend with future projections through the application of cellular automata modelling (SLEUTH). The case study featured in this work investigates a region in southern Italy where the depauperation of soil due to increasing development represents an emerging problem. This region is the Municipality of Altamura (Apulia region, Italy), which, although clearly an example of how urbanization negatively impacts agricultural and natural land, it has not yet been, to our knowledge, the object of similar investigations. Our analysis observed that built-up areas significantly increased between 1956 and 2011, showing an accelerated land consumption trend for the most recent years. Further, results also show that despite the tight constraints recently imposed by regional administrations, agricultural land will still be allotted for significant percentages of urbanization. This would have tremendous consequences for the entire development of the region. This research represents a step forward in the construction of an atlas of Soil Consumption Geography in southern Italy, aiming to provide a useful tool for the development of informed sustainable policies.

Land Use Change Predictive Models to Support Decision-Making Processes

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The European Union defines soil as the "upper layer of the Earth's crust, formed by mineral particles, organic matter, water, air, and living organisms." Recently, the commission to the European Parliament developed the Roadmap to a Resource Efficient Europe, which sets a target of achieving a state of no net land take by 2050. In fact, for more than a decade, the EU has recognized soil as a common good and considers soil to be a finite resource with an inestimable value. Despite that, Italy still consumes its soil at the rate of 8 m² per second.

This paper presents the case of the Valley of Agri (Basilicata, Southern Italy), a region characterized both by the presence of extremely valuable land (because of the exceptional degree of soil fertility) and by the presence of one of the largest oilfields in Europe. An application of the cellular automata model, SLEUTH, was developed to produce a simulation and an estimate of the extent to which urban areas may grow in the near future. Results confirm that the urban policies implemented so far by local governments—which aimed almost exclusively in favor of industrial development—irreversibly threaten the integrity of the natural values of the valley. The use of predictive models can therefore provide an important support for decision-making processes.

A Community Based Pollution Prevention Program for Two Urban Environmental Justice Cities

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Pollution Prevention is a concept for generating less waste, using less toxic chemicals while conserving water and energy and reducing air pollution to achieve Environmental Sustainability. In this presentation we describe the results of a community based pollution prevention program funded by the US Environmental Protection Agency. One objective of this program was to investigate whether a community-wide effort within an environmentally impacted area can help establish focus and enthusiasm for pollution prevention in order to improve the overall environmental picture of the community and help advance the economic development of the community based on cost savings and potential further use of the savings for job retention or expansion. This program was developed based on the New Jersey Technical Assistance Program for Industrial Pollution Prevention (NJTAP). The NJTAP was designed to provide objective, confidential, non-regulatory assessments of pollution prevention opportunities for small and medium sized firms in New Jersey. For our program we target our attention to businesses in for two urban environmental justice cities in the State of New Jersey, Newark and Jersey City also the two largest cities. We have developed our program in collaboration with Ironbound Community Corporation (ICC) and Greater Newark Enterprises Corporation (GNEC) in Newark and Sustainable Jersey City (SJC) in Jersey City. Two urban cities we selected are also the two oldest cities in the State of New Jersey and hence there was no urban planning and hence commercial businesses that uses hazardous chemicals are intermingled with residential units. Furthermore, both cities were impacted by super storm Sandy where chemicals and hazardous waste was released to the environment. We visited most of the small businesses in the two cities to study and document the full business operation and use of chemicals with a focus on steps responsible for waste and pollution generation. With this information, we have performed an analysis to provide suggestions for modification of process/business steps with greener technology in order to prevent pollution as well as to reduce the overall cost. We have documented pounds of hazardous materials reduced, metric tons of carbon equivalent (MTCE), gallons of water conserved (gal), dollars saved and pounds of non-hazardous waste reduced. Since our program is voluntary only a limited number of businesses accepted our services and there is economic burden on business owner during our information gathering process. Finally, we will organize two community events in Newark and Jersey City to inform the two communities the outcome from our research including testimonies from businesses that joined our program.

Collaboration and Competition in Local Sustainability Transitions: The Example of Energy Transition Processes in a German City

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Local and regional spaces constitute hotspots of sustainability processes, in particular, energy transitions. Actors from different social spheres such as politics, civil society, economy, science, *etc.* are involved in local transitions processes. However, comprehensive research on these processes and theoretical approaches that take the various social spheres and their interactions into account, barely exist. This paper contributes to filling this void by presenting an empirical study on the energy transition processes in the city of Emden (Germany). Based on document analyses and 37 narrative interviews with local actors involved in energy transition processes, it emphasizes the collaboration and competition between actors from the local economy, politics, science, religion, and civil society. The material shows an increasing involvement in energy transition processes by actors from various spheres, which can be attributed to the benefits they can generate from their activity in the transformation processes, such as political votes, power, economic profits, publications and research funds, credibility and moral legitimacy. Despite seeking different types of benefits and engaging in dissimilar operational logics and fields of activity, actors from different spheres (businesses, politicians, scientists, ecological activists, *etc.*) tend to complement each other in their transition activities. Thus, actors from each sphere assume specific functions in the local energy transition: politics take favorable decisions for local energy transition; businesses “materialize” energy transitions in the form of wind farms and energy efficiency measures; civil society agents act as moral watch dogs; science provides scientific expertise to transition projects. While the local activity is mostly marked by collaboration, there is also competition about the dominant positions in local energy transitions processes. Conveying high legitimacy and sphere-specific benefits to actors (e.g. votes, economic profit) as well as the potential to shape local transitions processes, actors compete for leadership roles and seek to brand themselves as pioneers of Emden’s energy transition. The rising attractiveness of local energy engagement as well as the collaboration and competition between actors, indicate the emergence of a local “energy transition”-arena, which constitutes a social field in which actors from different social spheres collaborate in energy transition activities and struggle for dominant positions.

Measuring the Sustainability of Urban Spatial Structure: A Capital Approach

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The spatial structure of a city is a key determinant of its socioeconomic well-being. There is a growing interest in models investigating the relationship between spatial structure and the sustainability of urban development. Despite an extensive and notable literature that links the built environment with sustainability, there is a dearth of quantitative models that focus on measuring the environmental, economic, and social effects of urban spatial structure using comprehensive metrics of sustainability. Recent advances in developing capital-based sustainability indicators, such as the Inclusive Wealth Index (IWI) and the Genuine Progress Indicator (GPI), offer more comprehensive approaches for sustainability assessments; these approaches clearly account for economic, social, and natural factors that are infrequently measured in conventional approaches.

This paper presents an integrated modeling framework for simulating and measuring the effects of changes in urban spatial structure on wealth, as embodied in physical, natural, and human capital forms. This framework consists of four components: 1) a spatial database, 2) a land suitability analysis, 3) a spatial optimization model that is a combination of optimal facility location and optimal shopping frequency models, and 4) a sustainability assessment. The sustainability metrics of the GPI were employed to evaluate simulation results and reveal the direction and magnitude of effects. The strength of the GPI as a measure of urban sustainability lies in its capacity to be a proper yardstick for all wealth components, including natural, human, and physical capital.

The modeling framework was applied to the study area of Morgantown, West Virginia for the case of locating food and beverage stores. The results show that even a modest change in the spatial configuration of the selected urban facility (the food and beverage store) can significantly change the urban sustainability level, as measured by the GPI.

Sustainable Cities. The Polish Niche Area

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Architecture, like all other disciplines connected with the building construction industry, reflects changing political conditions and contemporary social knowledge and approaches. It is evident that both the design abilities as well as social expectations should match, especially now when mankind is facing a serious lack of resources. In Poland, the construction and city planning process is an investor driven issue. The basic expectation of the owner is low construction cost and, of the user, low exploitation cost. Both aims do not have to exclude the other, especially when design of a building is not considered merely as a technical issue, but requires choosing an option which offers the most rational economic and technical solution. A lot is said about sustainability, but very little effort is visible to include it as part of city planning. A further problematic issue arises when social expectations and understanding develops faster than the knowledge of professionals, legal codes and the scope of education offered to young architects. Many professionals state that a sustainable approach where architecture is concerned is often not their key concern as it does not allow for aesthetically acceptable effects and restrains creativity. Education does not effectively cover the sustainable approach. Much is said and done at the technical level and advancement of software skills, but it is frequently said that there are more important issues than the environment, which in fact should be treated as a design niche area. The outcome of such arguments is that in most cases sustainable resilient cities will remain achievable only on paper. This paper will focus on an interdisciplinary sustainable course which ran from 2012–2014 as an experimental study during a three semester Master course at the Faculty of Architecture, Warsaw University of Technology. Presented projects were based on programs formulated by public body clients from a sustainability objective. Students worked in teams comprised of a designer, with structural and environmental consultants. Besides design issues, part of the feasibility study was preliminary an economic evaluation confirming if the project could be designed within the client's budget. The main finding was that provided solutions prove that when working in interdisciplinary teams with a clear set of sustainable aims defined at the concept stage, a strong synergic effect may be detected. Furthermore, such an approach does not limit architectural creativity in any way.

Sustainable Social Development in Lithuania (Applying Wallerstein World Systems Theory at the Mezzo-Territorial Level)

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Social inequality is programmed into the modern economic world. Wallerstein developed world systems theory, a multidisciplinary, macro-scale approach to world history and social change that emphasizes the world system (and not nation states) as the primary (but not exclusive) unit of social analysis (Wallerstein, 1989). We can see the development of core, periphery, and quasi-periphery zones at the state level. The quasi-periphery may be understood as an intermediate model between the core and the periphery; the quasi-periphery is a synthesis of those two zones. Wallerstein asserts, with regard to states, that there are three levels of economic zones that cannot exist separately. Changes with respect to these three zones are determined by the fight for resources. In this paper, Wallerstein's theory is applied at the municipal (mezzo) level. The fight for resources occurs not only in a state's periphery and quasi-periphery, but also inside the state. This sentence can be confirmed by statistical territorial and cluster analysis (via ArcGIS 9.3). We can see that in peripheral zones, there is agriculture, but no industry. We contend that when the core increases, the periphery and quasi-periphery are simultaneously reduced. The production of the core is exported into the other zones. Wallerstein emphasizes the growing impacts of cultural indicators and periphery recapitalization on the development of a state within the world system (Wallerstein, 1974). The aforementioned we can see reflected in the amount of investment per capita. Decreasing population in a territory makes the territory even less attractive, and generates weak social infrastructure (Van Stel, Suddle, 2008). We contend that human resources are relatively bigger in urban territories. Therefore, in this paper, three groups of municipalities were analyzed: *i.e.*, cities, rural municipalities, and municipalities with dominant town populations. Thus, Wallerstein's theory may also be applied for explaining inequality inside the state.

Urban Sustainability: An Indicator-Based Assessment of Selected Indian and Global Megacities

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Cities are at the forefront of global socio-economic change, and rapid urbanization is a phenomenon of the current century, which has significant implications for economic, environmental and social sustainability. Given this, the study investigates whether the present pattern of urbanization in India in the creation of mega cities is sustainable, and what can be learnt from the experiences of global megacities. This has been done by comparing two Indian cities, Mumbai and Bangalore, with selected mega cities of the world (Shanghai, London and Singapore) using an indicator-based approach under a sustainability framework. First, a hierarchical sustainability framework is developed with the prioritized set of quantifiable indicators under three dimensions of sustainability—economic, social and environmental. Second, these indicators are quantified using data from secondary sources and then used for constructing urban sustainability indices (USIs) for the selected megacities. Third, the megacities are evaluated by benchmarking them with a hypothetical sustainable megacity, which has been created using best indicator values realized across cities of the world, and sustainability gaps are identified. These gaps essentially represent the targets for achieving sustainable urbanization. The results indicate that, compared to benchmark index values, both Mumbai and Bangalore have large gaps to bridge with respect to economic sustainability, whereas both the cities are relatively better placed with respect to social and environmental sustainability. Among the five cities, Singapore emerges at the top with a high USI value and Bangalore and Mumbai occupy the bottom two positions respectively. We believe that the indicator-based approach represents a primary tool to provide guidance for policy makers to potentially assist in decision-making and monitoring local strategies/plans. The outcome of the study will contribute to the design of policies, tools, and approaches essential for planning to attain the goal of sustainable urban development.

A Multidimensional Approach to the Location Process of a Municipal Solid Waste Processing Facility—An Example of Anaerobic Digestion

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The location of an organic fraction of municipal solid waste (OFMSW) processing facility is often affected by domestic environmental regulations and local determinants. The phenomena of local resistance is frequently observed in the case of waste treatment investments, such as mechanical-biological treatment (MBT) installations, composting sites, or anaerobic digestion (AD) plants. Protests accompanying such investments refer to both source separated organics (SSO) and biodegradable fraction separated from mixed municipal solid waste (MSW). Therefore, the investment process should be assisted with multicriteria decision support tools, indicating environmental advantages as well as allowing for tradeoffs between actors involved in the process. This article describes a multidimensional approach to a location process, in particular for an AD facility, with the help of a multicriteria biogas investment tool (M-BIST). The main categories included in the analysis cover environmental, social, spatial, organizational, technological, and economical issues. A three-stage analytical process is divided into: (i) preliminary analyses of conditions for AD technology implementation; (ii) detailed analyses of selected categories described above; and (iii) spatial analyses conducted with the help of a geographical information system (GIS) tool. The output results of (i) and (ii) are expressed as boundary conditions and presented as a data matrix in the form of a calculation sheet. They include specifications for three basic types of AD facilities: (a) AD units onsite at an MBT, fuelled with the mechanically-selected OFMSW; (b) AD plants fuelled with SSO; and (c) plants fuelled by SSO in codigestion with agricultural substrates. The results of (i) and (ii) combined with the GIS output data, such as land use cover (urban, rural, suburban), urban function (living, production, services, agricultural areas), population density, waste generation density, and power infrastructure are the final outcomes of the M-BIST tool. The conclusions of (i), (ii), and (iii) are presented in a graphic format: cartograms, carto-diagrams, topographic maps for optimized sitting procedures (distances, exclusion, protection and preferential zones). The expected outcome of the M-BIST tool is to improve the integration of a new facility with a local technical infrastructure, to avoid conflicts with a local community, to reduce negative environmental impacts, and, at the same time, to ensure a sustainable development of the area.

Empirical and Numerical Comparison among Mitigation Strategies against the Urban Heat Island Effect in the City of Toronto

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The increasing awareness of the urban heat island (UHI) effect has directed attention towards the outdoor thermal comfort in cities worldwide. The urban microclimate is an important factor for pedestrians' health, but it also affects the urban air quality, energy use of buildings, citizen wellbeing, and urban sustainability. Unfortunately, urban microclimate issues are becoming more common given the increasing rates of urban development and construction. Although being in a cold climate may be associated with suffering less from the UHI effect, several studies in the last few decades have revealed how critical the UHI effect can be in Canada. As a result, many Canadian cities have started promoting actions plans for mitigating UHI. In particular, in Toronto, a city experiencing one of the highest building developments in developed countries, UHI mitigation strategies are currently object of extensive debates. This study evaluates different UHI mitigation strategies in different urban neighborhoods of Toronto, selected according to their building density. The effects of cool surfaces (on roofs, on street pavement, or as garden areas) are evaluated through numerical simulations using the software ENVI-met. After having obtained the surface temperature, outdoor air temperature, mean radiant temperature, and physiologically equivalent temperature, this study compares the possible mitigation of net surface radiation and thermal radiative power. The results demonstrate that the duration of direct sun and the mean radiant temperature, which are strongly influenced by the urban form, play a significant role in urban thermal comfort. Finally, this research supports new policies for promoting a sustainable urban development in a cold climate, such as that of Toronto, and suggests design strategies for a more resilient urban planning.

Enhancing Comfort in Urban Open Space of Jakarta's Superblocks Through Research on Thermal Comfort, Wind Speed, and Distribution. Utility of Physiological Equivalent Temperature (PET) and Computational Fluid Dynamic

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Jakarta, the capital city of Indonesia, is facing the same problems as other metropolitan cities in the world. The UNFPA (the United Nation Fund for Population Activities) has reported that all metropolitan cities in the world face, not only urbanization and rapid population growth, but also global warming. In terms of the Urban Heat Island phenomenon, it is necessary for the heat in a city to be released quickly. The phenomenon of an Urban Heat Island is when the air temperature is higher in the center of the city than in its surrounding area. Recently, it has demanded attention as an environmental problem unique to urban areas. Jakarta, a city with more than eight million inhabitants, has grown faster than other cities in Asia, such as Kuala Lumpur, Beijing, and Bangkok. One of the policies to mitigate Urban Heat Islands in Jakarta is the development of superblocks. A superblock is developed to contend with the explosive population growth, is built in the center of the city, and uses available land efficiently for the integration of groups of buildings. Developing high-rise buildings with a mix of functions becomes the solution to use land efficiently in the rapidly growing city. On the other hand, high-rise buildings can hinder wind distribution and velocity used to release the heat in a city. This study explores the application of PET (Physiological Equivalent Temperature) index and CFD (Computational Fluid Dynamic) in urban micro-spaces (urban structure) of superblocks in order to measure the impact of thermal comfort, and wind distribution and velocity, which relate to the release of heat in the city, which can provide an increase in comfort. The study was carried out in the three biggest superblocks in Jakarta with the goal of discovering the natural and ecological effects of urban design through these indices. The study focused on: the role of urban open-spaces among the buildings in the superblocks; the impacts of different street orientations; the effects of the hard and soft materials of the street surfaces and open spaces; the effects of differences of high-rise building form and height; and the wind distribution and velocity in the city.

Structured Participatory Decision Processes to Promote Energy Sustainability at a City Level: A Systematic Review

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There are three reasons why a focus on sustainable energy solutions should be a priority for players in the energy market in South Africa. Firstly, state-owned power utility, Eskom, is under a huge amount of pressure to keep the lights on. Secondly, the reduction of carbon emissions to reduce the impact of climate change has become a non-negotiable necessity. Thirdly, as part of the National Development Plan (NDP), all South Africans should contribute to reducing poverty and inequality through job creation and community development. Local governmental institutions, namely municipalities, are well positioned to have a direct impact on 1) supplying and distributing electricity, 2) reducing carbon emissions and 3) improving the lifestyles of the communities they serve. For a municipality to exploit the opportunities of promoting sustainable energy solutions requires a structured participatory decision process, which deals with the complexity and interlink of social, economic and environmental factors. Such a structured participatory decision process should entail specific theories, methods, tools and techniques and should include a range of stakeholders participating in the process. The main objective of the paper is to conduct a systematic review on the current structured participatory decision processes in literature to determine their effectiveness in addressing the complexity of energy systems at a city level. A detail analysis of 265 articles found in a search on Scopus and Web of Science Core Collection is currently underway. Initial research findings show that to improve environmental decision-making requires a strong focus on stakeholder engagement and deliberation. Adoption of a systems-thinking approach could further improve the quality of the structured participatory decision process, as it is key in dealing with the complexity of current environmental problems. The synthesis from the systematic review will be the first step in developing a structured participatory decision process for local energy sustainability.

The Barriers and Strategies of Electronic City Establishment in Iran

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This article surveys the barriers and strategies of establishing e-cities in Iran. The literature around the research topic is briefly reviewed and is divided into two classifications. The first encompasses the electronic government, electronic life, electronic organization and electronic infrastructure, and the second includes the technical, managerial, economical, cultural-political and educational obstacles. Furthermore, this research is bounded on nine theories. The discovery-survey research method is applied in this research and the needed data is gathered through library data, an interview and a questionnaire. The questionnaire under the title 'The Barriers and Strategies of Establishing E-Cities in Iran' was distributed among the statistical population, which included experts and specialists from this field. The results data of the completed questionnaires were analyzed by statistical techniques: t-test and Friedman analysis of variance, by SPSS. The theories were examined by classifying the different dimensions of the obstacles identified. The suggestion for conquering the obstacles makes up the final section of the research. Meanwhile, we tested assumptions. We ranked barriers of research in style ranking variables into two categories of independent variables, and in the end, all variables were ranked. The findings of the research are: In the first category of variables, ranking on the basis of importance is low. Also, some variables had important effects such as e-governance organization, .e-life and e-infrastructure. In the second category, ranking is also low: for example Management barriers, Educational barriers, Economical barriers, Technical barriers and Political-culture barriers.

Tree Characteristics and Their Impact on the Retrofitting of Sustainable Drainage Systems and Road Structures

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Trees play key roles in creating healthy urban ecosystems and environments by purifying air and reducing pollutants, acting as flood control measures, reducing localized extreme temperatures, and increasing the aesthetics and economic values of a place. However, most trees cause damages to structures, and cities are spending substantial sums of money to address conflicts between tree root spreading and corresponding damages to infrastructure. Therefore, this study focuses on analyzing the different types of damages to structures and their severity in relation to tree species and their characteristics, such as species, distances to nearby structures, diameters at breast height, tree heights, crown spreads and tree hang-over characteristics. Individual structures selected for this study include permeable pavement, impermeable pavement, kerb, road, retaining wall, footpath and building. One hundred sites of 100 m ´ 100 m in area were randomly selected within Greater Manchester for this study. Aesthetics and community acceptance studies of the most common tree species were also carried out. Damages to structures were classed as minor, moderate and severe. Results indicate that most damages (44%) occurred to impermeable pavements. Damages to structures were 66% moderate, 21% light and 19% severe in nature. Overall, *Acer platanoides* (Norway maple) was responsible for most damage (17%). However, most damage calculated by comparing the number of trees that caused damages to the number of trees that were found close to structures was associated with *Aesculus hippocastanum* (Horse chestnut; 59%). An analysis of the relationship between distance of different tree species to a structure, tree diameters and percentages of damage to different structures was carried out. This study provides valuable information for retrofitting of sustainable drainage systems and to urban developers in choosing the right trees for their locations. It will also help to reduce the amount of money spent in maintaining and repairing buildings.

The Success of Sustainable Cities by Night: Between Theory and Practice

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When the Nobel Committee awarded the 2014 Nobel Prize for Physics to Japanese physicists for their “*invention of efficient blue light emitting diodes [LEDs], which has enabled bright and energy- saving white light sources*” it gave the general public the impression that this new lighting technology was completely safe and harmless, and that we were looking to a more sustainable future for our cities. Unfortunately, a review of the growing body of lighting-related literature reveals that much research has been already conducted and published in diverse fields, such as biology, environmental sciences and medicine, on the negative impact of artificial lighting, especially new LED light sources on humans, flora and fauna. However, little published work has been found to show that lighting research in these fields is making any significant contribution to urban lighting design practice. This new knowledge is rarely considered; the reason being that researchers and scientists do not share the findings of their scientific work with those who pay to design the lighting. There is a lack of information available on the above topic and there are no established guidelines to follow. These new technological capabilities bring new concerns about their application, as municipalities around the globe are quickly converting their current functional and decorative external lighting to LED in an attempt to preserve energy and save money. In consequence, the advent of light-emitting diodes has elevated concern among some researchers, scientists and professional lighting designers about the potential negative effects of blue-rich white light, as such exposure during the nighttime has adverse effects on the environment leading to problems with reproduction, avoidance of suitable habitats, changes in seasonal migration routes and to a reduction in numbers or even the extinction of certain species. It is also believed to be the origin of certain chronic disease in human beings, including cancer. The blue component of outdoor white LED lighting also increases light pollution more than older lighting technology. As the United Nations General Assembly proclaimed in 2015, at the International Year of Light and Light-Based Technologies (IYL 2015), it is a great opportunity to talk not only about energy savings arising from the use of new energy efficient light sources, but also about how urban lighting should be designed and how to mitigate the negative consequences of external illumination. This should include such aspects as the reduction of light pollution, light trespass and the impact on the environment and human beings at night.

Comprehensive Evaluation of the Sustainable Development of Chinese Cities at Different Scales and Measures to Improve Sustainability

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Cities are hybrid socioeconomic–natural ecosystems that represent humanity’s densest concentrations of people and their activities. Given the resulting ecological impacts, sustainable development is necessary to allow urbanization to continue. The sustainability of urban development can be monitored using an indicator system that accounts for both socioeconomic development and environmental protection. We designed a 24-indicator system capable of meeting this need, and used data from 277 Chinese cities at the prefecture level or above in a case study of the method. We evaluated changes in their sustainability from 2000 to 2010 using the full-permutation-polygon synthetic indicator method. The results of our analysis showed that socioeconomic indicator values increased with increasing city scale, accompanied by decreasing values of environmental indicators. From 2000 to 2010, the capacity for sustainable urban development increased at all three city scales. However, by 2010, the sustainability index values for megalopolises, large cities, and small or medium-sized cities were only 0.40, 0.29, and 0.25, respectively (where a value of 1 represents sustainable development). The sustainability level was only moderate. Thus, Chinese cities at all scales have a long way to go to achieve sustainable development, and it will be necessary to implement measures to guide future urbanization in China and other developing countries around the world.

Informal Urban Settlements under Global Economy: The Urbanization of Dry Ribeiras 'Favelas' in Cape Verde

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Cape Verde has shown fast economic growth in the past decade. The international tourism industry, diaspora remittances, and financial service sector development have been the key elements in Cape Verde transition to a middle-income development country. The fast economic growth is also accelerating rural to urban migration. Immigrants illegally occupy low land ribeiras, increasing pressure over poor water infrastructures and worsening the living conditions in the informal settlements. The situation is compounded by a lack of water resources. In addition, unplanned informal settlements are less resilient to climate change effects, and water access is becoming increasingly difficult for the poorest in the urban areas. The aim of this study is to identify typologies, dynamics and trends in current settlements in low lands ribeiras. The study uses satellite images collections from 1990, 2000, and 2010 from different informal settlements in Cape Verde's biggest urban center, Praia. Additionally, main infrastructures, demographic data, and ownership cadastres were compiled to create a geographical information system. Subsequently, these data was analyzed to identify informal settlements typologies, land occupation, and land use changes, focusing on low valley "ribeiras". Results show clear differentiated typologies, depending on time since settlement, slope, island and ethnical origin, and access to infrastructure. The findings of this paper can serve as a basis of further research on urban dynamics and as a planning tool to increase resilience to climate change, and decision making on new infrastructure-building in informal settlements.

The Impact of Pollution on the Urban-Rural Income Gap in China

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Most prior literature has proved that income inequality would have a significant impact on pollution. However, the relationship between pollution and income inequality would not be unidirectional, and the pollution may affect income inequality by way of health capital investment. Urban residents have a higher-level income and produce more emissions of pollutants than rural residents. However, the negative effect resulting from pollution will be undertaken by both the urban and rural residents equally; this is triggered by the negative externality of pollution. Therefore, the rural residents would have to pay medical expenditure equal to the urban residents to keep themselves healthy.

In view of the previous research, this paper has provided an inter-period model to describe the impact of pollution on urban-rural income gaps regarding the main characteristics of the dual economy between urban and rural areas in China. The production and consumption behavior has been assumed to be subject to the hypothesis of life-cycle consumption, and then the model is used to analyze the heterogeneous health capital investment between the urban and rural residents. The conclusion indicates that the urban-rural income gap will be enlarged by the increasing of pollution, and the bigger gap of the beginning period would enhance the impact of pollution on urban-rural income gaps.

Accompanied by the fast economic growth in China, pollution and the urban-rural income gap have been two important issues which have had a negative effect on sustainable development and social stability. Hence, we collect China's provincial dataset (which contains 30 provinces) over the period from 2002 to 2013 to capture the impact of pollution on urban-rural income gaps. By using the method of dynamic panel model, the results suggest that pollution has an impact on the income gaps between urban and rural significantly. A panel threshold model is used to detect whether the income gap of the beginning period has strengthened the impact. Finally, both the theoretical and empirical conclusions has proved that urban-rural income gaps would be significantly affected by pollution, so the relative policy should pay more attention to correct negative externality of pollution between urban and rural areas, such as more public health investment to rural areas and stricter environmental regulation in urban areas.

Between Social and Environmental Sustainability: A Look into the Time and Space Use Patterns of Households with In-School Children around Min-Sheng Community in Taipei

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When the Min-Sheng community was developed some 40 years ago, it was planned for young families in a society with a fast-growing population. The design was pioneering for the time. The community has tree-lined pedestrian walkways, neighborhood parks, and amenities on every street block. Due to economic considerations, residential apartments are mostly four stories high, without elevators or garages. Walking was the method for in-community travel. As time goes by, social development changes the demography of the community. After 2000, the number of in-community children has been decreasing continuously. Public schools accept out-of-district students to maintain their vitality. Questions arise concerning how changes in life style affect the community's sustainability.

This study begins to explore these questions. The study focuses on the demographic group the Min-Sheng community was originally designed for: households with young children. A survey to elicit life style and energy consumption patterns was distributed to households of 330 students in the Min-Quan elementary school. One-hundred and fifteen households completed the survey. A detailed database of household activities in temporal and spatial dimensions, during both work days and non-work days, was created.

The survey shows that one third of the student households actually live outside the school district. The energy consumption from commuting has increased and the free time of individuals has been reduced, owing to the need for time management. Also, planned activities, for both adults and children, have significantly outweighed unplanned activities. Moreover, a significant percentage of children are under non-parental care, and conduct planned activities during afterschool hours. With regard to the use of space, family activities seldom take place in public spaces. There is little social interaction outside household members. Also, three-generation households are near absent in the survey.

Several trends in Taiwan's social development are believed to contribute to the misalignments between the sociable, low-energy infrastructure of the Min-Sheng community and the life style of high environmental costs experienced by young families today.

RE-CYCLES. Revitalization of Dismissed Brownfield Areas through Landscape CYCLES in Post-industrial Territories

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This PhD research carries out an innovative approach, apt to create new methodologies and solutions to revitalize contaminated brownfield areas in a post-industrial context. A new pioneering landscaping, strictly connected to the Landscape Urbanism theory (landscape, with its ecological component, becomes a dynamic planning practice), is our answer to this challenge through the innovative "Landscape cycles" device. In the recent decades, with the advent of the Internet and with space-time contraction, one lives and works in the same spaces, or one lives and works hundreds of kilometers away. "Landscape cycles" could make a relationship between these two scales in a horizontal and non-hierarchical way, managing innovative concepts of the compensation of human presence on territories. Thus, "Landscape cycles" will define qualitative multifunctional landscapes as environmental monitoring of the health of territories, and will intervene for industrial reconversion through the dynamic logic of incentives. The consequent redefinition of urban regulations and urban standards, in a resilient landscape-centered perspective, should be drawn up, so as to plan policies, to be applied by local governments, to encourage public-private partnerships and to respond to the EU's wishes, which consider brownfield areas' reconversion as a key point to achieve the necessary territorial restructuring. This presentation wants to introduce the fundamental reflections and the foreseen methodological guidelines of the research program, concerning the following topics: 1) the definition of a new landscape-centered and resilient approach, capable of regulating temporal and spatial cycles of reconversion processes, looking at landscape cycles like a dynamic compensation model of human presence on a territory, based on qualitative criteria; 2) the redefinition of urban regulations and urban standards in a resilient centered perspective; 3) the delineation of new design strategies and new innovative graphic representations of landscape cycles to reach an updated communicative language able to graphically describe present fast-changing dynamics.

The Identification Approach to Territory Space Multifunction at Provincial Level in China - Taking Hunan Province as an Example

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The purpose of this presentation is to introduce the identification approach to territory space multifunction at provincial level. Methods include comparative studies, an index system of identification, and a framework of regional downscaling in multifunction identification. The results indicate that production and living functions are obviously stronger than the ecology function in Hunan province, and the three functions' distribution showed a significant difference because production functional areas are mainly distributed around Changsha-Zhuzhou-Xiangtan urban agglomerations, and gradually weakened from central city areas to the surroundings. High living functional areas are concentrated in the northeast plain and central basin area, which largely follows a trend of decreasing from the east to the west area in Hunan province. However, the distribution of the ecology function shows the opposite trend: high functional scores areas are mainly distributed in the northwest and southeast; the densely central regions have a weak ecology function. The analyses' results show that regional downscaling offers effective and comprehensive ways to solve the problem of space, and the identification approach is feasible for territory space multifunction.

The Importance of Physical Space in Shaping the Public sphere Case Study of Neshat Park in Kerman, Iran

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The public sphere is an area that provides space for free social interaction. The public sphere is recognized as an area of social life where individuals can discuss matters of interest freely, to explain or solve differences through logical debate and without the implication of dogmatism, or the traditional orders issued by local customs, or at least to clarify differences.

The main component of the formation of a public sphere is participation. Certain components of social capital are crucial for the formation of sustainable participation; e.g., people's trust to enter the discussion which would provide the chance of reaching agreement possible.

This article is a case study of research on Neshat Park in the city of Kerman, Iran, using two methods of observation and enquiry to measure the social capital and factors of a human scale city project, as a stable platform for social interaction and to prove how crucial public physical space is for the realization of basic aspects of the public sphere.

Better Cities through a New Climate Economy

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The New Climate Economy (NCE) is the flagship project of the Global Commission on the Economy and Climate. It was established by seven countries: Colombia, Ethiopia, Indonesia, Norway, South Korea, Sweden and the United Kingdom, as an independent initiative to examine how countries can achieve economic growth while dealing with the risks posed by climate change. A key message of the Commission is that it is possible to have better growth and a better climate at the same time. This conclusion is based on a deep analytical work on possible transformations in three economic sub-systems: land use, energy and urban development. Related to urban trends, the Commission concludes that fewer than 500 cities in three key groups—Emerging Cities, Global Megacities, and Mature Cities—will account for over 60% of global income growth and half of energy-related greenhouse gas emissions growth between now and 2030. Action in these cities, particularly Emerging Cities, will have disproportionate benefits for the global economy and climate.

In the urban sub-system, the Commission introduces a new, alternative model of urban development—the “3C model”. This model that aims to lock in economic and climate benefits in cities stressing compact, connected and coordinated cities development. Compact urban growth can be achieved by encouraging expansion that allows for higher densities, walkable and socially mixed neighborhoods, redevelopment of old industrial sites and the facilitating of green spaces. Connected infrastructure will encourage improved public transport such as rapid bus transit, cycle paths, electric vehicles, smart energy infrastructure and integrated water, sanitation and waste services. Coordinated governance encourages accountable institutions that can coordinate planning and implementation of programmes of activity and investment across public and private sectors and civil society.

Clean Solutions for Power and Transport in Rapid Urban Development

Anders H. Nordström

Group Head of Environment ABB Ltd., Finland.

Projections by the U.S. Energy Information Administration indicate that global electricity consumption will grow by close to 70% in the next 25 years. In rapidly growing cities, regions and countries, demand will rise much more. During the same period, global CO₂ emissions must come down to far lower levels than today, to avoid dangerous climate change.

To solve this dilemma, we need to cut the link between economic growth, energy use and CO₂ emissions. There are two major ways to achieve this: the first is *energy efficiency*, which helps reduce the correlation between economic growth and energy use. The second is use of *renewable energy sources*, which reduces the correlation between energy use and emissions.

Rapidly growing cities may suffer from many conflicting challenges, such as shortage of reliable electric power supply and absence of effective public transportation, while at the same time suffering from abundant air pollution and associated health issues.

ABB, with its core business in electric power technology and industry automation, strives to be part of the solution for sustainable urban development. We provide products, systems and services that help customers and societies increase resource efficiency, and reduce emissions and energy costs. Already today, 51% of our revenues are related to our portfolio of energy efficiency and renewable energy products.

In rapidly growing urban areas, we provide solutions for smart, efficient and clean power transmission and distribution, solutions for clean metro and tram systems, charging infrastructure for electric cars and buses. End-user efficiency is another important area, where we see large opportunities in industry as well as in buildings, a sector that uses 40% of world primary energy while 80% of the economically viable energy savings potential remains untapped.

Urban Planning Challenges in Arrival Cities: The Case of the Grand Housing Development Program in Addis Abeba

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Rapid urbanization is generally seen as a positive factor in poverty reduction. However, the growing demand for housing in African 'arrival' cities, such as Addis Abeba, and missing urban planning strategies and innovative housing designs represent a great challenge to sustainable urban growth. In 2004, the so-called 'Grand Housing Development Program' (GHDP) was initiated by the Ethiopian government to address the ever-increasing demand for housing in Addis Abeba. This formal, top-down program aimed to develop 200,000 new housing units within five years in order to address half of the housing backlog, while cooperatives, real estate developers, and individuals were expected to provide for the other half. However, even though the lottery-based assignments of new apartments have addressed the housing shortage to some extent, it still remains a fraction of the original plan. Moreover, the inflexible typology of objects and the lack of open space as a social and economic base for new inhabitants may not be conducive to sustainable urban change. Another major challenge is the fact that the urban poor in Addis Ababa may simply not be able to afford to pay basic infrastructure costs for services such as water, electricity, or garbage removal that accrue in the new formal settlements. Their daily income is usually generated from informal and local businesses in the neighborhood, which at the moment are continuously shrinking due to urban renewal programs. Local markets are replaced by higher-priced supermarkets; strong social ties and the unique historical mixture of different income groups within the same neighborhood may not be easy to transfer to the new homogeneous typology of housing in the new settlements. The GHDP design may have to eventually respect existing social and cultural settings, make better use of local available materials, and create improved access to basic services for the new residents. The task will be to deliver innovative and resilient design strategies that are not just providing shelter but also encourage a new neighborhood culture and economic opportunities for the new residents.

No Lights, No Jobs, No Hope: The False Promise of Urbanization Absent Integrated Energy and Urban Policies

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Migration theories suggest that people moving from the country to the city are gain-seeking individuals transitioning from agriculture to industrialization. Yet, today's era of mass urbanization offers no guarantee of income producing returns to geographic mobility. Currently, migration to cities is superseding the process of industry/employment-induced urbanization. Without cities' economies enabled to support migrants, populations are piling up with limited access to resources and livelihoods. Thus, when considering smart cities we must understand the larger forces driving urbanization and recognize the need for: urban areas inclusive of economic development opportunities, industrialization-supporting infrastructure and policies recognizing energy systems as a critical element of social support during the rural urban transition. Technology will play a role, but decisions about which technologies, for what purposes, and for whom raise big questions about order of actions, patterns of settlement, and paying for and sustaining urban growth.

This paper considers the complexity confronting urban management and planning along the way toward global urbanization in the context of an uncertain global energy system. Popular accounts aside, most migration induced urban growth is taking place in medium sized cities, sites originating as market towns, government centers or transportation hubs. Regardless of their origin, these cities are expanding through migration unaccompanied by needed energy infrastructure investment. Catch-up is the name of the game and the failure of government action is the target of blame. Mass scale urban energy retrofitting is held out as a solution to future need, but remains an abstraction, given the data and know-how required to support system change.

The distributional consequences of this new era of development are of mass scale. Nonetheless, much of the literature about smart cities remains decidedly light in content and empty of practical detail especially about energy. At their heart, current urban policies rarely contain energy systems assessments that accurately reflect projections of future energy supplies, technologies, and basic human needs. The gaps between the mass flows of people moving into global south cities, the highly skewed global distribution of energy resources, and the absence of sufficient and scalable energy supplies in many of the world's urban centers bring fundamental questions into view: where is mass urban scaling occurring, what is regulating the process of urban development and are the current pathways to city formation taking into account the basic goods needed for a minimally sustainable life? Wittingly or unwittingly planners, urban managers and architects are

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contributing to a conversation of the imaginary whereby technical solutions at wildly different scales are jumbled together and offered as answers when the context is far more complex and uncertain. That energy provisioning is not driving discussions of urban management today allows decision makers to postpone correctly characterizing the feasibility of urban management in an era of mass urbanization and constrained energy supplies.

Stream 3:
Environmental Sustainability

Analysis of the Impact of Climate Change on Cereal Crop Production in Northern Ghana

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Climate change poses a major challenge in the agricultural sector, particularly in northern Ghana due to the over reliance on rain fed agriculture. This paper determines the impact of climate change on cereal crops production in northern Ghana using 120 maize producers and 120 sorghum producers. The trend analysis and the Ricardian model were used to determine the trend of climate variables and to measure the impact of climate change on net farm income per hectare respectively. Climatic data were tested under two different scenarios (categorized as overall, *i.e.*, entire Northern Ghana, and regional, with climatic data spanning from 1982-2013). Results from the trend analysis of total annual rainfall show that all the northern regions exhibited a positive trend except one region. Analysis of the general trend of monthly average temperature exhibited an increasing trend in all the districts in the three regions. The results in all the models showed varying degrees of climate change impacts on net revenue per hectare. Soil variables, soil fertility status, soil types and land form, generally impacted significantly on net revenue per hectare of all the models for both maize and sorghum. Furthermore, crop and land management, off-farm, farm operation, livestock, and agro-forestry were adaptation strategies used by farmers to reduce the impact of climate change on crop production. The study recommends among others the need to build the capacities of farmers in northern Ghana generally to diversify their sources of livelihoods in order to reduce the risk of total loss in the event of unfavorable climatic events. Practical and reliable information on the onset of the rainy season as well as region-specific soil and plant health technologies should be generated and made available to farmers.

Applying a Decision Support Model to Investigate the Influence of Precision Agriculture Practices on Sustainable Crop Production

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The concepts of precision agriculture (PA) and sustainability are inextricably linked. PA can be described as a catch-all term for techniques, technologies, and management strategies that address in-field variability. The benefits of PA, through site-specific management, address three areas, namely improvement of economic margins, reduction of the environmental impact and risk, and assurance of crop quality and traceability. Sustainable agriculture, in short, strives to enhance environmental quality and the resource base on which agriculture depends; provides for human food and fibre needs; is economically viable; and enhances the quality of life for farmers and the society as a whole. The main objective of the study is to investigate the impact of precision agriculture (PA) practices on the sustainability of a crop production enterprise, and the combination of enterprises as a whole-farm business in comparison to Conventional Farming. The study was based on six centre pivot irrigation fields covering a total area of 181.95 hectares. The procedures that were used to achieve the objective firstly included the scanning of the fields with a Gamma-ray spectrometer for the identification of different management zones according to the variation in the physical soil properties and secondly the application of a decision support model, namely the SPARÉ Model, to investigate the impact of precision agriculture practices on the sustainability. Three crops, maize, wheat, and soybeans, were used in the model to generate the results. The results of the study indicated that precision agriculture do enhance sustainability as the amount of gypsum, fertilizer, and water that are applied per ton of grain harvested decrease by 20%, 9%, and 23%, respectively, on average for the three crops, making the resource use more sustainable than with conventional agriculture. The margin of the whole farm scenario increased with 10% and, thus, increased the financial sustainability of the whole farm enterprise.

Evaluating Sustainable Use of Nitrogen Fertiliser in Maize Production: A South African Case Study

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Production uncertainty in expected outcomes results in the over-fertilising of crops (Abdeullah and Pandey, 2004) in order to reduce production risk (Rajsic, Weersink and Gandorfer, 2009). Rasmussen and Karantinis (2005) stated that if a decision-maker is aware of the state of nature he faces, he could reduce his production risk. Assuming that farmers do not have information regarding the current state of nature, applying fertiliser levels to maximise outcome for the current state is not possible. However, if information on the state of nature is known, the appropriate amount of fertiliser is applied according to the prevailing state of nature. The aim of this paper is to evaluate the sustainable fertiliser use for maize producers. The paper uses the flexible response functions developed by Matthews and Grové (2014) to quantify production and environmental risk with fertiliser use. The response functions are incorporated into an optimisation model to determine optimal fertiliser use for maize producers. Results indicate that farmers' profits will increase when information on the state of nature is available. Results furthermore show that information on the state of nature have little effect on nitrate loss over the research period. The effect on nitrate loss is due to the fairly flat environmental response function and the combination of low fertiliser use and irrigation levels.

Climatic Changes Impact on Income Inequality and Poverty: Evidence from Paddy Farmers in Kelantan, Malaysia

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Farmers are the most exposed people to climate variability because of their 'real life condition', based on where they live or their livelihood activities. In order to understand climate variability within the context of vulnerability and its impact on farmers in Malaysia, this primary data collection study was conducted on 400 paddy producing farmers in the Integrated Agricultural Development Area in Kemubu and Kemasin Semarak in 2012. Descriptive statistics, ordinal scale, ratio, and percentile were used as tools of analysis. It was found that climatic changes have inauspicious impacts on farmers' income equality, productivity, profitability, employment, health, and government support and strategic policies. Sixty percent of farmers perceive that paddy cultivation is no longer profitable due to climatic changes which have induced low productivity. Fifty-eight percent of farmers have expressed their desire to change from a full-time to a part-time engagement in agriculture and look for part-time work in off-farm activities. The Kuznets ratio and Gini coefficient of income distribution of the paddy farmers in the study area are found to be 2.5 and 0.41, respectively, suggesting that there is a high level of income inequality among the paddy farmers. The fact is that poor farmers are affected more by the adverse effects of climatic changes, which contributes to the widening of the income gap. Findings of the study suggest that climatic vulnerability issues need to be incorporated into all the relevant policies to support the response-capability of the farmers by strengthening their livelihood assets to adequately adapt to the climatic changes and reduce the inequality in the farming community.

Family Farming System as a Platform for Achieving Sustainable Development Goals in Rural Areas: A Global Overview with Emphasis on Cases in Iran

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As based on the recent report of FAO, in both developed and developing countries, more than 500 million, or nine out of ten, farms are managed by families, making family farms the predominant form of agriculture. They not only produce about 80% of the world's food but also serve as custodians of about 70–80% of farm land. In fact, family farming systems are inextricably linked to world food security and sustainable agriculture. This system preserves as a base for organic food production. Moreover, the role of this system in poverty alleviation and environmental sustainability is approved. It is also stated that family farming still remains a key part of the solution to the hunger problem. In addition to their strong economic links to the rural sector, family farmers are the main custodians of their lands and rural environment. Given the diversity and complexity of this farming system, farmers need to sustainably increase farm productivity and simultaneously safeguard agrobiodiversity. Accordingly, the farmers need to be empowered and their indigenous institutions, knowledge and understandings about ecological processes and services get into account for supporting sustainable development. Unless introducing complementary and innovative business models of sustainable farming within which farmers get empowered both economically and socially, there is no scope of any achievement within the vicious cycle of poverty. Even, they cannot boost their economy, livelihood and well-being. In Iran, out of more than four million farms, about 86 percent are managed by small farmers, making family farming as a predominant form of agriculture. They earn livelihood to their families and have inherent potentials for food safety, environmental sustainability, poverty reduction and other millennium development goals. This paper thoroughly investigates the role of family farming in sustainable development at the globe with emphasis to the status of Iran.

How to Co-Build a Viable Farming Model: Some Insights from the French Caribbean

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The shift from a high-yield farming system to a more viable farming system (based on natural resources and social interactions) has become a major issue and challenge for agriculture. The end of the productionist model is supported by the FAO, which claims that “smart agriculture” principles are environmentally friendly. In this context, agroecological transition may be considered as a privileged pathway. To that extent, analyzing socio-technical conditions for the implementation of the agroecological transition is necessary.

We make the hypothesis that agroecological transition comes from the ability of all the stakeholders to build a common paradigm on the viability of a farming system and from the ability of each farmer to transform his production system. We then seek to highlight how farming stakeholders understand the viability of a farming system. Taking as an example the French Caribbean, we inquire as to the adaptive capacities of these areas, which face exacerbated global changes.

Our methodological stance unfolds in two steps. We first ran focus groups with farmers to tackle how they define the viability of a local farming system. Second, comprehensive interviews have been conducted with institutional stakeholders in order to know the rules they can initiate to make the farming system viable.

Our results show that stakeholders address differently the three dimensions of viability (*i.e.*, economic, agroecological, and socio-cultural). Interviews reveal that the most common entry on viability is the economic one, followed by the agroecological one. Also, our results indicate that for some stakeholders, the farming system is viable while for others, the end of an era has been reached. The lack of viability is a threat to the transition toward agroecology. Third, our results show that the viability of a farming system derives from negotiations, tensions, and conflicts between agricultural stakeholders concerning the ways and means of regional development, which create mechanisms for building new rules of action.

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Assessing the Sustainability Performance at Farm-Level: Synergies and Trade-Offs between Environmental, Social and Economic Sustainability Themes

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The Guidelines for Sustainability Assessment for Food and Agriculture Systems (SAFA), published by the FAO, define a globally applicable analytical framework for assessing 58 themes in four dimensions of sustainability (Good Governance, Environmental Integrity, Economic Resilience, and Social Well-Being). While the performance of farms against different themes of sustainability has been assessed in many studies, there are only few systematic assessments of the trade-offs and synergies between different themes of sustainability at farm-level. However, especially when trying to optimize farming systems, a consideration of trade-offs and synergies is required. The aim of this paper is to perform such a systematic analysis of trade-offs and synergies. For pursuing this aim, we used the Sustainability Monitoring and Assessment RouTine (SMART), which operationalizes the SAFA guidelines by defining science-based indicator sets and assessment procedures. The SMART-Farm Tool analyses the degree of goal achievement with respect to the 58 themes defined in the SAFA guidelines, using an impact matrix that defines almost 400 indicators and 1400 relations between sustainability themes and indicators. We calculated the degree of similarity of farm-management practices between the 58 sustainability topics, for understanding trade-offs and synergies between sustainability themes. We found that the degree of similarity within the environmental themes was weaker than within the social, economic, or governance themes. Within the environmental themes, the greatest similarities were found between greenhouse gas emissions and air quality, between energy use and air quality, between species diversity and ecosystem diversity, between soil quality and land degradation, and between animal welfare and health. The full paper will present the similarities over all four dimensions for sustainability and discuss the mechanisms behind these similarities in terms of farm-management practices. The results of this study can be used for optimizing farming systems under consideration of environmental, social, economic, and governance aspects.

Global Biomass Demand and Supply: Do We Need to Expand Cropland or Can We Feed the World on Existing Cropland in 2050?

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Recent studies suggest that the doubling of global biomass demand expected in 2050 cannot be satisfied on today's cropland. Cropland expansion and genetically improved crops are suggested as possible solutions. We show, by coupling global crop and economic simulation models, under current climate conditions, and based on today's cropland, that global biomass production can be increased by 148%, compared to today's production. Our larger estimates result from fully utilizing multiple annual harvesting and on an economic optimization of spatial crop allocation. Both factors consider that realizing the production potentials claimed in current studies not only results in improved management of crops through better technology and knowledge, but also inevitably goes along with better farm management, which increases the annual number of harvests and profit maximizes the spatial allocation of crops. From the 148% increase, 39 percentage points (pp) can be attributed to multiple harvesting, while economic optimization contributes another 30 pp. We find that the combination of optimizing multiple cropping and the spatial allocation of crops show their largest impact in sub-tropical and tropical regions. Our findings suggest that today's cropland can satisfy the biomass demand of 2050 and that the expected demands therefore do not justify cropland expansion or genetic crop modification.

Revisiting Dryland Afforestation Programs for Developing Countries: Integrating Uncertainty in Economic Projections with a Focus on Carbon Finance and Community Needs

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Large-scale pine and eucalyptus afforestation is a common practice in drylands for land restoration. The usefulness of these afforestation monocultures has been nevertheless questioned. More recently, carbon finance has raised interest in dryland afforestation given that income from carbon adds to other services dryland afforestation potentially provides. Carbon finance is increasingly considered an integral component of sustainable forest management. However, it remains largely unknown whether carbon finance can incite dryland farmers to engage in afforestation programs while considering high price and weather uncertainty in their decision. The study estimates the minimum price of carbon at which a farmer will find equal Net Present Values (NPV) over 30 years between an Afforestation/Reforestation-Clean Development Mechanism (A/R-CDM) project (*Pinus halepensis* plantation) and his customary use of land being either wheat on productive land, or pasture for sheep rearing on marginal land. Carbon yields from the A/R-CDM activity were simulated by means of the CO2FIX v3.1 model for *Pinus halepensis* (the most widely planted tree species in the Middle-East and North Africa) based on a yield table developed for the dryland conditions of Israel. The model was used to simulate carbon uptake in biomass and carbon build up in soils.

Wheat and pasture production for the foregone activities were estimated by means of yield models developed for dryland conditions, and calibrated and validated with observed data from Israel. The models required moisture stress inputs provided from 30 years of observed daily weather data including precipitation wind speed, minimum and maximum temperature, relative humidity, and solar radiation. Yield results were then iterated on a Monte Carlo simulation to estimate the expected NPV of each activity averaging for a large set of production and price variations reflecting uncertainty.

Results show that despite the high level of dryland trees' CO₂ removal from the atmosphere, carbon trading from dryland A/R-CDM at current carbon prices is unprofitable anywhere along the aridity gradient. Thus, if dryland forestry is to be justified by the benefits of carbon trading, it remains an economically inferior choice than the customary use of land, should these activities be mutually exclusive. On the stringiest emission reduction market

schemes carbon finance is currently unlikely to accelerate afforestation in the drylands. From a private perspective farmers will be insufficiently rewarded as demonstrated. From a governmental agency perspective, seeking carbon finance from afforestation will be difficult since additionality will be hard to demonstrate.

With an increase of carbon prices and better adapted accounting schemes, smallholders in the drylands may find in carbon offsetting schemes a means to financially support a multi-purpose use of their land and a way to secure livelihoods. Multi-purpose uses of afforestation with the plantation of native tree species fulfilling both land restoration and pastoral communities' needs will be discussed from a case study in the Hindu Kush Himalaya region in Pakistan.

Monitoring Land Cover Changes in the Savannah Woodlands of North Eastern Namibia (1975-2014) Using the Landsat Satellite

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Woodland savannahs provide essential ecosystem functions and services to communities. On the African continent, they are widely utilized and converted to other intensive land uses. This study investigates the land cover changes of 108,038 km² in NE Namibia using multi-temporal, multi-sensor Landsat imagery, at decadal and biannual intervals from 1975 to 2015, with a post-classification change detection method and supervised Regression Tree classifiers. We discuss likely impacts of land tenure and forms over the past four decades on changes in land use and land cover. These changes included losses, gains and exchanges between predominant land cover classes. Exchanges comprised logical conversions between woodland and agricultural classes, implying woodland clearing for arable farming, cropland abandonment and vegetation succession. The most dominant change was a reduction in the area of the woodland class due to the expansion of the agricultural class, specifically, small-scale agricultural production. Woodland area decreased from 90% of the study area in 1975 to 83% in 2014, while arable land increased from 9% to 14% of the study area. We found that land cover changes resulted from urban expansion, and woodland clearing for subsistence-based agriculture and pastoralism, as opposed to land cover changes for commercial export farming.

Making PES Work for Small-Scale Farming Communities in North-Central Namibia

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Small-scale farming in north-central Namibia is facing many challenges, ranging from high rainfall variability, to social changes reducing the work force available for farming. Therefore yields in north-central Namibia are generally low and land degradation is threatening the long-term productivity of the farms. This paper will assess existing land use practices and determine their impact on ecosystem services, in order to identify potential to improve them through payment for ecosystem services (PES) schemes. We suggest finding ways of combining an improvement of provisioning services together with regulating services, to develop multiple win situations on a landscape level. Apart from identifying suitable land use practices we furthermore want to scrutinize the potential of using the existing community conservancies in Namibia as a role model for implementation.

A Method to Assess Social Sustainability of Capture Fisheries: An Application to a Norwegian Trawler

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Social sustainability assessment of capture fisheries is, both in terms of method development and measurement, not well developed. The objective of this study, therefore, was to develop a method consisting of indicators and rubrics (*i.e.*, categories that articulate levels of performance) to assess social sustainability of capture fisheries. This method was applied to a Norwegian trawler that targets cod and haddock in the Northeast Atlantic. Based on previous research, 13 social sustainability issues were selected. To measure the state of these issues, 17 process and outcome indicators were determined. To interpret indicator values, rubrics were developed for each indicator, using standards set by international conventions or data retrieved from national statistics, industry agreements, or scientific publications that explore rubric scales. The indicators and rubrics were subsequently used in a social sustainability assessment of a Norwegian trawler. This assessment indicated that overall, social sustainability of this trawler is relatively high, with high rubric scores, for example, for worker safety, provisions aboard for the crew and companies' salary levels. The assessment also indicated that the trawler could improve on healthy working environment, product freshness, and fish welfare during capture. This application demonstrated that our method provides insight into social sustainability at the level of the vessel and can be used to identify potential room for improvement. This method is also promising for the social sustainability assessment of other capture fisheries.

Analyzing Consumers' Awareness and Perception of Organic Food Products in the United Arab Emirates

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The global demand for organic food products has been increasing rapidly in recent years. Consumers are willing to pay higher prices (*i.e.*, a price premium) for certified organic food products. Growing demand, high price premiums, uniform standards, and the increased production of organic food products indicate an opportunity for the organic industry to expand in the UAE. Consumers' knowledge and awareness of organic foods will be deciding factors for expanding organic food markets. The objective of this paper is to analyze consumers' knowledge, awareness, and perception of organic food in the UAE. Data was collected from 400 respondents throughout the seven Emirates of the UAE. The results show that a small number of UAE consumers have heard "a little" about organic food. UAE consumers who know of organic food consider organically-grown products as very healthy, fresh, and chemical free. The results also show that the majority of consumers lack knowledge about organic certification. However, knowledge about organic certification is a deciding factor for those who purchase organic food products. Consumers indicated that there are not enough organic markets available in the UAE. The major negative perceptions about organic food are that it is more costly/expensive, irregularly shaped/formed, and lacking in certification. According to the research results, an important task for the industry will be to increase consumers' knowledge and awareness of organic food and promoting organic certification that differentiates organic food from others in the marketplace. The UAE has the potential for an organic food market because of a growing population with high income and education. The focus on organic certification will build consumer trust, a key factor when buying organic food; there is also a need to establish more organic food markets. It is the responsibility of all stakeholders, including consumers, producers, the government, organic certification bodies, and organic markets to play a major role in promoting and enhancing organic food markets in the UAE.

Nitrogen Use and the Integration of Environmental Concerns into Production

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Fertilizer nitrogen (N) rate has varied in countries and regions over time, driven by numerous factors. The paper first discusses N rate and N use efficiency, and compares economically optimal N rate and actual N rate applied in main crops production in China and Finland. It was noteworthy that the different views implied disparity in fertilization intensity, economy and efficiency optimization of applied N in the two countries. Mineral fertilizer N constraint level regulated by Finnish Agricultural Environmental Schemes has played a key role in the decline in fertilizer N consumption in Finland. This was in line with the conclusions from a follow-up study on the Impacts of Agri-environmental Measures in Finland (MYTVAS 3, 2007-2013) that noted the constant decreasing agricultural nutrient load potential, primarily because of the reduction in the use of chemical fertilizers. Besides complex natural and environmental heterogeneity, such as geography, climate, soil types, crop cultivation varieties and structures, and customary management models that cause different N rates, agricultural economic characteristics and support policies involved should be seen as an indispensable inducement. We used panel data to analyze how actual N rates were affected by different policy measures in the two countries. The results indicated that Finnish agri-environmental policy measures, such as organic-farming, fallow area, and manure application with compensation of agri-environment payments, were connected to more environmental concerns in terms of less fertilizer N use. In contrast, Chinese perpetual grain security support policies and fertilizer subsidies for input producers and farmers—thereby influencing price-ratio of output and input, to some extent— contributed to fertilizer N use at a considerably high level. The link between agriculture and nitrogen pollution has had significant negative impacts on drinking water, the eutrophication of fresh water, marine ecosystems, as well as nitrous oxide emissions, due to the massive increase in fertilizer N application and nutrient run-offs. Although mitigating N pollution would necessitate a multi-dimensional approach, N fertilizer application reduction is a pressing need under current Chinese context.

Options for Maintaining a Sustainable Fishery Production in the United Arab Emirates

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Fisheries around the world continue to face increasing demand for more fish catch to provide healthier alternative source of protein relative to red meat, meanwhile the jury is still out of the real causes of the declining wild fish stock globally. United Arab Emirates (UAE), like many other countries, witnessed a declining per capita fish availability in the last three decades due to a decreasing of fish catch. Fish represents one of the major diets in the country. The goal of this research is to study benefits of adapting sustainable practices in face of uncertainty in UAE. More specifically, the study aims at carrying out scenarios/impacts analyses of the efforts to sustain such valuable natural resource endowment (*i.e.* fish stock). Fisheries sector sustainable practices include hard measures such as construction of artificial fish habitats in the Arabian Gulf and soft measures such as the enforcement of regulations that protect and conserve the fisheries' stocks. The economic impacts of these practices evaluated assuming targeted shifts/ scenarios between stocks of fish, as a natural resource endowment, and conventional other factors of production such as capital and labor used in the country to produce fish final products (*i.e.* study of technological change). The empirical UAE economic data used to construct the General Equilibrium (GE) Model of the UAE. Results of simulated interventions obtained from the GE model showed that prices of the fishery products as well as other related commodities will decline and the consumers will benefit the most from such interventions. Factors of production such capital and labor prices were found to be significantly changing due to the sustainable practices in both positive and negative directions. The study also measured the changes both consumers and producers' welfare in the UAE due to the simulated targeted interventions.

Sustainable Food Production Systems for Global Food Security- Tillage, Crop Rotations, and Nutrient Management Systems Effects on Crop Production and Water Quality

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Food and water security are important needs of the society. The key challenge for researchers is “how to develop innovative agricultural production systems to double the food production by 2050 to feed nine billion people in the world”? This will require us to grow more food on the same unit of land using lesser amounts of water and nutrients. This will require good science and well thought out and incentive based policies for agricultural watersheds. In addition, science based information would be needed to understand the land and water resource degradation processes from intensive agriculture, especially in areas of the world where major water bodies are showing signs of hypoxia. Development of sustainable agricultural production systems will be necessary to restore the already damaged ecosystems.

To develop sustainable agricultural production systems, long-term studies were conducted from 1990 to 2014 at Iowa State University to investigate the impact of tillage (chisel vs. no-till) and N-application management systems on crop yields and $\text{NO}_3\text{-N}$ leaching losses to groundwater. The results of these studies clearly indicated that tillage and nutrient management systems have significant impacts on crop yields and groundwater quality. On the average, higher $\text{NO}_3\text{-N}$ concentrations were observed in plots receiving higher N-application rates. Chisel plowing increased corn grain yields and exited almost equivalent $\text{NO}_3\text{-N}$ leaching losses to tile water compared with no-till system. Effects of excessive wet years after dry years and low plant N-uptake in some years elevated $\text{NO}_3\text{-N}$ concentrations to as high as 32.8 mg L^{-1} in 1990, 12.5 mg L^{-1} in 1995 and 24.5 mg L^{-1} in 2004. Fall applied manure and chisel plowing had significantly higher $\text{NO}_3\text{-N}$ concentrations of 27 mg L^{-1} compared with 17.7 mg L^{-1} from no-till and spring applied manure. These results suggest that low N-application rates for chisel plowing can result in higher crop yields and lower nitrogen leaching to groundwater. This paper will discuss possible solutions related to food and water security for the global society.

Meat Consumption in Industrialized Countries and Hunger in Developing Countries: Two Sides of the Same Coin

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Although global food supply has generally improved in recent years, still more than 800 million people suffer from hunger. Every four seconds one human being starves to death.

This paper investigates the sustainability effects of high meat consumption on the global food situation. To answer this question, we first of all analyze the market size of meat production and draw attention at its considerable economic impact.

Subsequently, global ecological implications of meat production—measured in land use, water consumption and air pollution—are analyzed. It turns out that about 70% of agricultural land is used for animal breeding. Eighty-five percent of soy and 35% of cereal production are used to feed animals. A total of 15,000 liters of water are required to produce one kilogram of beef. Meat production causes 14.5% of global CO₂^e emissions.

Analyzing underlying data, it becomes apparent that the production of current meat quantities is highly inefficient from a resource-economic perspective. The efficiency of meat production—measured in units of energy usable for humans—is 10% on average and therefore very low.

Based on these results, social implications of the high and constantly rising global meat consumption are examined. We firstly outline the negative (health) effects of mass meat consumption on wealthy nations: In industrialized countries, twice as much meat is consumed as recommended by nutritionists. As a consequence, vegetal food, used to feed animals and to (over)feed wealthy peoples with meat, is no longer available for the basic nutrition of starving humans in developing countries.

In the last part of the paper, interesting changes in consumer behavior in leading industrial nations are identified. It turns out that meat consumption is declining there since a few years. Analyzing this tendency in more detail, a high level of education is identified as a key driver of this development. All aspects of sustainability as well as global food security might greatly benefit from this trend, if spillover effects on other population strata and emerging countries—associated with public support—are strong enough.

New Approaches for Fostering Sustainable Nutrition Behavior— The Potential of Social Norms in Gamification Interventions

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Today, most people's food and dietary choices are far from sustainable and account for about one third of the total environmental impact of the Western world. New, effective approaches for changing behavior are needed, for personal health reasons and because consumers' food choices have considerable implications for the environment. This research paper aims to shed light on social mechanisms and their effectiveness in the context of gamification interventions that are designed for changing nutrition behavior.

By looking at gamification from a socio-psychological perspective, we relate the behavioral change model HAPA (Health Action Process Approach) to the gamification approach so as to develop a gamification design that activates self-efficacy and social norms, and thus, fosters sustainable nutrition behavior.

Empirical studies are proposed to investigate the influences of social mechanisms as a requirement for effective gamification design in this context. We propose that reference group information should be considered in gamification design by visualizing the reference group members' sustainable nutrition behavior, so as to increase self-efficacy, especially in people who are motivated to change, but do not act, because they lack the right skills for translating their intentions into actions.

According to the above propositions, experimental studies are suggested and presented accordingly. We highlight several research aspects that can be applied to create the best realistic conditions and to operationalize sustainable nutrition behavior.

It is expected that the proposed studies' findings will provide scientific evidence as to how gamification can be supplemented with social norm-based information and how this may affect psychological constructs like self-efficacy, a central variable for the behavioral change process, and which is essential for fostering sustainable nutrition behavior.

Switching Imperfect and Ugly Products into Beautiful Opportunities

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Social Enterprise Espigoladors, Catalonia.

ESPIGOLADORS, based in Catalonia, is a social enterprise that fights food waste in a transformative and inclusive manner. We transform imperfect products into opportunities.

The aim of the company is to have an impact on three social issues that are relevant nowadays: food waste; the lack of access to safe, healthy, and nutritious food in groups at risk of social exclusion; and the lack of opportunities for these groups.

Espigoladors has a social enterprise model that directly affects the dignity of people who are in a critical situation while sensitizing the general public on a hot topic (food waste) in a transformative, participatory, and inclusive manner.

Our model involves the collection of fruits and vegetables from farms and wholesale markets that are rejected from the market for a variety of reasons, such as aesthetic standards or gluts. We donate part of this produce to organizations that provide food to people in need. The remaining fruit and vegetables are transformed into four types of product—jams, creams, juices, and sauces—which are sold under our own brand, 'Es Im-perfect'. Es Im-perfect works with groups at risk of social exclusion to create and sell these products.

We are creating a network of farmers, producers, and food companies to work with Espigoladors in the fight against food waste, in which we recollect fruits and vegetables that would otherwise have been thrown out. All the enterprises that belong to the network are allowed to use Espigolador's certificate "I don't waste: we are part of the solution". This certificate is intended to give value to these enterprises' commitment and prove that they are aligned with their corporate social responsibilities.

Biogas Innovations through Grassroots Movements. Learnings from the Latin American Experience

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Mass dissemination of biogas plants is regarded as an effective strategy for addressing the sustainable development needs of a poor population. The striking figures of accumulated installations achieved by mass dissemination programmes in Asian countries such as China, India and Nepal seem to support that assumption. Those are programs that have been counting on continuous and long-term political support from central governments and have led to the emergence of nation-wide institutional structures for reaching predetermined targets. Installations in countries lacking that kind of centralized structures tend to be rather marginal. This has been the case of most Latin American countries. However, while installation figures have remained rather low, there has been a profusion of innovations in biogas technologies around the region during the last two decades. Although those innovations emerged from very diverse and localized processes, all of them can be better described as ‘grassroots’ movements rather than as national (mass dissemination) programs. Recently, with the emergence of the Network of Biodigesters for Latin America and the Caribbean (RedBioLAC), interaction and mutual learning among localized initiatives has intensified. The main aim of the study is to better understand these alternative innovation processes in order to support their own development. To that end we analyse those initiatives applying conceptualizations of ‘grassroots innovations’, which have been evolved through a growing body of literature, studying grassroots frames as alternative sites for nurturing innovations for sustainability. The analysis draws on qualitative case study research of initiatives promoting domestic biogas technologies in Latin American countries. We examine driving values, organisational settings, resource bases, framing approaches and achievements along their evolution trajectory. We also look for pertinent interactions and mutual learning processes. We discuss the implication of our findings for the conceptualization of grassroots innovation, for Latin American practitioners working in initiatives promoting biogas technologies and for the further development of the RedBioLAC.

Reconstructing Greenhouse Gas Balance Indicators for Agricultural Bioenergy Production

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Previous life cycle assessments (LCAs) aimed at taking inventory of greenhouse gases emitted and sequestered within the full length of bioenergy production chains from agricultural sources, often do not factor in the effects of different local and regional agronomic factors. Such local and regional agronomic factors include: (i) the variety of farm power types deployable (tractor vs. man vs. animals); (ii) difference in tillage methods employed (conventional vs. conservation vs. no-till); (iii) available fertilizer sources (synthetic vs. animal manure vs. biogas digestates); (iv) alternative irrigation techniques (rain-fed vs. surface vs. sprinkler vs. drip); and (v) seed-sowing options applied (native vs. GMO vs. hybrid seeds). In response to this need, this study suggests LCA methodological templates, based on life cycle thinking and assumptions, in order to include these important agronomic factors into subsequent LCA studies. An eventual application of these templates is expected to improve the accuracy and completeness of subsequent greenhouse gas LCAs for agro-bioenergy production chains, even though precision and degree of certainty might still be a subject of doubt, due to associated data availability limitations and complexity of adding more elements to already somewhat complex life cycle systems.

Sustainability of South African Agricultural Crop Residue Collection for Bio Energy

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Fossil fuels are the main source of energy. Renewable energy can contribute to a country's needs and reduce the use of fossil fuels. Biomass is one of the largest contributors to renewable energy. Agricultural crops are used as sources of renewable energy; these include wheat, barley, oats, rye, maize and sunflower. The primary objective of this study is to evaluate the feasibility of a 4 million ton (economic viable unit) bio-energy plant using maize and wheat crop residues in South Africa. Removal of crop residues leads to overall negative effects on soil, by affecting the soil chemicals, and physical and biological properties. The collection of crop residues is not financially viable, due to the lack of its availability. Crop residues are mainly used in South Africa as a form of animal feed and to reduce soil degradation. There is a 50% chance that the plant will not obtain the 4 million ton target, according to the Cumulative Distribution Function (CDF). These calculations exclude feed users and other competitors who might make use of biomass for other purposes. An increase in the demand for green energy and carbon trades can increase competitors. However, there is potential to use biomass from agricultural practices as a source of energy, if the crop is specifically planted for the purpose of biomass collection and not by-products from a commodity. The cost of collection is extremely important, due to the fact that the cost will determine the minimum price the producer must receive for the biomass. Currently the price of biomass is R650/ton; however, producers do not consider replacement costs of nutrients. The replacement costs of nutrients for maize range between R450.52/ton and R1084.14/ton for maize and between R240.44 to R513.76 for wheat. Twenty percent of dry land farmers and 80% of irrigation farmers are willing to sell their produce. The total supply of maize and wheat is 4,166,337 tons, which is higher than the 4,000,000 tons needed. The main constraints of using crop residues as a source of energy are that they are expensive to collect and are used as a source of animal feed with conservation agriculture implications. Further, there is no guarantee of a constant flow of biomass due to drought, price movements and farmers' willingness to sell crop residues.

The Future Role of Biogas Plants in Renewable Energy Systems

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The transformation to an electricity system, based on renewable sources, is characterized by an increasing need for balancing power in order to compensate for power supply from fluctuating sources, such as solar or wind. Biomass, more precisely energy from biogas, has the potential to generate electricity which is flexible on demand. As electricity from biogas has not been used to balance fluctuations of intermittent renewable energies (RE) in the past, there is a need for new configurations that are able to meet the requirements of highly RE systems and to supply biogas according to the varying demand for balance power generation. In this regard, this presentation focuses on the technical possibilities to enhance biogas plants to variable biogas suppliers for flexible power generation. A summary about the present state of the art of biogas plant concepts for flexible power generation, as well as an overview about first findings of a variable and on-demand biogas production, are provided to the audience. Finally different flexible biogas plant concepts are economically and environmentally assessed by comparing their biogas supply costs and their life cycle performance, considering a varying biogas demand for flexible power generation. Flexible power plants are essential to tackle the challenges of integrating large proportions of fluctuating RE for a sustainable future energy supply. Thus, biogas plants producing power, which are flexible and on-demand will be one key element for a successful transformation of the existing energy system.

The Importance of Remotely Sensed (SODAR) Data in Wind Energy Production

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The utilization of wind power is an essential element of sustainable energy production. The capacity of working wind turbines has reached 133 GW in Europe by 2014, according to the 2015 report of the EWEA, thus accounting for 14.1% of European energy production. The accurate determination of the wind energy potentials of new project sites is indispensable. These determinations can be carried out using different techniques.

The infrastructure for conventional meteorological instruments causes some damage to the environments of measurement locations. We have used a remote sensing instrument, a SODAR (SOund Detection and Ranging), which can measure wind speeds and directions up to several hundred meters in the atmosphere without causing significant environmental harm.

Roughness affects wind speeds, not only close-to-the surface, but also in higher levels of the boundary layer. Therefore, roughness impacts wind potential. Consequently, describing the temporal changes of the roughness parameter is one of the most important issues in wind energy measurements. The roughness parameter is determined by the features of surface cover and by natural and artificial objects in the environment of a measurement site. For this reason, the values of the roughness parameter for different levels, as determined by conventional measurement techniques and SODAR are compared in the present paper.

The SODAR was situated at the Agrometeorological Observatory of the University of Debrecen near the city of Debrecen, East Hungary. A one year long wind speed dataset, with a temporal resolution of 10 minutes, for heights between 20 and 400 meters, with steps of 10 meters, has been used for the study. Diurnal, seasonal, and annual courses of wind speeds and the roughness parameter for different levels of the boundary layer have been determined and compared to the values obtained using conventional techniques.

Simulation of Heat Transfer Enhancement of Phase Change Material for Thermal Energy Storage System

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High Efficiency thermal storage device is an important requirement for heat recovery, solar energy utilization and seasonal storage since it can bridge the time gap between energy requirements and energy use. Numerical studies are proposed to predict and investigate the thermal characteristics of a thermal storage device consists of graphite foam matrix saturated with phase change material, PCM. The composite (graphite foam matrix saturated with PCM) is prepared by impregnation method under vacuum condition, and then is introduced into a cylindrical shell and tube device while it experiences its heat from an inner tube fluid. The two-dimensional numerical simulation is performed using the volume averaging technique; while the phases change process is modelled using the enthalpy porosity method. A series of numerical calculations have been done in order to analyze the influence of fluid operating conditions on the melting process of the paraffin/graphite foam. The results are given in terms of temperature or liquid fraction time history in paraffin/graphite foam composite, which show that the heat transfer rate of the device is effectively improved due to the high thermal conductivity of graphite foams. Therefore, paraffin/graphite foam composite can be considered as suitable candidates for latent heat thermal energy storage device.

Strategies for the Application of Solar Energy in Rural Areas: A Case Study in the Lorestan Province of Iran

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Overuse of conventional energy sources has created various socio-economic and environmental consequences. Because there are more than 300 sunny days in Iran each year, and the high expenditure of transferring conventional and fossil energy to rural people, this research is an attempt to find strategic solutions for applying solar energy and technologies in Lorestan Province in Iran. A semi-structured interview with key informant people was used as the main tool of study and later the data was analyzed by SWOT. According to the analysis, lack of environmental pollution was the main strength and lack of supportive policies for the private sector in commercializing this technology was the main weakness. Global commitment of countries to expand the application of solar energy, as well as conservation of renewable energy resources, were identified as the main opportunities, and lack of preference for using solar energy due to availability and easy access to petroleum was the main threat. Accordingly, SO strategies were preferred as efficient solutions to cope with the barriers of solar energy application in the area of study. Out of many strategies, the following were found to be substantial: Giving priority to renewable energies as the main sources of energy, promotion and supporting of the private sector in this area, and enhancing the culture of adopting this technology by people, particularly in rural areas.

Sustainability of Saudi Arabia's Energy Generation Sector through the Integration of CCS to Meet Climate Targets

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Relating to energy demand, Saudi Arabia is of a vital interest to the World's economy as it continues to be the chief oil producing country in which oil consumption is rising at an alarming rate. Sustainability of the Saudi energy generation sector will be met by three key approaches, which are investing in alternative energy, enhancing energy efficiency and fuel economy, and integration of carbon capture and storage (CCS). Current climate negotiations showed the kingdom's ambitions to contribute to reducing global CO₂ emissions to meet the 2° C climate target while maintaining its economic growth. The recent revolution of US shale oil may present a hurdle for investment in alternative sources of energy as oil prices remain cheap. Under such circumstances, investment of CCS in the Saudi energy sector can be a strategic option, especially if captured CO₂ can be converted into useful chemicals or utilized for enhanced oil recovery. Hence, this work analyzes the impact of CO₂ capture on power generation in Saudi Arabia under various economic and environmental constraints for a set of prospective climate policies, using both fossil and non-fossil sources of energy. Furthermore, the introduction of new energy resources into the Saudi energy mix, such as pet-coke, has been assessed to replace power generation using diesel, for which demand is rising in the transport sector. The production of pet coke from only two refineries in the kingdom was found to be sufficient to meet power demand while saving diesel and, potentially, Heavy Fuel Oil. Setting a carbon tax to meet carbon limits was found to compensate on investment costs for CCS compared with conventional power generation systems.

The Role of Sustainable Agricultural Soil Management in Enhancing Ecosystem Services

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Over many centuries, agricultural soil management has led to wind and water erosion of soil and to degradation of soil physical, chemical, biological, and hydrological qualities. This is because the dominant farming paradigm is based on mechanical tillage of various types to control weeds and to soften the top soil to serve as a seedbed for crop establishment, and to loosen the compacted subsoil layer. Consequently, tillage is still considered to be normal and necessary, and mechanized tillage is considered to be a symbol of 'modern' agriculture. However, it is also known to be the major root cause of soil degradation, leading to loss of many of the ecosystem functions and services, including biological production.

Over the last few decades, the concept of sustainable production intensification (SPI) has taken shape. SPI methods aim at supporting productive agricultural systems capable of delivering maximum yields and ecosystem services while being resource efficient and resilient. Overall, this translates into producing more from less, and sustainably, primarily with regards to soil and water, but also from other inputs such as fertilizers, plant protection products, energy, labor and capital. It also means that certain ecosystem services that are soil-mediated, such as carbon sequestration, water resource quantity and quality, water regulation, control of erosion, biological nitrogen fixation, control of certain weeds, insect pest and diseases, can be enhanced.

The three interlinked principles of Conservation Agriculture: (i) minimal soil disturbance (based on no-till); (ii) permanent soil cover; and (iii) crop diversity, are increasingly being accepted as constituting the core or foundation elements that simultaneously improve the overall soil conditions necessary to enhance its ecosystem functions while allowing for increased levels of productivity with reduced inputs. This communication discusses the evidence on the role of Conservation Agriculture in sustainable soil management for enhancing ecosystem services and production intensification.

Reduced Tillage and Organic Farming: The Potential of Combining Two Innovative Approaches

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Organic farming is of growing interest, and currently 7.7 Million hectares of arable land are worldwide under certified organic management. Typical management practices of organic farming are crop rotation including leguminous crops for nitrogen fixation, green manures, use of farmyard manure and recycling of crop residues. Energy efficiency, soil organic carbon stocks in top soil, soil quality and biodiversity were found to be enhanced in organic as compared to conventional farming systems, as reported in various review studies. The increased soil quality found in organic farming is of paramount importance regarding the dramatic soil losses due to erosion in conventional farming. Moreover organic farming can promote evenness and natural pest control. To control weeds soil tillage is system immanent in organic farming, and the potential of this system may not be fully explored. No Till and Reduced Till are conservation tillage practices with a high capacity to restore or improve essential soil functions. While No Till systems are widely used in conventional farming, these techniques are challenging to adapt to organic farming due to weed pressure and frequent nitrogen deficiency in early spring. A potential answer may be Reduced Till, such as shallow inversion plowing, or non-inversion tillage. The implementation of these practices in European organic farming systems was addressed by an interdisciplinary team of researchers from 11 European countries in a network CORE Organic II project (TILMAN-ORG). Yields tended to be lower in organic Reduced and No Till systems, while shallow inversion plowing resulted in yields similar to deep inversion plowing. By planting more systematically leguminous green manure crops, this yield reduction could be reversed. Under drought conditions yields were even higher under Reduced Till possibly due to improved water relations. Reduced Till positively affected indicators of soil quality such as soil organic carbon, soil microbial biomass and enzyme activities in top soil layer. Fungal to bacterial ratios were higher under Reduced Till and mycorrhizal fungi and earthworms were positively influenced, and biodiversity of mycorrhiza was increased. Life cycle assessment revealed lower carbon footprints under Reduced Till. It is suggested that combining Reduced Till and organic farming can further contribute to more resilient crop production systems in the future.

The Potential of Organic Farming in Developing Countries: Lessons Learned from Case Studies in Kenya, Central India, and Bolivia

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The maintenance and improvement of soil fertility is of prime importance for the sustainability of agricultural systems. Soil erosion and degradation is one of the main challenges faced by agricultural systems around the world. This is particularly relevant in the tropics, where the loss of soil fertility is already limiting the food production. Conventional farming practices are known to negatively affect soils. In contrast, organic farming practices can support soil structure and fertility in the long run because they are based on holistic management principles. Organic farmers, in addition to not using synthetic fertilizers, usually apply higher amounts of organic matter and have more diverse cropping systems. The differences among soils under prolonged organic and conventional management are well documented in temperate environments. However, the build-up and stability of organic matter in tropical environments remains to be proven.

Since 2007, the SysCom program has been comparing the agronomic, economic, and ecological aspects of organic and conventional farming systems in India, Bolivia, and Kenya. The cropping systems and crop rotations characteristic to the trial locations are being followed. Results from the three project locations obtained up to now suggest that the influence of organic management practices on various soil parameters can be site-specific. Preliminary data from India shows a build-up of soil fertility (particularly higher total N and organic carbon) in the soils subjected to seven years of organic management. Higher nutrient mineralization has been observed in the organic treatments, due to increased enzymatic and microbiological activity. In Kenya, higher values of microbial biomass were found under the organic high-input systems at one location (Chuka), whereas no differences were observed in the other location (Thika). However, in Bolivia, no significant differences for microbial biomass and cellulase activity were found between the organic and the conventional, after 3 years of management. Detailed results from the three countries will be presented.

Managing Organic and Inorganic Inputs for Short- and Long-Term Agro-Ecosystem Services

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Concerns about sustainability of agroecosystems and the provision of agroecosystem services in developed and developing countries are pertinent. Currently, there is still a debate as to whether organic or inorganic input use is the better approach towards sustainability in agroecosystems. I will outline how the combined use, rather than one *versus* the other, of organic and inorganic resources, is a holistic approach for soil fertility management because it embraces the full range of driving factors and consequences—biological, physical, chemical, social, economic and political—of soil building in the short- and long-term. Together with my colleagues, I have investigated the link between plant growth, N use efficiency, N losses, C cycling and soil structural dynamics across gradients of purely organic, to organic plus inorganic, to only inorganic additions, and focused on the interactions between organic resource quality and inorganic resource quantity. Experiments comprised different levels of environmental control and different timescales of measurement. They included short-term laboratory incubations using inputs enriched in ^{13}C and ^{15}N , single season field trial monitoring short-term N dynamics, and longer-term field data collection to measure longer-term C and N stabilization. We conclude that capitalizing on short-term interactions between fertilizer and low quality organic residues allows for the development of sustainable nutrient management practices that also reduce environmental impact of agriculture; nevertheless, the input of organic residues, regardless of their quality, contributes to long-term soil fertility improvement.

Sustainable Nutrient Cycling through Soil Biota

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Efficient resource use is a key factor for sustainable agricultural production and a necessity for meeting future global food demands. However, the factors that control nutrient use efficiency in agro-ecosystems are only partly understood. Soil organisms are responsible for important nutrient cycling processes but their activities find little recognition in agricultural policy and management.

In a first step, we manipulated soil biodiversity in specifically designed model systems. We found that the loss of soil biodiversity negatively affected a number of ecosystem services (e.g., plant diversity, decomposition, nutrient retention).

Then, we used an outdoor model system to investigate the influence of soil biota on nutrient cycling and plant performance. Soil treatments containing a reduced soil-life or an enriched soil-life were set up. An agricultural crop rotation was planted and nutrient leaching losses after rain, plant biomass and nutrient contents were assessed over a period of almost two years. The presence of an enriched soil life greatly enhanced plant growth and nutrition and strongly reduced nitrogen leaching losses as well as emissions of the greenhouse gas N₂O.

In a next set of experiments, we inoculated field soils with arbuscular mycorrhizal fungi (AMF), symbiotic soil fungi that can promote plant growth and ecosystem functioning. We tested for effects of AMF inoculation on plant productivity and nutrient leaching in different agricultural soils and under differing farming practices. Management practices influenced nutrient leaching losses and N₂O emissions. Inoculation with AMF enhanced plant yield in some soils but not in others, indicating that the success of field inoculations with AMF may depend on environmental conditions.

Overall, our results reveal that soil biota bear a huge potential to enhance agricultural sustainability and that soil biodiversity and ecosystem multifunctionality are positively interlinked. For the maintenance of sustainable ecosystems, there is a need to protect soil biodiversity.

The Use of Beneficial Root Microbes for Improved Nutrient Uptake in Arable Crops

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Producing food for the increasing population with limited impact on the environment is one of the main challenges agriculture is currently facing. Soil and root microorganisms are major components of the natural fertility of soils. They contribute largely to the uptake of essential macro and micro nutrients by arable crops by stimulating root growth or transforming plant-unavailable forms of nutrients into plant-available forms (e.g. by biological nitrogen (N) fixation, solubilization of inorganic or mineralization of organic phosphorus (P)). Plant growth promoting rhizobacteria (PGPR) and soil fungi (e.g., arbuscular mycorrhizal fungi) can be formulated as inoculants for improving the efficiency of nutrients uptake by arable crops.

This presentation will summarize the current knowledge about the use of soil microbes (*i.e.*, rhizobial strains, P solubilizing bacteria, mycorrhizal fungi) as biofertilizers to improve performance of crops under stress-prone conditions such as drought, cold temperatures and low P availability. We will present advanced tools for monitoring biofertilizer inoculum and we will show how their use can be combined with other integrated soil fertility management practices to increase sustainability of the agricultural production.

Biofertilization and "Bioirrigation" for Sustainable Mixed Cropping of Pigeon Pea and Finger Millet (The BIOFI Project)

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Agriculture remains the livelihood for two-thirds of the 1.21 billion Indian people. Yet the lack of food security continues to be a major threat in India. The most immediately threatened people are the small and marginal farmers, accounting for more than 70% of the Indian farming community. The combination of biofertilization and bioirrigation in pigeon pea—finger millet intercropping is a novel biotechnological approach with a particularly high promise for stable and sustainable yield increases. The goal of the BIOFI network is to deliver a "package" of carefully selected plant cultivars and biofertilizer strains consisting of arbuscular mycorrhizal fungi and plant growth promoting rhizobacteria, together with the know-how of mixed cropping. While the microbial biofertilizers solubilize nutrients, the pigeon pea plants take up water from deeper soil layers and provide it to intercropped finger millet. This system is highly cost-effective and affordable even for the marginal farmers of India. To verify the potential of the planned novel approach, the project will not only perform field experiments and demonstration trials, but also study the climate impact and the socio-economic implications of biofertilization and bioirrigation in the pigeon pea—finger millet intercropping system. For this purpose, research experts from both India and Switzerland have joined under the umbrella of the Indo-Swiss Collaboration in Biotechnology (ISCB). ISCB is a longstanding and well-established research and development programme, jointly funded and steered by the Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India and the Swiss Agency for Development and Cooperation (SDC), Federal Department of Foreign Affairs, Government of Switzerland. The overall goal of ISCB is to contribute towards food security in the Indian context through innovative life sciences and biotechnology approaches, supporting sustainable and climate resilient agriculture.

Arbuscular Mycorrhizal Fungi (AMF) as “Biofertilizers” for Sustainable Agriculture—Potential of AMF Hyphae to Spread from Inoculated Pigeon Pea Seedlings to Uninoculated Finger Millet Plantlets

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Rainfed farms on marginal lands will be most affected by scarcity of non-renewable resources such as fertilizers. Mutualistic root organisms such as arbuscular mycorrhizal fungi (AMF) can increase the availability of nutrients and water, thus contributing to a more resilient, eointensified dryland farming system. Fertilizer applications can be reduced, while yield levels are maintained. We are interested to study the possibility of using AMF as “biofertilizers” in mixed-cropping schemes in Indian agriculture, planting pigeon pea (*Cajanus cajan*) seedlings pre-inoculated with AMF into a field sown with finger millet (*Eleusine coracana*). To study the potential of AMF spreading from AMF-inoculated pigeon pea to uninoculated finger millet seedlings, we established experimental microcosms in the greenhouse, in which the pigeon pea and finger millet plantlets were kept in separate pots, connected by a soil bridge of 512 cm length, inaccessible to roots but accessible to fungal hyphae. We found that AMF hyphae could spread readily through the soil bridges from the roots of pigeon pea to the roots of finger millet, covering distances of up to 35 cm in 20 weeks, and showing growth and yield promoting effects. We conclude that the distance between the plants and the choice of AMF species play a crucial role for the application of AMF as biofertilizer.

Rhizosphere Management of Permanent Crops in Drylands—The Case Study of Date Palms

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The vegetation in drylands has to cope with drought, heat, soil salinity, and low fertility. The beneficial mycorrhizal symbiosis between plants and arbuscular mycorrhizal fungi (AMF) is a key factor supporting plants' growth under such environmental conditions. As part of a multifunctional symbiosis, the mycorrhizae enhance (i) plant accessibility to soil nutrients, (ii) drought tolerance, and (iii) soil aggregate stability, a feature of particular relevance for sandy dryland soils that are prone to erosion. Most importantly, native AMF communities must be "stress-adapted" to withstand these harsh conditions. The application of AMF in horticulture (e.g., of olives, lemons, *etc.*), agriculture (e.g., of cassava, wheat, *etc.*) and revegetation programs (involving, e.g., *Lavendula*, *Rosmarinus*, *Prosopis*, *etc.*) has become more prominent within the last few decades as the number of studies demonstrating improved plant growth after inoculation has steadily increased. Therefore, the exploration of AMF strains originating from drylands is of great interest; these strains are potential biotechnological tools for cultivating date palms in the desert.

Here, we present a pioneering program aiming to isolate, identify, and apply AMF strains that are native to Omani agricultural and natural habitats. Taxonomically unique, these new species of AMF have been obtained as single-spore cultures and form the core of an expanding germplasm bank for arid zone-adapted ecotypes of AMF. Initial experiments have been conducted to evaluate the ability of isolated AMF strains to promote the growth of date palms, the main crop in Oman and in many other drylands. The results show that, under nursery conditions, certain AMF strains from our collection are able to enhance the growth of date palms while simultaneously reducing demand for mineral fertilizers during date palm propagation. Similarly, improved growth and disease resistance after AMF application were shown in studies conducted in the United Arab Emirates and Morocco, thus highlighting the potential of AMF technology to contribute to more sustainable, resilient date palm cultivation while safeguarding natural resources.

Quantifying Trade-Offs Between Food Security and Biodiversity

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The trade-off between providing sufficient quantities and qualities of food in the future, and sustaining ecosystems and their services, is driven by various biophysical and socio-economic global and local parameters and assumptions. With a world population that is expected to grow from about 6.9 billion to 9.2 billion by 2050, as well as changing lifestyles and consumption patterns the trend toward more protein containing diets, the Food and Agricultural Organization (FAO) estimates that meeting the world's food demand requires a 70% increase in total agricultural production. Land productivity has considerably increased over the last six decades since in this period: food production has been doubled while agricultural land only increased by 10%. However, agricultural yields and production stability are threatened by a changing climate. Besides intensification, land expansion constitutes another possibility of reaching higher production quantities. With rising demand for different uses of biomass, land use changes and the expansion of farming areas into natural habitats may threaten ecosystems and their services.

Food supply, for instance, does not only depend on the ability to produce sufficient quantities and quality of food, but also on food price levels. Changes in agricultural productivity are driven by regional factors, but at the same time, agricultural productivity is also driven by economic factors, such as the profitability of certain crops in certain areas. To take these drivers into account, we use an approach that includes various biophysical as well as socio-economic global and local parameters. We combine a high spatial resolution biophysical crop growth model with a computable general equilibrium (CGE) model to simulate agricultural production potentials. We also compute the profitability of expanding agricultural land in a certain area and the feedbacks on global agricultural markets, which in turn affect agricultural profitability and therefore land use. The approach allows for identifying global hot spots of land use/cover change as well as price changes of food sectors under different scenarios. Our results show that an expansion of agricultural land into grassland is not profitable on the global scale.

The Metabolism of Spanish Agriculture: Modeling Bio-Physical Relations between Agriculture and Society in the Industrial Transition (1900-2010)

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Our knowledge concerning the biophysical functioning of modern economies has grown enormously in the last two decades. A significant body of research has been generated, even from a long-term perspective. This research provides wide-ranging information on resource production and consumption patterns. Material and Energy Flow Accounting (MEFA) has been a recurrent methodological tool for assessing the metabolic transition to industrial economies, and has been gaining importance as a sustainability indicator. This tool has been commonly applied to the study of the economy as a whole, and distinguishes between various types of resources (biomass, fossil fuels, other minerals, *etc.*), but usually has not been applied to the study of specific economic sectors. Metabolic approaches to the study of agriculture tend to model bio-physical flows in two steps. First, they attend to biomass flows in the context of a given territory (*i.e.*, the MEFA approach), where inputs and outputs are considered, respectively, as biomass imports and exports in the territory studied. Second, these models take the agricultural sector as a boundary, where inputs refer to agricultural inputs and output to agricultural production (*i.e.*, the EROI approach). This presentation aims to provide a metabolic-based analysis of agriculture in the process of economic transition. We develop a model of bio-physical relation between agriculture and the rest of economy, using cited approaches (MEFA, EROI, *etc.*) and accounting for other bio-physical flows (e.g., of nutrients, carbon, *etc.*), so as to generate a better understanding of the role of agriculture in the context of metabolic transition. Our case study concerns Spanish agriculture within the timeframe of the entire 20th Century (1900-2010). We identify the main environmental challenges and the driving forces behind agricultural and food changes during the industrial metabolic transition, and provide useful information for designing sustainable agricultural and food systems.

Bayesian Modeling of Coastal Marine Environment for Sustainable Coastal Development

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To support sustainable coastal development, we propose a Bayesian method for modeling coastal marine environments and apply the method to the Saemangeum Coast located along the mid-western coast of Korea. For the purpose of economic growth, coastal development has been conducted by the construction of an approximately 33-km-long sea dyke, reclaiming about 40 Kha of land since 1991. Originally, the Saemangeum Coast had a well-developed and large area of tidal flats, comprising two estuaries in addition to a chain of small islands. However, a large change in water movement and a reduction of tidal currents occurred following construction of the sea dyke. Severe environmental problems have occurred over time, such as the intensification of vertical stratification, the occurrence of red tide and oxygen depletion, coastal erosion/deposition, and the death and reduction of fishes. To monitor the environmental changes, continuous spatio-temporal ocean observation has been performed periodically since 2002 at several sites using observation platforms, such as the deployment of buoys, installation of towers with oceanographic and meteorological sensors, ship surveys, and water sampling. Using the accumulated observational data, we developed Bayesian modeling to understand, assess, and predict coastal marine environment and its changes, quantitatively. Furthermore, Bayesian inference was conducted to predict, 1) how much is coastal water quality has worsened, and 2) how strong do currents need to be for water exchange in order to maintain minimal coastal water quality as it is the major concern of stakeholders. Moreover, there are new findings on the threshold quantity of ocean currents to maintain optimal coastal water quality, and trade-off relations between water exchange and the improvement of water quality. The results show that our study may well be effectively applicable to coastal management and it also brings economic benefits to budget- reduction by utilizing a coastal management tool. Furthermore, the effects will be maximized on sustainable coastal development.

Impact of Anthropogenic Activities on Salinity of the Shatt El-Arab: A Transboundary River Basin Case Study

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Salinization is an increasing challenge affecting the environment of many rivers in arid countries. The Shatt El-Arab waterway is formed by the confluence of the Euphrates and Tigris Rivers near the city of Qurnah in Southern Iraq. The river stretches for about 190 km before discharging into the Arabian/Persian Gulf. The watercourse forms part of the border between Iraq and Iran. The region draining into the Shatt al-Arab includes the Euphrates Basin, the Tigris Basin, and two major river basins: Karkheh and Kārūn (chief tributary) from the eastern (Iranian) side. The river receives untreated domestic and industrial wastewater and agriculture drainage. Moreover, the watercourse has experienced the adverse impact of salt intrusion from the Gulf. This has jeopardized the environment and the economy of the region. The man-made activities upstream have caused a noticeable degradation of the entire ecosystem, in particular exacerbating salinization of the Shatt El-Arab. This study assesses the impact of intensive water resource development (mainly dams and irrigation infrastructure) in the upstream areas of the Kārūn on the environment and flow regime of the Shatt El-Arab system; in particular, the increase of salt concentration. Initial findings indicate that the discharge contribution of Kārūn to Shatt El-Arab has been decreased between 93% and 97%. The salinity levels of the Shatt al-Arab increased more than five-fold in early 2014. The total dissolved solids increased from approximately 1000 to more than 6000 ppm. Such a salinity value exceeds guidelines for irrigation, limiting agricultural activities and suggesting the need to study the current and predicted environment system of Shatt El-Arab. This representative case study highlights key sustainable water resources solutions for other transboundary case studies in arid regions. Moreover, the research suggests the urgent need to achieve a binding water agreement between riparian countries to maintain healthy environment of the transboundary water body.

Impact of Upstream Man-Made Interventions on the Sustainable Management of Downstream Natural Wetland Systems

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The sustainable management of natural wetland systems in arid and semi-arid regions has become a serious challenge, particularly when the main water feeder is a transboundary river where competition between upper and lower riparian countries is substantial. Human-induced interventions in upstream countries have exacerbated the challenges confronting the decision-makers in lower riparian states to soundly manage and maintain the healthy environment of their wetland systems. This study assesses the impact of anthropogenic activities upstream of the Karkheh River, which originates in Iran, but is shared between Iraq and Iran, on the water resources management of the Huwaizeh marsh (representative case study) in the downstream country, Iraq. This river has a vast catchment area of about 51000 km². The Huwaizeh wetland is a natural depression at the river outlet. The total area of the marsh varies between 2000 and 3000 km² according to hydrological conditions. The Huwaizeh marsh forms part of the Mesopotamian marshes, facing a complex range of site-specific, basin-wide and national management challenges. The major challenge is the dramatic decrease in marsh input water, primarily due to the construction of upstream water control structures and frequent droughts. The unimpaired and impaired flow conditions have been examined. Man-made changes upstream, such as damming of the main corridor of the river and its tributaries, as well as water abstraction for irrigation purposes have been assessed to estimate the potential impact of upstream development on the environmental regime of the wetland system; in particular, the increase of salt concentration. Findings reveal that the flow was reduced by 90% from about 5 billion m³ to nearly 0.5 billion m³. The salt concentration in the marsh has risen from about 880 ppm to just above 8000 ppm. This dramatic change in the Huwaizeh marsh suggests the need for sustainable restoration of the entire watershed.

The Sustainability of Formal and Informal Interventions against the Impact of Sea Level Rise in the Nigerian Niger Delta

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Environmental degradation is a familiar concept in the Niger Delta. For example, erosion caused by river and coastal flooding has left many areas uninhabited, and acid rain from gas flaring corrodes roofing sheets and destroys biodiversity. Apart from these natural causes, wood logging and deforestation have exposed parts of the soil to more erosion, and the over 500 onshore oil fields increase the possibility of oil spills and soil degradation. Niger Delta coastal communities are exposed to daily floods, and tidal waters have penetrated further inland in recent times. Moreover, between 1976 and 1996, there have been over four thousand reported cases of oil spills, even as those communities around the oil companies experience high temperatures from gas flaring. The physical consequences of sea level rise (SLR) for coastal areas include coastal flooding, erosion, inundation, displacement of coastal wetlands, and the inland intrusion of sea water. These consequences will affect the Niger Delta because the region is one of the most vulnerable coastal areas in the world, due to its natural physical properties, e.g., a very low elevation and gentle slope. This paper evaluates the methods used by the government and the local people to combat flooding, inundation, erosion, sea water intrusion, and storm surges in order to assess the sustainability of such methods as resilience measures against SLR on the Niger Delta. We use remote sensing and GIS techniques to quantify the level of exposure of areas within the Niger Delta, compared with the resilience measures being used. Based on these results, we make recommendations for strengthening the aforementioned resilience practices that are simple and easy to implement.

Realizing the Environmental and Socioeconomic Aspects for Three Desalination Technologies: A Life Cycle Assessment Approach

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Water desalination for potable water production is an indispensable project due to the lack of renewable fresh water resources in the region. The current desalination practice consumes over 10% of the national GDP and has a massive adverse environmental impact. In this study we present a life cycle management (LCM) framework to evaluate three water desalination technologies: The Multi Effect Humidification, Photo-Voltaic Solar Energy, and Nuclear desalination technology and compared them with the current practice of Multi-Stage Flash Desalination (MSF). To ensure that the decisions being sought are as sustainable as possible, the framework encompasses socioeconomic aspects to the technologies together with environmental impacts for such a strategic project. The environmental aspect is assessed evaluated through a life cycle assessment (LCA) using the four methodological stages of ISO 14042. Data obtained from the European Reference Life Cycle Database (ELCD) were adapted to reflect regional energy sources and types of emissions. The three water desalination technologies were evaluated according to the CML 2001 method. The financial aspect was assessed by calculating capital and operational costs through apportion methods for the three water desalination technologies. The environmental and financial criteria were optimized through a mixed integer mathematical program that is solved using GAMS optimization software.

Scope for Sustainability of Metropolitan *and* Agricultural Communities under Drought-Constrained Conditions: The Growing Potential Demonstrated by Reverse Osmosis Desalination

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This paper reviews metropolitan and regional water security and sustainability arising from population growth. Desalination options can potentially secure regions threatened by drought and population. The case is illustrated by the worst drought in Australian history across five cities. The question is: how many can benefit from ocean-sustainable water solutions? The paper argues desalination is increasingly sound “water insurance”. Reverse osmosis for seawater and wastewater treatment is growing in countries in the Middle East and high population parts of Australia, China, South America, USA and other countries with ocean access.

Australian experience, and lessons from water pricing and trading across regions, suggest desalination and wastewater treatment including through reverse osmosis, are integral elements of sustainable rainwater-constrained economies. The recent declines in unit cost of reverse osmosis technology confirms rising scope for sustainable use of oceans as a source of fresh water, supported by increasingly cheap solar energy.

It is shown, based on our published and current research for the National Centre of Excellence in Desalination in Australia, that viability of desalination also depends on using efficient water institutions and incentive structures in water-short regions. River based *regional* agriculture can experience higher water security and secure premium food production as a result of increasing the *urban* capacity to draw on oceans for potable water; using regional dams, rivers and aquifers for agriculture.

We use over 100 years of rainfall data, and cost data for dams, rivers and rainfall-based storages, to demonstrate that desalination is increasingly a logical part of water security and sustainability in regional economies sharing scarce rainfall and storages. Use of abundant ocean water increases water security in agriculture and inland areas that otherwise might find water resources reduced. However, pricing and allocating water with drought-related scarcity tariffs is also needed to sustain supplies and regional water treatment as population increases.

The author has published five international papers on Desalination and Drought within Water Grids

Viability of the Agrosystems of Small Islands

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Global changes have strong environmental and socio-economical effects on the development of small islands. The expected negative effects could particularly concern the agricultural sector which is one of the most important in providing income. In this context, adaptation to global changes covers major challenges such as the preservation of agricultural activities and their contribution to wealth and food security. In this paper, we focus on the agrosystems dynamics prevailing in small islands, taking as an example the French West Indies (FWI). These territories are at the beginning of their agroecological transition, a fact which is likely to improve the viability of agriculture.

A mathematical viability model is suggested at the farm scale. Farming systems are consistent agronomic and decision units of analysis for the implementation of doubly efficient agriculture that reconciles competitiveness with respect for the environment. A simplified representation of farming systems is provided. It encompasses three components (agroecological, economical, socio-cultural) with respect to the nature of the ecosystem services they produce. The challenge consists in suggesting a modelling pathway that admits a few representative variables while taking into account the systemic complexity of cultivated areas (natural, technological, economic, socio-political). It helps (1) determine viable trajectories of agrosystems in an uncertain context related to global risks; and (2) reveals the most suitable decision rules which fit their sustainability. The variables must describe the current state of the agrosystem (*state*), the drivers of action that can be controlled by the agents (*control*), and the nature of uncertainty (*tychastic*).

A simulation exercise is implemented for a diversity of crops (short cycle, annual, semi-perennial, perennial), agricultural practices (low, high intensive) and soils in the FWI. This numerical simulation tool is able to determine to what extent farming systems are viable or not. It sheds light on the decision rules that permit farming systems to remain resilient.

Adaptive Regulation through the Lens of Viability Theory: A Theoretical Framework for Sustainable Economics in the Anthropocene Era

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A theoretical framework is suggested to answer the regulatory issues that arise from the huge contemporaneous uncertainty driven by economic and ecological (global) risks. The Earth is an evolutionary (and hence dynamic) system that has started a new geological phase, *i.e.*, the Anthropocene Era. Consequently, the Earth as a whole has turned into a dynamic, anthropized system (DAS). The economic system is an emblematic, dynamic system controlled by humans that runs on a natural support. Hence, the DAS of interest is nothing else than the social-economic system built around money (SESM).

However, from the leading age of the Anthropocene, twin crises threaten the DAS, no matter the geographic scale of analysis. Economic or environmental crises have, now more than ever, a systemic component that may affect the sustainability of any SESM. The higher frequency of financial or monetary krachs, with almost unheard-of social and economic impacts (*e.g.*, the recent subprime crisis, the sovereign debt crisis, etc.), coupled with environmental uncertainties (*e.g.*, climate changes), forces us to tackle the crucial issue of adapting to the twin sources of global shocks by refining the regulation process of any SESM. Indeed, economic crises reveal the current difficulty of conveniently allocating our scarce monetary resources, as compared to increasing human needs, while environmental uncertainties cost huge amounts of resources, with regard to rebuilding procedures (when it is possible to make such repairs).

Consequently, one main interest would be to provide a theoretical regulatory framework that is generic enough to deal with both monetary/financial and environmental uncertainties.

The aim is to provide such a framework for basing human adaptation through a regulatory framework in favor of sustainable economics in the Anthropocene Era that fill these four gaps. The Mathematical Viability Theory gives this opportunity, provided that it be adjusted to design the adaptation of human activity and organization.

The Vulnerability of SIDS: A Sustainable Assessment Development Method

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A large consensus in the economic literature has concluded that Small Islands Developing States (SIDS) are more vulnerable than others. Academic works have given rise to numerous composite indexes of vulnerability that can be criticized on three main points: (i) Most of these indexes claim to stress the economic dimension of vulnerability while sustainable development has developed momentum; (ii) Although some of these indexes can be interpreted from a sustainable development perspective, they do not simultaneously cover all dimensions of sustainability; (iii) The multiplicity of variables and computation methods used in these indexes raises the question of whether there is a set of variables that consistently describes the states of vulnerability and resilience.

This article attempts to reconsider vulnerability-resilience composite indexes from a sustainable development perspective by proposing the Net Vulnerability-Resilience Index. We test this hierarchical multimetric composite index on a worldwide sample integrating SIDS and non-SIDS. On this holistic basis, we give evidence that SIDS are not specifically more prone to vulnerability than other countries. Moreover, there is no determinism that dictates that a country will remain either vulnerable or resilient despite its intrinsic and structural features.

Benchmarking Freshwater Use by Smallholder Raisin Producers—A Sub-Vector Efficiency Analysis

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Smallholder agriculture is argued to have a major contribution to make towards poverty alleviation in South Africa. The challenge is to ensure that smallholder farm-businesses are operated in a sustainable manner. The aim of this research was to benchmark efficient water use for the production of raisins by smallholder raisin producers in the Northern Cape Province of South Africa. Data on the amounts of inputs used and raisin yields of 28 raisin producers were used to calculate sub-vector efficiency scores for water use by the farmers under consideration. A sub-vector efficiency analysis for water aims to minimise the amount of water that was used to produce a certain amount of output, while keeping the other inputs constant. The results show that nine of the raisin producers in Eksteenskuil have sub-vector efficiency scores of one and, hence, can be considered to use water efficiently. By implication, they cannot reduce their current water use without reducing other inputs or the amount of raisins produced. The results also show that there are a number of farmers who use much more water than necessary to produce their raisins. The average sub-vector efficiency score of the bottom-third group of raisin producers amounts to 0.426. Thus, on average, this group of producers should have been able to produce the same yields by applying only 42.6% of the water they had applied. A possible reason for the large number of Eksteenskuil raisin producers who use water inefficiently may be the fact that Eksteenskuil farmers typically do not pay for irrigation water. The problem is that there are no consequences when they fail to pay, hence, there is little incentive for them to improve the efficiency with which they use water. Thus, failure to enforce institutions may have a negative impact on sustainable production practices.

Farmers Choice of Drought Coping Strategies to Sustain Productivity in the Eastern Cape Province of South Africa

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This paper determines the factors that influence communal farmers' choice of coping strategies to sustain productivity during drought and to determine current adaptation and coping capacities for drought risk in the Eastern Cape province of South Africa using field surveys, structured and semi-structured interviews and a multinomial probit model. The result identified three main coping strategies used by farmers, namely: irrigation, diversification and drought resistant crops/breeds. It was found that, on average, most farmers used drought resistant crops/breeds (44%), 32% practice farm diversification, while 29% use irrigation on their farms. Farmers who receive relevant information, have experience and receive sufficient income from their work are more likely to adopt resistance crop varieties and choose suitable animal breeds in case of drought. Access to water has of course a significant impact and is positively related to the probability of farmers not adopting any coping strategies. The variable risk level was significant and negatively related to the probability of adopting irrigation as a strategy to address drought. Record keeping was also highly significant and positively associated with the probability of using farm diversification to address drought issues. Even though education and extension services were not significant, they negatively influenced the farmers' probability to use one of the coping strategies. Such viable strategies to reduce the farmer's vulnerability to drought and to improve and sustain productivity should be incorporated into the farmer's existing strategy to adapt and cope with environment uncertainty. Measures such as rain water harvesting and till practice, keeping reserves, would help them survive through bad years and would increase their agricultural productivity and sustainability.

Impacts of Climate Change Adaptation Strategies on Drought Risk: Implication for Sustainable Agriculture in South Africa

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Human survival and social stability is highly dependent on food security. In sub-Saharan Africa, one of the major extreme climatic events that adversely affects agricultural production, and by extension the households, is drought. Droughts are recurrent features in South Africa, affecting plant growth and leading to loss of crop production, food shortages and, for many people, starvation.

This paper examines the impacts of climate change adaptation strategies on drought risk among farmers in Eastern Cape, South Africa using the Tobit regression model. Data were collected from 120 drought-affected farm households located in Eastern Cape. The study shows that most farmers are highly vulnerable to drought, as indicated by the mean drought risk index (0.681). The Tobit regression estimates establish that male-owned drought-insured farms, drought insurance, irrigation, male-owned irrigated farms, farm diversification, male-led farm diversification and high income households were all significant at 5% and they have a negative relationship with drought risk. While age and lower income households were also significant but have a positive relationship with drought risk. Whereas both high- and low-income households were affected by the drought, households belonging to the lower socioeconomic group were the most vulnerable to drought risk. The results indicate that the older the farming household, the more vulnerable they are. It is suggested that irrigation, drought insurance and farm diversification are very important adaptation strategies with greater impact for a sustainable agricultural production.

Water Footprint of Milk Production in the Free State Province of South Africa

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The aim of this study was to assess the water footprint of milk produced in the Free State Province of South Africa in order to inform water users towards sustainable freshwater use in the production of milk in the area. The study was conducted as a case study on a dairy farm that produces milk, processes the raw milk in a processing plant on the farm, and then sells the processed milk to retail stores in the Free State Province. The Water Footprint Network approach was followed to calculate the volumetric green-, blue-, and grey water footprint indicators for milk, and to assess the sustainability of the water footprint. Data for the purpose of this research were obtained from farm level measurements of crop water requirements; crop water requirements simulated with a crop growth simulation models (SAPWAT) and actual water measurements in the milk processing plant. The results show that the total water footprint to produce one kilogram of milk with an average fat content of 4 per cent and 3.3 per cent protein was 1 024.965 litres—marginally larger than the global average of 1 020 litres per kilogram. Consequently, the water footprint may be considered inefficient. When assessing the sustainability of the water footprint for the case study, results show that the period when freshwater is used for the production of the feed crops correspond with the period when sufficient freshwater is available in the catchment. Thus, although the water footprint indicator in this case study is larger than the global average, the water footprint is sustainable. In order to accurately advise water users towards sustainable freshwater use, the water footprint indicator has to be interpreted in combination with a sustainability assessment, and not merely based on the volumetric water footprint indicator alone.

Dye Removal in Experimental Ponds Treating Textile Wastewater with Lemna Minor

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A global increase in industrialization has resulted in the rapid growth of textile industries in developing countries, leading to a high rise in the overall discharge of a broad range of pollutants, including dye wastewater, which frequently has mutagenic and carcinogenic effects on humans and animals depending on whether the receiving watercourses are a source of drinking water. In contrast to traditional high-rate wastewater treatment units, passive biological treatment technologies, such as waste stabilization ponds, are a sustainable and cost-effective alternative technology to treat large quantities of contaminated water, especially in places where land costs are low. The aim of this study is to investigate the impact of different design variables on dye removal from experimental ponds. The objectives of this study were to: (i) assess the performance of the pond in accumulating dyes; (ii) evaluate the impact of different design variables, such as the presence of Lemna minor L. (Common Duckweed) and/or algae, on the removal of dyes; (iii) assess the effect of other parameters such as dissolved oxygen, pH and redox potential on the removal of dyes; (iv) compare the removal of four different dye types (acid blue 113, reactive blue 198, direct orange 46 and basic red 46) with each other; and (v) compare pond performances under controlled laboratory conditions with those in the semi-natural environment. Findings indicate that the proposed treatment method with L. minor is generally not very effective and that treatment differences between planting designs (L. minor only; algae only; L. minor and algae combined) were rather small. Further research on combining anaerobic with aerobic ponds in sequence is currently in progress. Initial findings indicate greater dye removal efficiencies. This work will contribute to a better understanding of the performance of sustainable vegetated treatment ponds in terms of dye pollution removal in the textile industry.

Floating Reed Beds for the Treatment of Synthetic Grey Water

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The focus on treatment of wastewater with constructed wetland systems has increased since the 1990s. Vegetation management to control water pollution is an essential component in wetland system design, management and maintenance. The grey water proportion of domestic wastewater is usually between 50% and 80%. Grey water compared to foul water has relatively few pathogens and low nutrient loads. Common Reed (*Phragmites australis*) has been selected to simulate floating islands within plastic bucket environments (wetlands) to assess its role in the removal of grey water pollutants, such as chemical oxygen demand and nutrients from synthetic grey water. The experiment layout comprised three groups of wetlands (60 in total). The first and second group had twelve wetlands (two replicates each) for short (two days) and high (seven days) contact times each. Six wetlands from each group were filled with ten litres of low strength synthetic grey water and the remaining six wetlands were filled with the same volume of high strength grey water. The plant rhizomes and roots were carefully washed to remove soil and then submerged in the grey water. The remaining wetlands were left for control purposes. During winter (worst case scenario), the chemical oxygen demand removal for low strength grey water was about 40% and 43% for short and high contact times, respectively. While for high strength grey water, the removal was about 20% and 27% for short and high contact times, respectively. Reductions of ortho-phosphate-phosphorus were between 2% and 33% for low strength grey water, and between 18% and 29% for high strength grey water regarding both short and high contact times, respectively. Findings have shown that the recycling of (pre-treated) grey water for toilet flushing, irrigation in agriculture, washing of cars and streets, enhancing amenity wetlands and groundwater recharge is a viable alternative to using drinking water.

Hydrocarbon Removal and Seasonal Variability in Vertical-Flow Constructed Wetlands Treating Urban Wastewater

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The global population increase, accompanied by a sharp increase in urbanization, and industrial and agricultural land use, has resulted in a tremendous increase in the discharge of a broad range of pollutants, including petroleum hydrocarbons, to receiving watercourses. This has caused harmful impacts on the different components of the water environment. Particularly, oil-rich countries suffer from wide-spread hydrocarbon contamination of both the natural environment and urban wastewaters. Wetlands are a sustainable and cost-efficient technology to treat large quantities of contaminated water, particularly in regions where land costs are low. The aim was to compare the impact of different design (aggregate size) and operational (contact time, empty time and chemical oxygen demand (COD) loading) variables on the long-term and seasonal performance of vertical-flow constructed wetland filters operated in tidal-flow mode before and after diesel contamination. The objectives were to (i) assess the performance of the wetland filters before and after diesel contamination; (ii) assess the impact of different doses of diesel concentration on the performance of the wetland filters; (iii) assess the impact of design and operational variables on the removal of diesel and other water quality variables; and (iv) to assess the seasonal variability of the wetland performance before and after diesel contamination between June 2011 and January 2015. Before diesel contamination, compliance with secondary wastewater treatment standards was achieved by all wetlands regarding ammonia-nitrogen, nitrate-nitrogen and suspended solids, and non-compliance concerning biochemical oxygen demand (BOD) and ortho-phosphate-phosphorus. Filters contaminated by diesel performed worse in terms of COD and BOD, but considerably better regarding nitrate-nitrogen removal. Moreover, all hydrocarbon components were effectively removed. No filter clogging was observed. This work will contribute to better understanding of the performance of constructed wetlands in terms of hydrocarbon pollution control indicating that this technology will play a positive role in the petroleum industry.

Mineral Contamination of *Capsicum annuum* Irrigated with Recycled Domestic Wastewater Treated by Vertical-Flow Wetlands.

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Since the financial world crisis started in 2007, sustainable water resources management, agriculture and food production is becoming both economically and environmentally more important. The effective use of renewable resources is particularly essential in relatively poor developing countries. Due to water scarcity in many arid countries, there is considerable interest in recycling various nutrient-rich wastewater streams, such as treated urban wastewater for irrigation in the agricultural sector. However, a potentially high risk is associated with heavy metal and trace element accumulation in the soil irrigated by contaminated waters. Subsequently, this will cause high mineral contamination levels in the tissue of the marketable yield. The aim was therefore to assess if domestic wastewater treated by different sustainable wetland systems can be successfully recycled to water commercially grown crops. The objectives were: (i) to study the effect of irrigation on Chilli (De Cayenne; *Capsicum annuum* (Linnaeus) Longum Group 'De Cayenne') with domestic wastewater treated by wetlands compared to tap water (fresh water); (ii) to assess the overall quality and particularly the mineral contamination of Chilli fruits; and (iii) to determine the accumulation of mineral contaminants in the soil irrigated by treated wastewater between September 2013 and September 2014. High yields were associated with tap water and an organic growth medium. However, as the compost becomes depleted of nutrients after about 14 months, the harvest increased for pots that received pre-treated wastewater. Nevertheless, fruits contained high amounts of aluminium, zinc, iron, magnesium and manganese compared to the permissible limits. The project contributes to ecological sanitation understanding by closing the loop in the food and water chain. Findings will lead to a better understanding of the effects of different wetland treatment processes on the recycling potential of their outflow waters used to irrigate crops. Moreover, growers will have the opportunity to optimise their methodologies.

Performance Evaluation of the Electro- Coagulation Treatment Process for the Removal of Total Suspended Solids and Metals from Water

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Globalization, industrialization, mining, and uncontrolled population growth have fostered a shortage of potable water. Thus, it has become imperative to understand an effective and reasonable water purification technique. A renewed interest in electrocoagulation has been spurred by the search for a reliable, cost-effective, water-treatment processes. This paper has elucidated a technical approach for getting rid of heavy metals and total suspended solids from synthetic water using an aluminum electrode. The effect of operational parameters, such as current density, inter-electrode distance, operating time, and pH, were studied and evaluated for optimal properties. This study corroborates the correlation between current density and removal efficiency. Neutral pH and a low electrode gap (2 - 4cm) have been found to aid the efficacy of the electrocoagulation setup. The outcome indicates that a maximum TSS removal efficiency of 76.6 % has occurred at a current density of 5.3 mA/cm² during a contact time of 30 minutes. In the case of heavy metals remediation, 30 min of process time at neutral pH has exhibited extreme reduction rates of 99.9%, 75.6%, and 47.9%, for Cu, Cr, and Zn, respectively. During the experiments, electrical conductivity and total dissolved solids were also found to fluctuate by 5-6 % of the original value. The reduction on cathode and hydroxide species generation at anodic dissolution of the metal electrodes has been considered as a possible reason for the increasing of pH of the solution. The conclusion is drawn that electrocoagulation has a future as a decentralized water treatment technology.

The Impact of Different Irrigation Waters on the Growth of Chili Grown in a Greenhouse

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Wastewater reuse is becoming a common practice worldwide. With increasing water demands and the lack of freshwater resources, particularly in regions of water scarcity, the reuse of pre-treated wastewater has become an attractive option to compensate for the shortfall in freshwater resources and to meet the growing need for relatively clean water. The study aims to assess the usability of two types of water sources: (a) treated wastewater from a set of ten different wetland filters; and (2) untreated wastewater from five sources (river, rain, gully pot, and real grey and artificial grey waters), which are utilized for watering commercially grown crops. The corresponding objectives are: (i) to examine the impacts of variables and boundary conditions on the growth of chilies (*De Cayenne*; *Capsicum annuum* (Linnaeus) Longum Group 'De Cayenne') under semi-natural conditions; (ii) to assess the influence of wastewater quality on chili fruits (specifically their marketable yields); and iii) to evaluate the impact of the metals and nutrients accumulated in the system. Different water qualities were compared with each other to evaluate their corresponding source suitability for irrigation purposes. Regarding treated wastewater, findings show that the irrigation water has variable concentrations of nutrients and trace minerals. Results also reveal that high yields in terms of economic return were observed in wetlands with a small aggregate size and a low contact time. As far as untreated wastewater is concerned, except for artificial grey water, the water qualities were highly variable, depending on season and temperature (river, rain, and gully pot waters), family home practices (real grey water), and domestic and industrial effluent discharges (river water). A few irrigated chili plants suffered from either a shortage and/or excess of some nutrients, which led to a relatively poor harvest. The highest yields were associated with river water. Low fruit numbers correlated well with rainwater and grey water.

Community Based Tourism in Mexico: Contribution to Achieving the Millennium Development Goals

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By the end of 2015, Mexico will meet 85 percent of the targets of the Millennium Development Goals agreed to at the Summit of the United Nations—including reducing extreme poverty and hunger—but will fail on key issues for development, such as the reduction of pollutant emissions, deforestation, maternal health and employment generation. Tourism has been promoted all over the country in the last decade to alleviate poverty, most of which being community-based tourism. Local people (sometimes indigenous) share their customs, food, lifestyle, and set of beliefs with visitants. These communities manage both the impacts and the benefits of this tourism, strengthening their self-governance, economic alternatives, and traditional ways of life in the process. How tourism has helped in these goals is the main purpose of this work, so literature on this topic was reviewed. Certified small community-based ecotourism projects/enterprises at different places in Mexico were surveyed and the main contributions to reduce poverty were explored. It was concluded that the inhabitants of the communities themselves consider they are living better as they are employed and especially feel useful in their communities, but they are very concerned about violence, insecurity and corruption as the main obstacles to development of their communities. This would also impede sustainable tourism and its potential benefits.

Impact Studies on Environment and Ecological Certification of the Expansion Areas and Coastal Touristic Sites Such as the Case of El-Aouana in Algeria: Indicators for Considering Biodiversity

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There are many forms of tourism that can be described as "viable" industries, but fail to take biodiversity into account when studying the planning of sites, despite the encouragement of international bodies such as the International Union for Conservation of Nature. All these forms of tourism aspire to achieve sustainability from different perspectives and come together in the desire to minimize the impact of human activities on the environment. However, perpetuate responses of non-renewable resource consumption are dictated by the unrestrained search for comfort to satisfy customers who become more and more demanding and sensitive with regard to the ecology of the visited places. Coastal biodiversity offers inestimable wealth in terms of flora and fauna but this diversity is threatened by human activities that attack it directly by soil erosion, overfishing and pollution of the sea beds. Methods of evaluating the sustainability of urban planning instruments and touristic sights are applied throughout the world with different names and impact studies on the environment. Our purpose is to explore the research done in this area and to implement the role of biodiversity in tourism and hospitality to verify which indicators should be adopted to take into account biodiversity in the development studies of the Expansion Area and Touristic Coastal Sites (EATCS) such as EL-Aouana town situated in the west of Jijel city, Algeria.

What Factors Can Influence the Expansion of Protected Areas in the World in the Context of Millennium Development Goals?

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The Millennium Summit of the United Nations in 2000 established eight Millennium Development Goals, which the member states and international organizations committed to help achieve by 2015. The approaching anniversary offers an opportunity to review the fulfilment of the commitments. The attention should not be focused solely on the performance, but also on factors critical for success or failure in achieving the goals. Understanding the drives of change is an important precondition for meaningful setting of the post-2015 sustainable development agenda. This paper deals with the seventh goal which calls for ensuring environmental sustainability. A key aspect of the global environment sustainable future is reducing biodiversity loss. Target 7.B committed member states to conserve valuable ecosystems by ensuring a certain proportion of protected terrestrial and marine areas. While many countries registered improvements in the coverage of protected areas, a significant portion lags behind the target. The paper attempts to shed light on the role of various factors behind the performance of individual countries in nature conservation. Regression analyses were performed on variables that could influence the coverage of protected areas. The main findings point to the significance of economic development, whereas other factors remain less relevant. Although the level of economic development corresponds with the protected areas in individual countries, it does not automatically ensure the slowdown of biodiversity loss. Therefore, the actual performance and sustainable management of nature conservation in protected areas should be taken into consideration in the post-2015 agenda.

Are We in Another Rare Earth Metals Crisis? There Will Be a Cascading of Criticality from Rare Earths to Commodity Metals

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A dispute over rare earth minerals (REMs) between China and Japan in 2010 spread awareness of the criticality of these resources throughout the entire world. Even though the situation between supplier and consumer has not changed much since the 2010 crisis, the critical mineral issue has largely fallen from the world's consciousness. Moreover, when geologically processed into concentrated products, rare earths are coproduced as byproducts of commodity metals, which are sometimes more economically profitable; such metals include copper, aluminum, and zinc. Demand for commodity metals is expected to ramp up, due to rising income and the consequent increase in demand for common home appliances, such as air conditioners and refrigerators. Comparing the current situation, in terms of production and metals consumption, between the “importantly issued” rare earths and “not issued yet” commodity metals, it is represented that the monopolistic consumption of resources by a few countries is much more severe with regards to commodity metals than with respect to rare earth metals. To prevent commodity metals from becoming critical resources, we have to focus on transferring eco-mining and processing technologies to resource-holding countries, such that these countries may obtain wealth and improve the economic and living situations of their populaces.

Examining the Determinants of Community Based Natural Resource Management (CBNRM) Programme Performance Indicators

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The conservation and preservation of natural resources is a concern that seems to be prevalent across the globe. The CBNRM programmes model was selected by the government of Botswana, through the Ministry of Environment (MEWT), as an approach towards encouraging the use of sustainable environment practices. This paper examines the CBNRM programme projects and whether there are factors that influence the performance of these projects. Extant literature on CBNRM projects is reviewed to guide the direction of the enquiry. It emerged from the literature review that factors that influence the CBNRM programme performance can be classified into four dimensions: CBNRM programme related factors, factors relating to the CBNRM stakeholders, CBNRM organisation related factors, and CBNRM environment related factors. The paper recommends further studies that will establish the impact of the identified factors that influence CBNRM programme project performance in Botswana.

Global Implication of Oil Sands Resources on Sustainable Development

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Over the years, there have been various projections and estimates indicating the depletion of conventional resources; while unconventional resources accounting for about 75% of worldwide hydrocarbon resources remain largely unexplored (Compagnie Générale de Géophysique (CGG) 2014; Energy International Agency 2014; Oil Sands Truth, 2014). There is a very high possibility that these are the set of resources the world will be turning to for energy supply as seen in the case of the Canadian and Venezuela Oil Sands (OS), as-well-as the US oil shale; since global energy demand is said to be on the rise and still expected to increase by 25-45% come year 2030 (International Energy Agency, 2010, 2012).

OS and other natural resources found in unconventional sources are of great importance to all of us: transforming global energy supplies, creating new opportunity resources and also having the following potential of reducing imports, increasing reserves, enhancing job opportunities, among others. Provided they can be sustainably developed on a commercial scale by countries in which they are found (Statoil, 2013). Examples include Venezuela and Canada playing vital roles in the global economy through providing steady and dependable energy to the world; and currently occupying the first and third positions in the world respectively in terms of oil reserves (World Energy Council, 2013 and OPEC, 2014).

Ordinarily, challenges to the attainment of sustainable development at any level, be it local, national/state, regional or global are complex and multi-dimensional in nature requiring environmental governance (UNEP, 2009; IUCN, 2014). Such challenges, associated with energy resources and production represents a crux of the issue as they result in environmental as well as economic and social impacts. OS resources are a mixture of sand, clay and other minerals, water and bitumen; bitumen which is of major interest is a heavy and extremely viscous organic matter that ordinarily does not flow to the surface except when treated and diluted. Hence require special techniques for its enhanced recovery (Meyer *et al.*, 2007; Isaacs, 2011; Falebita, 2014). They usually require extra or special characterization, influences and recovery technologies for their mobilization.

However, exploration and development of these resources are in themselves a source of local, national and global concerns; rooted in their myriad effects and implications for sustainable development. The issue of sustainable development is on the frontier of majority of nations and governments as well as international organizations including the United Nations (UN), Environmental protection Agency (EPA), and Organization for Economic Cooperation and Development (OECD). These organizations have developed a number of frameworks and indicators for the assessment and expected achievement of sustainable development status (UNDP, 1990-1998; UNEP, 2002; EPA, 2003; OECD, 2005).

On a global scale, the sustainable development of OS resources demands attention; due to associated effects manifested in all three pillars of sustainability and sustainable development vis: environmental, economic and social (Common and Perrings, 1995; Harris, 2000; Kates et al, 2005). Some of which are land and water stress, Greenhouse gas emissions, water, air and land pollution, security issues, as well as displacement of residents from surrounding host communities of these resources; addressing such issues require a holistic and dynamic approach which necessitates this study.

This study presents a work in progress of an attempt at unravelling the potential, implication and multiple effects of OS resources on economic, social and environmental dimensions of global sustainable development through a System Dynamics (SD) approach; taking a case of Canada, Venezuela and Nigeria. This paper would be of significance to researchers and practitioners interested in promoting sustainable resource development. It will also provide useful information to policy and decision makers for the formulation of policies on energy and natural resource governance.

Analysis conducted involve the use of SD tools to develop models of OS development and its environmental, economic and social effects; for each of the countries to analyse their implications on global sustainable development as-well-as explore the interrelationships among the various factors associated with OS development and sustainable development, through scenario and sensitivity analyses. This analysis effort also involves capturing the cause-and-effect-relationships among a multitude of economic, environmental and social factors that influence sustainability.

A Resilient Traditional Practice of Grassland Management in the Caribbean

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Creole cattle in Guadeloupe are mainly tethered either in natural pastures, at roadsides, near sugar cane crops or houses. The "tethering practice" has been well established for a long time and consists of 90% of cattle holders and 60% of goat farmers. Beyond the Caribbean, this type of farming is also practiced elsewhere, in Africa, India, North America and even in Europe. Faced with the persistency of this practice, and despite promotion of other conventional managements to the local farmers, surveys of farmers highlighted no less than five different types, identified according to different elementary interventions which are generic zootechnical bases. Farmers carrying out a particular tethering practice are not distinguished by their means of production, social status, or their marketing arrangements, but according to the geographic area and the local agro-ecological context. A bottom-up study of this practice, from the traditions held by livestock holders, to scientific experiments, revealed that it can truly play a key and laudable role, considering various perspectives.

Besides high animal performances achievable with certain interventions, this practice is very flexible: it involves a low cost of material, cheap labor from family, while allowing a better use of natural areas as well as non-arable land. By driving the animals individually, detection of any health or anoestrus issues is enhanced, as well as facilitating adjustments of stocking rate and preventing overgrazing. This practice provides an income with little investment to a wide range of farmers (multi-active retirees, young dynamic operators) and meets the objectives of livestock holders that may diversify their agricultural production, especially with sugar cane. This diversification is a security factor that allows a stable income and a flexible production system, autonomous and resilient to market fluctuations. Moreover, this practice is suitable for the organization of farmers, and contributes to some ecosystem services (savings, centralized manure production, patrimonial value, etc.).

Modelling Efficient Strategies to Set up Safe Local Livestock Rearing Systems in Agricultural Areas Highly Historically Contaminated

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The chlorinated polycyclic ketone pesticide Chlordecone (CLD) was used from 1971 until 1993 in the French West Indies to fight against the banana black weevil. Its application resulted in a long term pollution of soils which is thought to last 5 to 7 centuries for the heaviest polluted soils. More than 1/4 of the agricultural acreage of the two French overseas departments (Guadeloupe, Martinique) are moderately to heavily polluted and National survey plans carried out since 2008 in slaughterhouses revealed unexpected contamination of animal products. Thus, the Martinique and Guadeloupe populations are concerned by CLD contaminated food and there is a growing demand for solutions that would enable to maintain the local animal production and to produce safe animal products even in historically contaminated areas.

Overall, this paper aims at evaluating the local animal production systems in terms of livestock exposure to CLD, characterizing the bioavailability of CLD, its behavior and metabolization in the animal organism, and establishing innovative strategies to bind CLD via activated carbon in the digestive tract. Safe local livestock rearing systems will be proposed in agricultural areas historically contaminated by CLD, and assessed in terms of economical efficiency and social acceptability.

We will provide an estimate of the economic cost for producing healthy meat as a function of (i) the chosen species (sheep, cow, pork), (ii) the alternative depolluting processes and (iii) the modified rearing practices (grazing management, use of commercial feed). We will then identify the set of possible biotechnical strategies that allow the farmers to produce healthy meat, viable from an economic point of view. This study fully complies with the objectives of the Millennium Development Goals for the development of sustainable and innovative production systems to ensure food security.

Variables Affecting Sheep Theft in the Free State Province of South Africa

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Livestock theft has a big impact on the livestock industry of South Africa and is threatening the sustainability of the industry. In order to generate information that can be used to inform sheep farmers on how to effectively mitigate stock theft on their farms, the objective of this study was to investigate whether the variables affecting the occurrence of livestock theft are significantly different from the variables affecting the level of livestock theft experienced in the Free State Province of South Africa. The study was based on data captured in 292 structured questionnaires completed during telephone interviews with livestock farmers in the Free State Province. The Craggs model specification was used to statistically test whether or not the same variables affect the occurrence of stock theft and the level of stock theft experience by the respondents. The results revealed that variables affecting the occurrence of stock theft are significantly different from the variables affecting the level of livestock theft. Technologies used by farmers proved to be significantly related to the occurrence of livestock theft, while loss-controlling actions taken by farmers proved to have significant relationships to the level of livestock theft experienced. Technologies used include elements such as livestock theft collars and alarms. Loss-controlling actions include night patrols, counting animals and access control. The results proved that the stock theft problem faced by farmers can be divided into occurrence and the level of occurrence aspects. Investing in controlling actions, thus, may decrease the level of stock theft, but not necessarily completely stop stock theft. Other challenges faced by farmers that threaten the sustainability of their farming enterprises should be approached in a similar manner to generate information that can be used to more effectively overcome the challenges at hand.

Sustainability of Irrigating Wheat under Climate Change Scenarios in a Humid Climate—A Study in the East of England

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Climate change is ‘the challenge’ of our times and for the next decades. The biggest impacts are likely to affect the sustainability of agricultural and food systems, both highly vulnerable to continuously changing climatic patterns. Wheat is a strategic crop for food security. It is widely grown worldwide as a rainfed (unirrigated) crop, but the latest research showed that recent world wheat price increases and increasing weather variability is making supplemental irrigation marginally profitable. The proposed study combines the outputs from a general circulation model (GCM), the FAO crop growth model (AquaCrop) and economic modelling to assess the sustainability of irrigated wheat production compared to rainfed, under current climate conditions, and in the future under different climate scenarios. AquaCrop model have been calibrated and validated for winter wheat grown on a sandy loam soil in the east of England (Bedfordshire). Long-term observed climate data (1970-1996) in Cambridge (Cambridgeshire) were used to validate the projected climate data from the GCM. The structural characteristics of the case study are representative of a typical farm of the area, and irrigation costs and the wheat prices for the economic model were calculated assuming current market prices, and sensitivity analysis will assess, in the longer term, the expected variations due to the increase in world wheat prices and the energy costs involved. Results will quantify simulated wheat yields (t ha^{-1}) and irrigation water requirements ($\text{m}^3 \text{ha}^{-1}$) for the baseline and the selected climate change scenarios for both rainfed and irrigated practices. They will also elicit the trade-offs between different options, according to the sustainability triangle: i) the yield benefits (£ ha^{-1}), ii) the added value of water (£ m^{-3}), iii) the global warming potential due to irrigation, and iv) the labour requirements. Covering the three pillars of sustainability, these results would offer a complete and integrated tool for decision makers for the adoption of future sustainable policies.

The Impact of Climate Change on Crop Water Use and Chill Unit Accumulation

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Climate change and its impact on already scarce water resources are important issues being publicly debated in the world today. Water resources are of more concern because changes in the water supply will affect the water availability for household use, agricultural practices, and for the vast industrial water demand. In addition to the impact on water supply, climate change is also expected to affect future winter chill and thus could have a major impact on fruit species with chilling requirements. Research on crop water use has received a lot of attention but researchers have not taken the future climate into consideration. They have also focused on increasing temperatures but failed to relate it to chill unit accumulation. With a view of helping farmers to adapt to climate change, this study provides information that will assist farmers in their decision making process for adaptation and in the selection of appropriate cultivars of crops and deciduous fruits. Crop water requirement is modelled for the present and future climate for two irrigation systems. Similarly, chill unit accumulation is modelled using two different models for both the present and future climate. Results show that irrespective of the irrigation system employed, there will be an increase in crop water use in the future climate as a result of climate change. The water use for drip irrigation is less than that of sprinkler irrigation because of efficiency differences in the irrigation systems. It is also confirmed that the accumulated chill units will reduce in the future as a result of climate change. Water resources management strategy is thus important in ensuring that agricultural production can withstand the stresses caused by climate change. Therefore, farmers must be equipped with a collection of management or adaptation tools to overcome slight climatic differences.

The Impact of Irrigation Scheme on Farmers' Livelihood in Northern Ghana: Policy Implications for Sustaining All-Year Agriculture

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Ghanaian agriculture relies on rainfall. However, rainfall agriculture cannot sustain the ever increasing demand for food, particularly in this era of climate change. This has created a need to practice irrigated farming. This paper, therefore, determines the impact of irrigation scheme on farmers' livelihood in Northern Ghana, using the propensity score matching (PSM) technique and the logit model. The study employs a multistage random sampling technique to select 180 farmers, comprising 120 irrigated farmers and 50 rainfed farmers. The logit estimates indicate male farmers, large household size, land ownership, access to ready market, and access to extension services tend to increase farmers' participation in irrigation scheme. Contrary, farmers with large farm size are less likely to participate in irrigation schemes. The PSM estimate suggests that irrigation schemes are able to raise farmers' income by US\$ 392.65. The study concludes that irrigation scheme positively impacted the livelihood of farmers. In order to sustain the agricultural sector, it is recommended that policy measures should be geared towards increasing farmers' participation in irrigation schemes and governments should give a great deal of attention to developing the irrigation schemes in the country.

Stream 4:
Lifestyle, Consumption, and Mobility

The Influence of Media Design and Knowledge on the Acceptance of Regenerative Energies

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Introduction: A groundbreaking decision was made by the Swiss government: the abolishment of nuclear power in favor of regenerative energies by 2050. This monumental project requires an understanding of stakeholders' and the population's expectations of how sustainable energy production can be ensured. Further it is important to understand the factors that enhance the acceptance of regenerative energy projects. In the present study we aimed to explore the effect of media and knowledge on the acceptance of different regenerative energy production. Methods: N= 268 subjects performed on an online assessment, which had to be completed on two separate days (7-10 days delay between the two days). At the first day the assessment lasted about 10-12 minutes, on the second day it took another 12 minutes to complete all tasks. Every subject participated on both days. At the first day demographic data and acceptance of different regenerative energy productions were measured. After one week the participant received a mail to log in again and proceed with the second part. This part started with an online knowledge test (with pictures and statements, three different presentations (video, podcast and text) of a regenerative energy supply network. After the knowledge test and the presentations the acceptance of different regenerative energy productions were measured again. To look for changes between measurement one and two a multivariate ANCOVA with repeated measurement was performed using SPSS 21. Results: Several significant main effects of between subject variables (time, knowledge, age) and within subject variable (time) were found. Also significant interactions (time * age, time* media, time * knowledge) were observable. Discussion: The results demonstrate the possible influence of media on the acceptance of regenerative energies in Swiss-population. Further it seems that the factor of media design has no influence on changes in the acceptance of regenerative energies.

Consumer Valuation of Energy-Efficiency Investments: The Case of the Vietnamese Air Conditioner Market

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Typical consumers underestimate the benefits of future energy savings and underinvest in energy efficiency, relative to the description of the socially optimal level of energy efficiency. This phenomenon is called the energy-efficiency gap and has been widely studied in many developed countries. However, research concerning the energy-efficiency gap is still very limited in developing countries. In this study, we use sales data of air conditioners (ACs) in the Vietnamese market and conduct hedonic price analysis to examine how Vietnamese consumers value energy efficiency in ACs. We find that the implicit discount rate in the Vietnamese AC market exceeds 11.7%. This high implicit discount rate suggests that consumers in developing countries place a much lower value on energy efficiency than do consumers in developed countries. In purchasing energy-efficient appliances, consumers can save substantial amounts of money. Financial and technical support from developed countries is necessary to promote energy-efficient appliances in developing countries.

Eco-Efficiency and Cultural Consensus: Acceptability Standards for Renewable Energy Systems

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Which factors affect stakeholders' choices on the installation of renewable energy systems in a specific environment through the optimization of such installations' positive impacts? The development of eco-efficiency is considered to be a leading goal. From a systemic and multidimensional perspective, the development of eco-efficiency is classified into five approaches: environmental, social, institutional, economic, and spatial/functional. Within these approaches, how evaluative factors are defined is the result of interpretative macro-categories that outline different relations between energy systems and landscapes. Evaluative factors are key concepts for possible meta-decision planning choices, and are as follows: for the environmental approach, eco-compatibility; for the social approach, cultural consensus; for the institutional approach, social acceptability and participation; for the economic approach, profitability and utility; and for the spatial approach, multi-functionality. For the social approach, in light of historical, cultural, and perceptual elements, cultural consensus becomes a crucial concept for eco-efficiency, and is related to participation in, as well as the quality and intensity of, social networks. The evaluative factors concerning the relations of renewable energy systems/context result from a SWOT analysis of power generating systems, which are considered only as plants, and a SWOT analysis of single case studies reported to each context, which are considered as energy systems. The crossing of the results of the two different SWOT analyses generates a matrix expressing specific goals and sub-goals, requirements, and evaluative factors. The outcome reveals acceptability criteria for the social approach, and is summarized as follows: aggregation and cohesion policies, community involvement, consensus, eligibility, and the creation of new employment opportunities. Our main goal is to define a replicable, meta-planning model that is applicable to different contexts and interventions, so as to determine acceptability standards that are based on a systemic-complex, multidimensional analysis. Our tool generates a network and verifies the simultaneous existence of the conditions connected to the aforementioned approaches and is relevant to a variety of contexts and scales.

Predictors of Attitudes towards Regenerative Energies

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Introduction: In Switzerland, the decision to change energy policies and the decision to switch to regenerative energies by 2050 have had meaningful impacts on how one increases acceptance of regenerative energies in stakeholders and the population in general. Sustainable products, such as energy from regenerative sources (*e.g.*, thermal, wind, water, *etc.*) need to be placed in the market and therefore information concerning the best predictors of attitude may help in deploying the best methods for increasing the readiness of "users" and for increasing acceptance of regenerative energies. Our study aimed to find the best predictor of attitude towards regenerative energies. Methods: N= 268 subjects participated in an online assessment that had to be completed on two separate days (there was a 7-10 day delay between the two assessment days). During the first day, the assessment lasted about 10-12 minutes; on the second day, the assessment took 12 minutes to complete all tasks. Every subject participated on both days. Demographic data, skepticism values, the attitude towards regenerative energies, and knowledge about regenerative energies were measured. After one week, participants received mail instructing them to login and proceed with the second part of the study, which is explained in Zeballos *et al.* (in press). To explore the best predictor of attitude towards regenerative energies, we calculated a linear regression using SPSS 21. Results: Neither age nor skepticism were significant predictors for attitude towards regenerative energies. Only knowledge about regenerative energies was a significant predictor. Discussion: It seems that educating people is a very important issue when it comes to increasing acceptance towards regenerative energies. Since there may exist many more predictors, our study could identify a possible issue for later interventions regarding the placement of sustainable products and the readiness of the users.

Situation Awareness and Home Energy Reduction: A Study

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Reducing home energy consumption is a complex activity. In order to successfully complete it, home energy users must (at least) commit, plan, monitor and revise. In other domains (e.g., aviation, emergency response), devices *supporting* similarly complex activities have been shown to have multiple points of failure (including but not limited to failure to show key information, failure to present that information in an easily understood manner and failure to promote the projection of future results, e.g., Endsley 1992). Importantly, for our work on the ENLITEN project (an academic-industrial collaboration sponsored by the EPSRC) the identification of those failure points has been used as the basis for developing mitigation strategies, enhancing human-computer interaction and extending the support provided to home energy users. In this paper, we examine the applicability (or otherwise) of literature describing situation awareness failure in domains such as aviation, military operations and emergency response to home energy. We find the theoretical approach employed and the mitigations proposed to be a useful starting point for the extension and revision of home energy feedback devices.

More specifically, we consider domestic energy reduction from the perspective of situation awareness (SA). We report on a focus group study that investigates this SA. The participants in that focus group reported multiple under-researched SA issues in the home energy management domain, areas in which they identified additional information that would assist them as they committed to, planned, monitored and revised approaches to reducing their energy consumption.

The paper draws upon a multi-disciplinary research base (situation awareness, human-computer interaction, design science), investigates failures in home energy reduction and proposes concrete amendments to home energy feedback devices as a result. It contributes to discussions of home energy reduction and its impact on consumers' economic, health and sustainability concerns.

The Use of Smart Technology for Energy Saving by Changing Consumer Behavior

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Energy resources are an important factor for each country's economic vitality. It is important to investigate what economic benefits the country's population, businesses, and industrial companies are experiencing that are attributable to the use of smart technology in the consumption of energy. Society is not always interested in innovation and does not have enough information concerning smart technologies. This article assesses how the smart use of technology influences consumer behavior by increasing efficiency. To achieve our purpose, the following tasks were carried out: a) an analysis of consumer behavior concepts and studies on energy efficiency; b) an analysis of the key factors that determine energy consumption trends in Lithuania and other EU countries. Our analysis showed that smart technologies influence sustainable energy consumption. This article was prepared on the basis of a pilot study. The results showed that in Lithuania (as compared to the EU-27 countries), there is less energy consumption for heating and hot water, but more energy is used for cooking, lighting, and electrical appliances. The study distinguished the key economic factors that influence energy consumption trends in households—the price of electricity for residents and their real disposable income. Electricity prices have had an impact on the decline of energy consumption per capita in the United Kingdom, Germany, and the Netherlands, but in Lithuania, a positive relationship between energy prices and energy consumption in households was detected. In Lithuania, due to the relatively low energy consumption per capita in comparison with the other "old" EU member countries, energy consumption per capita is expected to increase even with increasing energy prices. The study showed that the Lithuanian population believes that the impact of climate change on the environment is an actual problem, and that all residents can and must contribute to a solution for climate change.

Global Health and Sustainability: Ensuring People and Ecosystems Health

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Population health cannot be sustainably improved and maintained without ecologically and healthy sustainable development. Global environmental threats to health include overexploitation of natural resources, uncontrolled urbanization, climate change, depletion of the ozone layer, reduction of biodiversity, degradation of ecosystems, untreated wastewater flows and the spread of persistent organic pollutants. The long-term health consequences of human induced climate change are likely to be particularly profound and induce threats to the food supply, increased frequencies of extreme climate events that will impact on infectious diseases. On one hand, infectious and parasitic diseases (communicable diseases) account for 14 million deaths per year, around 25 per cent of the world total, and are the world's leading killers of children and young adults. On another hand, non-communicable diseases, injuries and violence are becoming more and more important and will account for nearly 80 per cent of the global burden of disease in 2020. Moreover, both ambient and indoor air pollution is a major contributor to respiratory ill-health conditions and of particular concern to the health of children, women and the elderly, in the context of an urban growth. Transport and traffic are at the interface of accidents-pollution-noise-absence of physical activity, which is much linked to how cities are built and used. Among the former Millennium Development Goals there were clearly three health targets and two more environmental-related which had also indirect impact on human health and global burden of diseases. Environmental, ecological and people's health will be also at the center of many of the forthcoming proposed sustainable development goals (SDGs). This session is proposed under the panel 6. It is pertaining to discuss on health and sustainability referring to the major public/global health challenges with a particular emphasis on lifestyles, mobility, cities, global ecological and climate changes, women, equity and gender.

Multiple Win-Wins of Sustainable Traffic: Tackling Air Pollution, Noise, Climate Change, Physical Activity and Accidents for Healthy Cities

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The mobility of people and goods is an essential element of economic development and prosperity. However, the resulting traffic in and between cities causes a range of societal and environmental challenges that affect peoples' well-being and health. In some countries, traffic accidents have become the most important cause of death in young men. The close spatial interrelation of traffic arteries and residential as well as work locations in most cities all around the world results in large fractions of the population being annoyed by night-time traffic related noise. Traffic remains as well a primary cause of ambient air pollution where both primary (*i.e.*, exhaust-related) as well as secondary traffic-related atmospheric pollutants have become one of the leading causes of mortality and morbidity world-wide. Movement of goods and people remain heavily dependent on fossil fuel, thus, traffic is a major contributor to greenhouse gas emissions and climate change. Traffic arteries also separate neighborhoods, affecting social connectivity. Moreover, auto-mobility competes with healthier mobility modes such as walking and biking, which in turn adds to the challenges of remaining physically active in daily life. The presentation will put these challenges in perspective of opportunities for sustainable solutions for healthier cities.

Globalization, Global Health Challenges and Sustainability

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As globalization increases, interdependence between the physical and social environment reaches higher dynamics and complexity and calls for an integrated ecological and social perspective to understand the determinants for health and well-being at micro/local to macro/global levels.

The global health challenges have become more complex owing to the increased population dynamics that basically affect all ecosystems. Consequently, the demographic and subsequent epidemiological transitions forge unprecedented paths in the different social, ecological, cultural and economic settings. Tackling global health challenges and the changing disease burden from a sustainability view-point can be achieved when reconciled within socio-ecological settings and health systems, such as:

- People and household-centered approaches to ensure equity and access;
- Systems thinking that focusses on effective governance and financing through decentralization and well-defined partnerships;
- Continuous monitoring through minimal essential surveillance—response approaches;
- Human resources management that includes training and continuing education, and
- Accompanying, relevant research and development activities.

Using the examples of emerging and re-emerging diseases, these key determinants will be illustrated and discussed based on recent case studies, including the Ebola outbreaks. It concludes with the perspective that sustainability will only be achieved if we: (i) consider the inextricable linkages between ecosystems, society and health, particularly the health of animals and humans; (ii) understand that contemporary complex global health problems cannot be solved by “reductionist” approaches; and (iii) finally, this requires ecological, health, social and political systems thinking and taking action. The way forward lies in the combination of ecosystem and public health approaches, in the spirit of global health and Sustainable Development Goals which, in turn, entails scientific approaches to a coherent hypothesis-driven sharing and comparing across systems and cultures.

Women' Role in Sustainable Health Systems—From Victims to Game Changers

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This session will address the question of women's current position within health systems *vis-à-vis* that of men, with a focus on, but not limited to, developing countries. It will discuss two hypothetical scenarios, based on what is known from the literature: one portraying women mainly as victims, often subject to the decisions of others both at home and at health facilities; the other portraying women as leaders, decision-makers and change agents. Examples will range from the persistent neglect of gender equality in health, such as failure to address women's needs beyond the reproductive period, to severe gender inequalities affecting women's health, such as the Boko Haram atrocities in Nigeria and public rapes of young women in India. It will argue that the victim scenario, which in many developing countries is the prevailing one, is highly problematic from the perspective of attaining national health goals and sustainable health and social systems. It argues that the game changer scenario, within the context of Health in All Policies and the Social Determinants of Health, has the greatest potential to effect positive change and sustainable development. It prioritizes a holistic and inclusive approach to public health (inclusive of male, female, and gender diverse groups), gender equality, and willingness to explore and exploit the potential contributions of all, including civil society. Although this will require a paradigm shift on many levels and the charting of new territory, it offers the greatest promise for the global community to achieve an ethical way forward that combines prosperity, social inclusion and justice, and environmental sustainability.

A Research Model of Environmental Behavior as a Tool for 'Ecological Citizenship' Agendas in Planning

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'Ecological citizenship' is an under-researched definition within the environmental planning and policy agendas. As environmental behavior is the nucleus of ecological citizenship, this paper seeks to describe a research model that is developed as a tool for a user survey aiming to examine the constructs, determinants and dimensions of environmental behavior in the city of Famagusta, North Cyprus. According to the conceptual framework of the research, ecological citizenship is the emerging dimension of environmentally based cities. Hence, without residents who are aware of the importance of environmentally responsive living as a lifestyle, the outcome of the sustainable urbanism debate would be inadequate or incomplete. Thus, it has been recognized that residents with sustainable lifestyles implementing ecological communities have a great significance and priority. Within this context, firstly, Ecological City is defined in terms of its dimensions. After the first four dimensions, which are all physical characteristics, the ecological citizenship is conceptualized as the fifth dimension. Then, environmental behavior is examined with the help of a theoretical review. Finally in the light of all derived information, a research model is constructed. This model developed, proposes that there are general values that influence the environmental attitudes. These environmental (ecocentric and anthropocentric) attitudes influence the environmental awareness. As a result of the problem awareness, the individual intends to perform environmental behavior. The model is eligible to be used for obtaining data about the level of urban residents' existing general values, ecocentric and anthropocentric attitudes as value orientations, environmental awareness and concern, and environmental behavior within different six behavioral categories.

An Investigation of the Influence of Domestic Tourists' Attachment and Loyalty to a Natural Based Tourist Setting on General Sustainable Behaviors: The Victoria Falls World Heritage Site Experience

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In the recent past, there has been an increased awareness that problems with the natural environment exist and that human activities are often the cause of these problems. Such problems include biodiversity loss, species extinction, ecosystem degradation, global warming and ozone depletion. Significantly, these problems present a threat to the ecosystem services upon which our well-being depends. Thus, society is at a critical junction in its relationship with the natural environment, a relationship in which tourism has growing significance.

Nature-based tourism can serve as a potential setting for activating favorable behaviors and attitudes towards the natural environment. This is because nature-based touristic experiences result in heightened awareness, appreciation of and reconnection with nature. Most importantly, it also encourages a realization of personal responsibility for the state of the environment.

A case study was conducted to investigate the influence of domestic tourists' attachment and loyalty to a natural based tourist settings on their general sustainable behaviors. Data for this study were collected using on-site self-administered surveys at the Victoria Falls World Heritage site in Livingstone, Zambia. Structural equation modeling was used to explore the relationships among the factors. Findings suggested that loyalty to a natural based tourist setting has a direct effect on general sustainable behaviors. Attachment to a natural based tourist setting was found to have an indirect effect on general sustainable behaviors mediated by loyalty to the setting. These findings suggested that promoting relational oriented lasting relationships between domestic tourists and natural based tourist settings has potential to foster general sustainable behaviors. Findings of this study are relevant for devising mechanisms that can promote a realization of personal responsibility for the state of the environment.

Perceived Ecosystem Services and Disservices of Residential Green Infrastructure within the Río Piedras Watershed

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Urban residential areas provide opportunities for the provision of localized key ecosystem services and in turn increase households' and cities sustainability. To improve the existing strategies for residential green infrastructure management, resident's preferences and attitudes towards ecosystem services need to be considered. This is because humans have direct (and indirect) bottom-up impacts on the socio-ecological characteristics of urban residential areas through management decisions. The San Juan Metropolitan Area is the largest urban area on the island of Puerto Rico. The San Juan ULTRA collaborative project has been evaluating the vulnerabilities of the Río Piedras Watershed socio-ecological system. This study formed part of an initial exploratory phase to address how ecosystem services and disservices are perceived by local residents within the Río Piedras Watershed by addressing questions related to perception, attitudes, awareness and motivations toward urban residential trees. A social survey using a combination of open-ended and choice questions about perceptions and behavior towards green areas and bodies of water as well as socio-demographic questions was applied on selected locations along the rural-urban gradient of RPWS. Our findings show that perceived services are numerous but emphasize atmospheric/climate services (shade, lower temperature, air purification) followed by provision (food) and cultural services (aesthetic value). Some residents also perceive trees as a disservice in areas related to maintenance hardship, property damage and obstruction of power lines. A larger fraction of these residents are located in urban areas where tree cover is reduced. Our findings argue for the need to understand individual decisions of yard management to develop integrated strategies of green infrastructure planning and as bottom-up strategies to increase resilience in cities.

Self- Identity, Place-Identity, and the Challenge of Proactive Planning for Climate Change Adaptation

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Many localities appear to encounter governance challenges as they strive to implement sustainability plans, especially if they address climate change adaptation. Adaptive planning involves decision-making with regard to anticipatory strategies, which can be difficult because proffered interventions can involve high cost, foregone opportunity, radical alteration of professional activity, attenuation of social networks, and significant changes in personal identity or group lifeways. Together, these factors combine to feed a reflexive apprehension, even hostility, to adaptive planning. This resistance to adaptive planning has received relatively little attention in the policy literature. Often dismissed in pejorative terms, such as NIMBYism, denial, or short-sightedness, stakeholder reluctance to embrace anticipatory planning may in fact be strongly influenced by participant self-perceptions that are foundational and resistant to change. Put differently, people's sense of self and place may contribute to a sort of "imaginative intangibility" with respect to certain types of climate adaptation. Practically speaking, self- or place-identities may make it difficult for some stakeholders to engage in anything other than superficial discussion concerning adaptive planning, block thoughtful reflection regarding alternative approaches, encourage "gaming" within the planning process, and provide rationale for cheating the system once it is implemented. In this paper, I explore the proposition that adaptation planning may be constrained by something akin to Stone's "rationality project;" by the widely-shared presupposition that adaptive regimes should emerge from a process of objective vulnerability assessment, informed by scientific characterizations of climate change impacts. Drawing on Clark and others, I will argue that community-based adaptation is not impeded by a deficiency in technical or scientific understanding of climate change, but rather by a lack of mechanisms through which to co-produce narratives that address people's inability to accept the problematicity of climate-induced impacts, articulate relevant issues, make sense of options, and embrace a process of genuine change.

Sustainable City Branding: Evaluating the Environmental Behavior of Slow City Citizens in Yeni Bogazici, North Cyprus

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The Slow City (Cittaslow) movement is one of the most rapidly growing city development trends over the last few years. Additionally, the movement has gained popularity as a branding instrument, as it aims to foster local resources, tradition, and culture in small towns, while consciously promoting cities' 'slow' qualities for a larger audience. In this sense, the slow city concept not only enhances slow living, but also aims to gain economic benefits from the status of being a slow city, e.g., by promoting traditional food or ecological lifestyles for cultural tourism purposes. Therefore, it is worth a critical discussion as to whether environmental concerns are considered as self-evident or are motivated as part of a branding strategy. This article mainly deals with the environmental behavior of citizens living in the Slow City context in the Mediterranean region. As a case study, a small village, Yeni Bogazici in North Cyprus, has been chosen; the village is the first Slow City in North Cyprus. The aim is to evaluate the relationship of being a Slow City citizen with citizens' attitudes toward issues related to sustainable environments and environmentally-friendly lifestyles. To achieve this goal, a field survey with citizens of Yeni Bogazici was conducted to evaluate their environmental behavior and the impact of being a Slow City citizen on their attitudes and behavior. Therefore, the key concern of this study is to assess, whether a *city-tag* (like Slow City) increases environmentally sensitive behavior and strengthens awareness towards environmental issues. The article ends up with critical remarks concerning the environmental concerns of citizens and recommends strategies for integrating environmental issues with branding strategies, in order to gain long-term and sustainable benefits.

The Effects of Persian Satellite Programs on Students' Lifestyles: A Case Study of Students at Tehran University

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The main purpose of this research is to review the effects of Persian satellite programs on the students' lifestyles at Tehran University. To do this research, we used a survey method and our samples of this research include 384 students who have watched satellite programs and also lived in areas of Tehran. The results of this research show that Persian satellite programs have high effects on students' lifestyles. The first hypothesis of this research has been rejected, which means that satellite programs did not affect their modes and students dressing style. On the other hand, second through the sixth hypotheses were approved so that there are some relationships between watching satellite programs and social behavior, lifestyle, buying facilities and staff-student attitudes. The conclusion of this research shows that all of the hypotheses were confirmed.

Urban Fabric, its Form, Quality and an Enhancement of Social Capital. A Comparison of Three Cities in Indonesia

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A city is a living entity, especially concerning its urban form; however, the quality of a city refers to its physical qualities. The physical quality of a city cannot be disregarded as it has a significant impact, not only bringing physical comfort, but also forming a social life for the community to be able to interact with one another. Thus, life within a city requires the understanding of urbanity, which means being ready to negotiate on four aspects of city life: density, heterogeneity, anonymity and social intensity. However, urbanization is often a precursor to potential cultural problems that at a certain level can lead to social friction, even crime. These social problems are somehow symptoms of the weakening of social capital in urban communities and associated with the cultural context of the city and urban life (urbanity). An unplanned urban spatial system, in terms of physical quality and newcomer's being uninformed of the essence of urbanity, is then considered to be the main factor in the lack of social capital in the urban community. The study of three cities with varying size and character, Surabaya and Bandung being metropolitan cities, and Surakarta, a traditional small city, describes the perceived quality of city residents' life, not only due to the physical size, but also their image perception. Physical quality based on measurements within 12 selected samples of each city using mapping and photographs compiled with a spatial plan and considering local regulations has used as an observation tool. Furthermore, a questionnaire was given to 40–43 respondents in each area, and using Likert scaling to assess the image of perception. The study aims to give a description of how and to what extent the physical environment is able to strengthen social value.

A Multidisciplinary and Multi-Criteria Approach to Sustainability in Evaluating Alternative End-Uses for Disused Areas: A Case Study.

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The aim of this work was to define and apply a multidisciplinary and multi-criteria approach to sustainability in evaluating alternative end-uses for disused areas. A contribution to sustainability is complete only if it simultaneously takes into account the social, economic and environmental points of view. In the literature, there is a gap in terms of practical approaches useful to measure how one alternative is more sustainable than another. This study tries to give a useful contribution to fill this gap. The procedure defined here is composed of three phases: 1) sociological; 2) economic; and 3) environmental. In turn, each single phase is developed by means of elementary operations. The sociological phase is useful in choosing the most socially sound alternative. This can be pursued by means of a consultative referendum. For the developed case study, we used the municipality of Santa Lucia di Serino (1460 inhabitants), in the Campania Region of Southern Italy; the referendum was simulated by means of a structured questionnaire submitted to a representative sample of the population (10% of people with no less than 18 years) in terms of age groups (18-29, 30-39, 40-49, 50-64, >65) and sex. The economic evaluation of the three considered alternatives (MSW separate collection centre, market area with parking, gym) was conducted defining the bill of quantities with regards to six main items (soil handling, landfill disposal tax, public services, structure and services, completion work, equipment and furnishings). The environmental evaluation was performed applying the Delphi method with local technicians who were involved in a qualitative-quantitative evaluation of the three alternatives with regards to eight possible environmental impacts (landscape impact, soil handling, odor, traffic, noise, atmospheric pollution, wastewater and waste). Simple Additive Weighting was used as the multi-criteria technique to define alternatives priorities. The defined procedure was able to ascertain the most sustainable alternative.

Community Energy Programs in the United States: Options, Trends, and Utility Responses

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Recent declines in the cost of solar energy have led many analysts to conclude that this technology will play a central role in the transition to a low-carbon future. While much attention has been paid to both utility-scale projects and individual rooftop systems, so-called *community energy* initiatives may, in fact, be the most important vehicle for realizing the full potential of solar generation. These programs come in a variety of shapes and sizes, ranging from common purchasing options to shared solar programs such as solar gardens. While the volume of new programs in the U.S. is extremely encouraging, significant barriers remain, including the looming decline in available federal investment tax credits and a host of complex technical issues. Perhaps the most important barrier, however, is the resistance on the part of the nation's utilities to community solar projects of all types. This paper will examine the variety of community solar initiatives currently under development in the U.S. and the manner in which the nation's utilities are reacting to what many in the industry see as a fundamental threat to a system of electricity generation and consumption that has changed little, at least in principle, for more than a century.

Local Authorities and Energy Governance in the UK: Negotiating Sustainability between the Micro and Macro Policy Terrain

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This paper explores the influence and changing position of local government in relation to energy and environmental issues, through an exploration of six UK local authorities and different ways in which they have been able to influence the governance of energy in their geographical jurisdictions by developing or instigating their own indigenous low carbon programmes. Through a combination of literature review and empirical research, the paper suggests that, in recent years, the UK has witnessed a shifting regulatory regime around energy, part of which has been instigated through the actions of local government. It is that argued that the low carbon agenda in the UK has provided a 'window of opportunity' for some of the more progressive of them, suggesting that local authorities are likely to exert greater influence over the future direction of energy policy in the UK. The paper provides fresh insights into the Multi-Level Perspective (MLP) conceptual framework in the context of these issues with the role of energy and sustainability providing a pertinent basis through which to assess ways in which local government has become more influential in redrawing system boundaries and opening up political and practical opportunities; particularly in relation to current understandings of both regime and niche level configurations.

Practitioners Knowledge Exchange and Networks in the Global South—A Sustainable Path to Foster Innovative Energy Know-How?

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Rural areas in the Global South often have only limited access to reliable energy services. One key step for their further and sustainable development is the introduction of clean and appropriate energy solutions that address the needs of these energy poor regions. Installation of energy technology without appropriate on-site know-how, technical and management trainings are likely to fail as experiences in the development cooperation work have shown over recent decades. On the other hand, well-established local Non-Governmental Organisations (NGOs) often build cornerstones for long-term success of energy projects. They can offer the technical, financial, organisational and/or political support needed to turn innovative ideas into reality. These non-governmental organizations concentrate "know-how" and form "knowledge hotspots" in their regions. However, due to large distances and cultural differences they often lack the opportunity to exchange their profound experiences with other practitioners working in the same field. This paper aims to analyse practitioners' networks and their potential for knowledge transfer and for increasing the acceptance and dissemination of sustainable energy technologies and fostering the transition process. Next to a brief analysis on key elements of networks, the focus lies on the analysis of three existing practitioner networks and their performance, with emphasis on the following small scale technologies: biogas digesters and wind/hydroelectric turbines. These networks are intended to actively facilitate the exchange of experiences through online forums, trainings and workshops. Besides different influencing factors contributing to their performance, all three face common challenges that are analysed and compared to the theoretical literature. The results will help expand the knowledge base on key factors that enable networks to increase the sustainability of rural energy access projects and programs in the long term.

The Influence of Context and Culture on Sustainability and Corporate Responsibility Expectations in China and South Africa

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In this paper, we explore the role of context and culture on corporate responsibility expectations in China and South Africa. To explore context and culture in these environments, we studied advanced, *i.e.*, postgraduate economics and management students, who provided written essays on their corporate responsibility expectations. We analyzed the data using Content Configuration Analysis and Multidimensional Scaling (MDS) within a Hermeneutic Content Analysis framework. In our analysis, we found that respondents bypass or transcend the mainstream academic literature on corporate responsibility and that responses are more akin to the debates around sustainability. Although economic development seems to be one of the main spheres in both settings, Chinese respondents differ systematically from South African respondents in relation to environmental protection and social development. Our analyses show not only the differences and similarities of corporate responsibility expectations of advanced economics and management students between these countries, but also how themes interrelate within and between national settings. A finer analysis of the MDS structures examines the ties between the respondents' expectations of the responsibilities of corporations, the historical contexts, and cultural dimensions within and between both countries. The purpose of this study is to develop a culture and context-sensitive tool for sustainable corporate responsibility (SCORE), to empirically examine the influence of context and culture on corporate responsibility expectations in different national settings, as well as to develop international policy and business applications in a more sustainable manner.

Climate and Health Co-Benefits from Changes in Diets. What Interventions are Effective?

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Diets link environmental and human health problems. Unhealthy “western” diets, which are related to high intake of meat, saturated fats and sugar are regarded as major causes for several diseases (diabetes, cardiovascular diseases, cancers) and rising obesity rates in industrialized and increasingly in low and middle income countries. The agro-food system, driven by an increasing demand for cheap and energy dense foods, has major impacts on the environment. Livestock farming is responsible for 18% of anthropogenic greenhouse gas emissions. Therefore climate and health co-benefits of changes in diets can be significant, as argued in a burgeoning literature. However, it still remains widely open as to how to reverse these global trends that endanger environmental and public health. Addressing the ensuing question on the effectiveness of proposed intervention strategies and in the search for measures that lead to substantial change in dietary patterns, we present the results of an in-depth literature review. Our main findings show: 1) In spite of official nutrition recommendations there are surprisingly few, if any, options addressing the required reduction of meat intake; proposed measures targeting the production side exclude health effects. 2) Measures to promote healthy diets are not far reaching enough: they largely focus on better-informed individual choices (e.g. mass campaigns, labelling unhealthy ingredients), which are not considered to be effective unless accompanied by “hard” measures (*i.e.*, command and control). 3) There is no evidence that self-regulation of food industries would be effective. 4) The only evidence based effective measures are public regulation and market intervention. Based on these insights, we propose a reduction scenario “less meat but better”, which is realistic in terms of its climate and health effects, using the example of Austria. We argue, that major interventions are necessary (*i.e.*, legal and fiscal ones) to promote diets which enhance both environmental and human health.

Climate and Health Co-Benefits from Changes in Urban Mobility

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There is growing evidence that climate change mitigation measures tackling urban mobility might also reduce adverse health impacts due to improved quality of air and even promote health gains through increased physical activity. Thus, health co-benefits could partly offset the costs of tackling climate change, since in contrast to climate mitigation health co-benefits can be realised more directly and often more quickly, thus making them more tangible and attractive to policy makers and the public.

While many studies focus on WHAT the benefits of assumed mobility changes might be, in our present analysis we focus on HOW to achieve such benefits. For this purpose we investigate the three biggest Austrian cities comprising more than a quarter of the Austrian population. The aim is to have a more generalised approach that provides political decision making with a clear understanding on what measures promise what changes in urban mobility and consequently what health, environmental and economic implications this implies.

To this end, we reviewed several measures and their potential effectivity in changing the modal split of urban mobility. Effectivity is derived from evaluation studies of past experiences and planning studies. Against this background, we identified relations, which can be understood as dose-impact functions. To provide a base for political decision making, we developed one scenario with measures of political acceptance and one that is more ambitious with measures both effective and efficient (efficient means here a favourable ratio between implementation costs and effects).

Best result in terms of health and environmental benefits at low costs promise measures that combine the extension of bicycle lanes, reduced prices for annual tickets and zones of reduced access (moving and parking) for individual motor car traffic.

Sick Building Syndrome, Energy and Thermal Control: A Norwegian Cellular vs. a British Open Plan Office

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This study investigated the impact of thermal control on users' health in two European contexts with high and low levels of individual control over the thermal environment: a Norwegian cellular plan office and a British open plan workplace, respectively. The former provided every user with a personal office and availability of operable windows, blinds, door and the ability to adjust heating and cooling. Air-conditioning was in operation in addition to natural ventilation. In contrast, the British approach presented a uniform thermal environment for all occupants through mainly natural ventilation. Limited control over the operable windows and blinds was provided for occupants seated around the perimeter of the building. The majority of occupants seated further away from the windows had no control over the thermal environment. A field study of thermal comfort was applied with questionnaires, environmental measurements and interviews. Users' health was higher in the Norwegian practice, while the British practice was much more energy efficient. Respondents of the British office suffered 40% more from sick building symptoms. The follow up interviews confirmed the significance of lack of availability of thermal control on users' health. A balanced appraisal was made of energy performance and users' health between the two buildings.

Ecological Modernization: A New View Based on the Second Modernization Theory

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Concerns about the environmental degradation, climate change, and overconsumption caused by continuous population growth and societies' pursuit of indefinite economic growth make ecological modernization a strategic alternative for sustainable development. Since the German sociologist Joseph Huber put forward the ecological modernization theory in the early 1980s, it has gained increasing international attention among scholars and policymakers during the last several decades. Such ecological modernization theory emerged in some Western European countries, such as Germany, the Netherlands, and Britain in the 1980s, which is mainly based on the European experience and describes the European mode for pursuing development with economic effectiveness, social justice and environmental friendliness. As an important aspect of modernization, ecological modernization represents a mutually beneficial coupling between modernization and the natural environment, and an ecological transformation of world modernization. The Second Modernization Theory proposed by Chinese scholar Chuanqi He is an integration and expansion of the classical modernization theory, post-modernization theory, and other new modernization theories within a global civilization scope, which successfully solves the theoretical dilemma of classical modernization and post-modernization theories. In this study, we mainly focused on the ecological modernization derived from Second Modernization Theory, including the definition, process, results, motivating forces, and modes of ecological modernization. The time-series analyses, section analysis, and case analysis have been conducted for support the historical facts of the world ecological modernization, such as long term trends, world frontier, and international disparities.

Environmental Burden Caused by the Consumption of Czech Households

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This paper is the first study quantifying both direct and indirect emission burdens on the environment from households in the Czech Republic. Indirect emissions are released during the manufacture and distribution of consumed goods by households, while direct emissions stem from the fuels burnt in homes or to propel passenger cars. Emissions of greenhouse gases, gases causing acidification, and substances giving rise to photochemical smog (that are attributable to household consumption) are taken into account. To assign indirect emissions to particular product consumption groups, linkages between detailed household final expenditure categories and industry sectors were made. A Multiregional Environmentally Extended Input-Output Analysis, based on the CREEA database in combination with Single Region Input-Output Analysis (using local NAMEA and symmetrical input-output tables), was used to calculate the indirect emission values in such a way as to take advantage of the strengths of both databases, so as to get the most precise results possible. Overall, the average Czech household is responsible for 11.1 tonnes of total GHG emissions, 61 kg of SO₂ eq. and 1.8 kg of ethylene eq. smog formatting emissions a year. Among product categories, a major part of GHG emissions stems from demand on electricity and heat, while food contributes mostly to SO₂eq emissions, and transport is mostly responsible for emissions causing photochemical smog.

Resulting emissions were aggregated into seven groups—food, housing, heating and hot water, electricity, transportation, goods, and services—so that pertinent lifestyles can be identified and relevant policies can be suggested. The results were statistically evaluated. The households were then grouped into deciles according to their expenditures and the emission elasticities of expenditures were calculated.

Locked in and Locked out: Understanding how Habits Affect Sustainable Energy Consumption

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Ninety percent of behavior related to energy use is habitual. People mostly use energy as part of their routines and with high degrees of automaticity. Habits may be understood as a factor in consumption behavior, triggered by, for example, contextual clues or other people's choices and actions. Alternatively, habits may be conceptualized as routine practices that emerge from the interplay of materials, skills, and images. Notwithstanding these competing theoretical stances, it is now assumed in sustainable consumption research that habits may lock people into unconscious modes of consuming energy or acting unsustainably. However, the concept of habits has so far only been weakly integrated into common frameworks, such as lifestyle approaches or decision theories. This contribution will show how the concept of habits may improve our understanding of sustainable energy consumption and present concrete theoretical and methodological innovations.

Participatory Approach Applied to Environmental Certification: The Case Study of Ecosustainable Events Using the Index “M.e.t.e.r.”

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This study aims to show how the participatory approach can be useful in the context of environmental certification. Participatory environmental certification systems allow for a higher engagement of citizens in the promotion of green behaviors. Until now, this approach has been largely applied in organic certification, in particular in France and South America. However, such an innovative approach could be applied in other contexts, in particular in each case in which the engagement of people may improve the final result. The case study here presented concerns the environmental sustainability certification of events, with a particular focus on scientific events (congresses, conferences, workshops, seminars, courses, etc.). The number of events worldwide is increasing, involving resources consumption, travel, and waste production. A more sustainable lifestyle includes the environmental sustainability of events, which has to be achieved and measured for a proper monitoring of their environmental impact. In our study, the environmental certification of the events is proposed using an innovative index called M.e.t.e.r. This index results from a set of environmental indicators, taking into account all the aspects contributing to the eco-sustainability of the event, such as resources consumption (energy, water, etc.), waste production, mobility, food, but also a parameter related to participation, which measures the participants perception of the level of sustainability of the event. This is a fundamental aspect, because it also means to apply sustainability principles in the phase of evaluation. One of the main principles of sustainability is subsidiarity, which means a bottom up approach and involvement of all the actors. The event examined in this case study is the European MCDA Spring School “Multiple criteria decision making: a key for sustainability”, held in Perugia in May 2014. We found that the contribution of the participants is a real added value for the measurement of sustainability of an event.

Estimating Traffic Emissions Derived from Congestion Using a Site-Specific Driving Cycle

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The ever increasing numbers of vehicles on urban roads are causing severe traffic congestion and poor air quality problems, especially at traffic intersections. Besides the number of vehicles, constraints to road widths within city premises and frequent stops by public transport worsen near-road environments. Therefore, effective traffic management (that would reduce traffic congestion and improve the level of service) necessitates the accurate quantification of traffic emissions. This paper evaluates the impacts of traffic congestion on emission via a modal based emission model with the help of a site-specific driving cycle. The results of these models have been compared against the Indian driving cycle (IDC) in metro cities and the New European Driving Cycle (NEDC). Similarly, the impacts of various vehicle types and heterogeneous traffic characteristics on emissions are also studied. A custom-made computer program was used to derive a representative driving cycle for each vehicle class using the instantaneous speed recorded during the trip. Further, the results will help policy makers use a correction factor for estimating traffic emissions. The study was carried out on a 12 km segment of National Highway 32 (NH-32) in Dhanbad, India. The prevalent driving mode was found to be a decelerating mode, and the cruising mode was the least frequent mode. Emissions estimated using site-specific driving cycle data were higher than those generated by conventional models using a constant emission factor and average traffic fleet speed.

A Measurement and Action Framework for the Triple Impact of Sustainable Heavy Duty Vehicles in Urban Space

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Sustainable urban mobility is a key factor for the sustainable, future development of cities. Such mobility determines the local air quality and health of inhabitants, contributes to the mitigation of global warming, and is increasingly seen as a decisive location factor for businesses. Over the last few decades, technology and regulations have enabled air pollution reduction in most cities of industrialized countries. Now, the next level of development is on the horizon, as technologies like hydrogen and electric power vehicles are entering a mature and cost-efficient state. However, there are obstacles in the way that currently prevent large-scale applications.

Within our research, we identify the major obstacles to widespread sustainable heavy duty mobility and describe the impact of a large scale transformation of urban vehicles from diesel to electric drives. We center our study on Heavy Duty Vehicles (HDV), such as city buses, local delivery trucks, or municipal utility cars like garbage collectors. The research concentrates on key economic, social, and environmental aspects. First, we apply a text-book approach to measure the impact of the replacement of HDV fleets by electric machines. From initial assumptions, over outputs for individual stakeholders, to final impacts, we present a coherent analysis of benefits and threats. Second, we present results from an empirical, interview-based study with private and public mobility stakeholders conducted in Switzerland. Third, we present our integrated platform, which brings together investors and vehicle owners to realize the projected impacts in all three dimensions of sustainability.

Assessing Scenarios of Transport Sector for IPCC 5th Assessment Report (IPCC-AR5)

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We have collected and assessed sectorally detailed studies for the transport sector as part of the activities of IPCC-AR5 and, at the same time, compared these to integrated assessment models (IAM) studies. Detailed results on the trends of the energy consumption and CO₂ emissions up to 2050 are described here as an overview of the representative pathways open to the transport sector to reach the specific mitigation targets, and to discuss the potential of various measures for CO₂ emission reduction. In the transport sector, the projections for energy use reductions and fuel switching are broadly consistent between sectoral and integrated studies. Although there is continuing growth in passenger and freight activity, efficiency improvement, modal shifts due to behavioural change, and low-carbon fuels offer high mitigation potential for a significant reduction of emissions.

Stimulating Sustainable Mobility in Urban Agglomerations in Industrial Regions

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For many years, the existence of cities connected as agglomerations and regions have been a challenge for ensuring consistent and sustainable development, and for improving attractiveness and competitiveness. This state of interconnection requires solving many problems. Problems connected with the operation and development of transport in these areas are of particular importance. This paper is comprised of two integral parts. First, in the theoretical part, apart from presenting the concept of sustainable mobility in the context of a specific industrial region and its agglomerations, discusses the problems of stimulating sustainable mobility, with a particular focus on instruments and mobility patterns.

Among the methods and approaches that can be used in practice, the paper presents a synthetic discussion of the issues connected with public transport as an instrument of transport policies involving the agglomeration of cities. Public transport creates sustainable mobility and helps achieve goals related to sustainable development. Similar investigations have been carried out with respect to technologies of intelligent transport systems (ITS), which, with respect to sustainable mobility, perform a double role. The implementation of ITS is one of the tools of a transport policy of agglomeration that is oriented toward the development of sustainable mobility. On the other hand, ITS services (algorithms, tools, measures of effectiveness) are determined by the goals of sustainable mobility. The third of the problems discussed is a postulate considering the means of public transport, with electric drives as one of the mobility standards in the nearest future.

In the second part of the paper, the theoretical investigations were supported with a description of the results of empirical studies carried out by the authors in 2012-2015 in selected agglomerations of the Silesia region in the south of Poland, which has over 4.5 million people. The results concern the problems of creating suitable informational bases for the decision-making process, where proposals of activities aimed at sustainable mobility are formulated. These decision-making processes use methods of hierarchization (of communication lines) and evaluate the level of their adaptation, according to the customers' needs. With regard to the use of ITS technologies, the paper presents scenarios for the development of an intelligent transport system in the central municipality of the agglomeration and the results of their assessment by city inhabitants. Furthermore, the paper proposes the verification of their consistency with mobility patterns, using the transport model. The economic aspects concerning the variants of implementation of a fleet of buses with electric drive into the urban public transportation system (mobility standard)

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are discussed in the second part of the paper presented. The conclusions formulated with regard to real instruments of stimulating sustainable mobility in agglomerated cities in industrial regions comprise the final part of the publication.

Between a Rock and a Hard Place: Transport Policy between Urban Sprawl and Accessibility?

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Today's OECD Societies have aimed at increasing their wealth since they got caught up in the industrious and then the industrial revolution. Central to this was the provision of accessible markets for both goods and labor. First the railway, then the car offered ways to increase access by orders of magnitude. The growth in car ownership is today in many countries well in advance of the ability or the willingness of their societies to provide the necessary infrastructure required for the speeds the car promises in principle. While urban sprawl helps to facilitate these speeds, that path is increasingly blocked by other policy concerns.

This presentation will discuss the feedback loops involved and possible ways forward to maintain the levels of access required for successful societies.

Sustainability in Aviation

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This paper presents a strong sustainability approach to deal with the challenge of aviation. The emissions from this sector account for 2-3% of global CO₂ emissions and are rising in step with growth in air transportation. There is a dilemma between retaining the benefits of air transportation and keeping its environmental impacts within safe bounds. Passengers like affordable flights; the economy benefits from facilitation of international trade and tourism; and governments are reluctant to impose restrictions which could have negative economic consequences. The aviation industry has put forward outlined plans to limit emissions, but there are no agreed upon targets and no clear way forward. The current approach to aviation policy is typical of the current weak approach to the challenge of sustainability, seeking to make adjustments to the current state of affairs. The research reported here took a different approach, focusing on a sustainable solution leading to the proposing of a step-change in both technology and the services offered to passengers. This is an example of how a stronger approach to sustainability has the potential to solve dilemmas and find solutions.

A Generational Analysis of Consumption Patterns and Their Effects on the Well-Being of Indigenous People: A Case Study of Rural KwaZulu-Natal

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This paper explores the well-being and consumption patterns of people living in rural areas of the Province of Kwa-Zulu Natal in South Africa from a social theory of consumption point of view. While there is a large bank of consumption pattern studies that have been undertaken to understand the effect of consumption on socio-economic factors in South Africa, there is a dearth of literature that looks at the changes in consumption patterns in rural areas. The effect of globalization on rural areas in South Africa has hardly been explored. Even scarcer, is literature that looks at the linkage between consumption and well-being across different generations in rural areas. This work focuses mainly on food consumption that is tied to social, epistemic and environmental values of indigenous people, across generations as far back as the 17th century during Shaka Zulu's reign. This approach made it possible to discern the utility function of food from its symbolic significance socially, physically, emotionally, and spiritually. The theoretical stance of the study facilitated the interpretation of the complex linkages between consumption, culture, customs and beliefs, and how these are linked to food consumption and well-being of people in different generations. Using ethnographic data and visual images collected from ancient libraries, archives and identified participants in rural communities in Kwa-Zulu Natal, the notion of well-being is defined from the perspective of different generational cohorts. The study found that food items such as amahewu (fermented maize porridge) and ukhothe (maize grounded as powder) is still relished across generations. Neither globalisation nor the apartheid system has affected the basic beliefs of amasiko nezithethe (customs and rituals). Even though the communities looked at, still espouse cultural values where all forms and types of rituals are accompanied by singing, dancing and food, there are divergent views on what constitutes well-being.

Primordial Spirituality and Traditional Livelihood Practices: Ethics Structures and Processes

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Africa has experienced a complex history and many challenges in her evolution. In ancient times, trees were not seen as timber and the elephant as ivory, nor were rhinos valued for their horns. The prevailing value system that views the natural environment and the nonhuman species on the basis of its economic value to humans has triggered an environmental crisis with devastating effects to human and nonhuman species alike. Notwithstanding the prevalent anthropocentric value system, and acknowledging the divergent discourses in the area of environmental ethics, there are indigenous people in South Africa that have profound respect for all creation. These people espouse primordial spiritual values that are linked to their traditional livelihood practices. The key purpose of this paper is to present a framework that describes the spiritual and environmental ethical structures and processes of individuals living in traditional and indigenous settings in South Africa. The study was centered on the following three questions: (1) What are the primordial spiritual values of indigenous people practicing a traditional way of life? (2) What are the ethical structures and processes that support their spiritual values? Ethnographic data will be drawn from various communities located in the Kalahari region in the Northern Cape, as well as in the deep rural areas in kwaZulu-Natal, with a view to exploring whether traditional livelihood practices have anything to offer environmental ethics today.

Sociological Meaning of Three Guangdong Ancestral Temples and Sustainable Strategies of Cultural Heritage Conservation

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In this paper, three Guangdong's ancestral temples are taken as case studies to explore sustainable strategies for cultural heritage conservation. Sustainable conservation of cultural heritage is very important in order that our own cultural identity can be formed today. In China, different stockholders hold various views on heritage conservation, and conflicts often take place among scholars, government and indigenous residents in the heritage conservation process. Many cultural heritages face a dangerous scenario and could even be damaged or destroyed for a variety of man-made "reasons", such as economic development, reconstruction for improving residences, over-intervention from government or outside communities, *etc.* The passive conservation of heritage for the sake of conservation is also not sustainable because varying attitudes from different stockholders may produce negative results, such as a reluctance to uphold conservation, lack of cultural authenticity outside of indigenous communities, eventually losing the preservation of heritage. Therefore, heritage can no longer be based on its intrinsic quality alone; it must be founded on the ability to recognize its aesthetic, historic, scientific, social values, *etc.*, and according to its varied cultural significance in today's world. We must adopt flexible strategies for its sustainable conservation according to local conditions and future needs.

Urban Sustainability and Traditional Neighborhoods—A Case Study: Bursa, Turkey

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There is a continual need for dwellings through which people can integrate their own values, form social links, and become anchored in a positive way. To meet this vital need, sustainability should be a core dimension of housing quality and be central to the development process as a whole. On the other hand, cities clearly appear to be the most important locations for actions that help the goals of sustainable development. In light of the above, the purpose of this paper is to highlight the potential of historic cities and their traditional housing areas to achieve urban sustainability, in the context of the compact city form. The paper consists of four sections, with a brief introduction on the critical role of cities for sustainability. The first section highlights the importance of traditional housing areas for urban sustainability. The second section covers an evaluation of the suitability of the compact city form for historic neighborhoods, through empirical studies undertaken in Bursa. The theoretical approach is based on the transactional perspective, which considers home and home environments as a transactional whole that defines and is defined by a range of cultural, social, and psychological factors. Observational and ethnographic research methods are used together with surveys that were applied in a valuable, traditional neighborhood in the city of Bursa, one of the most important historic cities of a developing country, Turkey. The paper concludes with the findings of the case study and offers some proposals for policy principles concerning sustainable urban development in historic cities.

Engendering Sustainable Mobility

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Despite the policy objective to reduce carbon emissions and efforts to build up sustainable public transport systems (European Commission, 2011) a lack of concordance between the macro decisions taken in transport policies and the everyday practices of people, makes the private car central in transport patterns; passenger cars accounted for 83.3 % of inland passenger transport in the EU-28 in 2012 (Eurostat, 2014).

Across Europe there is a diverse pattern of car use and car ownership—increasing in some areas and decreasing in others. While in countries like UK and Switzerland the share of the car in total inland passenger transport has fallen, in countries like Lithuania and Portugal this number had a significant raise (Eurostat, 2014). In the current context of crisis, households have a need to reduce mobility costs and yet the use of cars is growing due to an inadequate supply of public transport and too deeply established social patterns in which the possession of a car and *automobility* are a symbol of wealth and a social value in itself (Sales Oliveira, 2015). At the same time, socio demographic factors shape and are shaped by mobility and transport situations (Jones and Lucas, 2012). Gender is one important factor influencing and influenced by mobility as women seem to have a more sustainable attitude towards mobility, using more public transport and having a more ecological tendency. The question is whether this occurs due to traditional social roles for men and women and, in such a case, will this lead to women switching to the male pattern regarding driving and mobility, or, alternatively, will women, being more sensitive to sustainability, influence men to change. In this study, we analyzed mobility patterns in two metropolis from a gender perspective, using a mix methodology approach in order to highlight gender mobility profiles, and to look for the connection between these and sustainability concerns in order to help debunk the *automobility myth* and promote soft mobility.

Investigating Links between Transport Disadvantage, Social Exclusion and Social Sustainability: A Critical Review

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Social sustainability is a process for creating sustainable, healthy and liveable places and equitable, diverse, connected and democratic communities. It combines design of the physical realm with design of the social world, such as infrastructure to support social and cultural life, social amenities, systems for citizen engagement, and space for people and places to evolve. Although, all across the world, voluminous attempts aiming to establish social sustainability have achieved some improvements in the conditions of disadvantaged populations, they were not vastly effective due to the breadth of these populations and their problems. While social disadvantage is a multifaceted phenomenon, this paper focuses on the accessibility challenges of disadvantaged populations causing transport disadvantage and/or transport-related social exclusion. While mostly used interchangeably, transport disadvantaged and transport-related social exclusion concepts are not necessarily synonymous with each other. For instance, a socially excluded individual can have good access to public transport options or a transport disadvantaged can be socially included. Rather, transport disadvantaged and social disadvantage interact directly and indirectly to cause transport poverty. This in turn leads to inaccessibility to essential goods and services, as well as lock-out from planning and decision-making processes which can result in social exclusion outcomes and further social and transport inequalities will then ensue. Not only personal and socioeconomic reasons, but also the transport system itself can have a crucial role in creating barriers leading to social unsustainability. A combination of poor accessibility with low levels of mobility, and low levels of sociability intensifies the social exclusion, where among the transport disadvantaged categories, the elderly and disabled deserve more attention. This paper aims to provide a critical overview of the key issues, empirical research findings and policy attempts in addressing transport disadvantaged and social exclusion challenges to achieve social sustainability for all. The methodology of the paper includes a thorough review of the academic literature, best practice case analyses, and content analyses of government policy documents. The findings of this study reveal that the link between transport disadvantage and social exclusion is a well-researched theme in the literature. Based on either qualitative or quantitative analyses, these studies have concluded that a lack of access to public transport contributes to social exclusion. However, research has also questioned the robustness of these findings on the ground of causality. First, a correlation does not necessarily mean causality. An analysis of qualitative data is helpful to develop a hypothetical understanding of the construct, but is not sufficient to draw inferences. Second, analyses based on cross-sectional quantitative data have little relevance

for transport policy because such an analysis does not indicate the level of accessibility enhancement requires to enable a social transformation (i.e., providing transport disadvantaged groups with a more active participation in the society). Third, limited understanding exists on how to quantify the outcome of social exclusion, specifically caused by a lack of transport services. These limitations of prior studies suggest that a more robust analysis is required that enables examining the impact of changes in transport services on the changes in the level of social exclusion.

Mobility Deprivation of Low-Income Rural Households: Predisposition for Social Exclusion

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Low-income rural households are known to be a vulnerable social group in rural areas. In Serbia, they account for 14.7% of rural households, based on research conducted in 2013. Their deprivation is multiple: they are affected by social, economic and transport disadvantages, where transport is simultaneously the cause and the consequence of the first two forms of deprivation.

This paper is aimed at mobility deprivation of low-income rural households, located in four different environments, and its relationship with social exclusion, which is one of the key principles of sustainable social development. The studied environments cover typical rural areas in Serbia and include rural settlements near medium-sized town, isolated rural settlements and rural settlements of compact form near a small town.

The results indicated that households in rural settlements near a medium-sized town have a much lower mobility than their counterparts in isolated rural settlements and rural settlements of compact form near a small town. Data collected on car ownership revealed that low-income households have 'very low car ownership,' which prevents them from efficiently reaching work places, educational centers and shopping facilities. This leads to inequitable and unsustainable social development. The average daily distance travelled indicated that trips of low-income household members are limited to the local area. Surprisingly, they perform more leisure and private visit trips than their wealthier counterparts, *i.e.* the social activity space of rural low-income households suggests that their members are better integrated in the local rural community.

This paper revealed that low-income rural households are more likely to be affected by social exclusion, caused by transport disadvantage related to poor accessibility to work and educational opportunities, but their social connectivity with other community members is at a high level. In order to achieve sustainable social development based on social equity, decisions should be made that do not rely on ostensibly high rural car ownership favoring motorized households, but on transport modes that are accessible by all rural inhabitants.

The Imaginary of the Train of the Future in South Africa: From Public Access to Social Exclusion

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South Africa is a country of contrasts, highly stratified and unequal, and train systems both contribute to and are structured by this. Between 2010 and 2012, South Africa introduced its first modern mass rapid transit railway system, Gautrain, opening the door to sustainable mobility with its reduced carbon footprint, high commuter load, and excellent safety record. This is juxtaposed with the 'schizophrenic path' (Banister, 2005) of the established Metrorail commuter rail system, which is described as dilapidated and dysfunctional. The two rail systems occupy opposing points in the sustainable mobility debate, unsustainability *versus* sustainability. Since public opinion and acceptance play an important role in realizing the future of sustainable mobility, we examine the imaginary of the train by systematically analyzing its media representations in order to understand how the future of train travel and mobility, particularly in relation to access, is portrayed in contemporary South Africa. Two hundred articles, published in 2012, were selected for analyses from various regional and national English-language newspapers. Using Content Configuration Analysis, we examined the imaginaries of these train systems along their conceptual dimensions. We found little overlap between the imaginaries of the train systems in the media, and each is governed by its own interpretations, expectations, and appropriations. Gautrain, regularly lauded as the future of train mobility in South Africa, is explicitly presented as transforming the modes and access of mobility for its commuters, as well as, implicitly, entrenching the widening socio-cultural, economic, and political gaps between rich and poor, thus, excluding the vast majority of South Africans from future opportunities associated with modern mobility. These findings illustrate the complexity of the sustainable mobility debate for countries which lack the existing infrastructure and economic power to make lasting investments and, drawing from narratives on science, technology, progress, and development mostly associated with developed countries, do so at the expense of the poor and marginalized majority.

A Study of Students' Ecological Footprint and Whether Students Adopt More Sustainable Lifestyles by their Chosen Subject at Architecture School in the Chinese University of Hong Kong

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To deliver sustainability goal of building design, achieving more sustainable human behavior is fundamental. Applying sustainable development ideology in higher education for planners and architects can provide guiding philosophy for building design. It is remarkable to consider how the university courses will affect students' lifestyles that could help to examine the sustainability performance of individual student from each degree program and raise the awareness of sustainability. This research project is concerned with the consumption activities of students who study at Architecture School in The Chinese University of Hong Kong and whether they adopt more sustainable behavior as a result of undertake their chosen degree. The focus group of people of the topic is master students from Architecture School at The Chinese University of Hong Kong who are about to graduate and start their career of architecture or urban planning. The performance of the particular group of people will indirectly affect the development of the construction industry, and even shape the future of urbanization and regeneration of the city. There still needs architect and urban planner who have the knowledge and awareness of sustainability that to create a city which is suitable for living with lighter footprint. It is extremely attractive to consider the importance of the environmental sustainability of students' lifestyles now and in the future. Ecological Footprint (EF) calculator has been used to measure the results of students' EF and conducting interview with course directors in order to identify how environmental sustainability has been incorporated into the design of courses. The EF results for each postgraduate degree are similar with an overall result of 5.506 gha/cap. Domination components of EF were home, spending on goods, and food that counted slightly 70% of the total EF that is similar to existing studies. However as different from those studies the focus on research questions also about the results present by students in different programs, different gender and different background. Whether the EF analysis is important to promote awareness about during students' university study and change their lifestyles towards sustainability, it depends on the desire of students, their chosen degree course, university policy and also external environment. School offering courses have relationship with environmental sustainability that is in a key position to identify and address sustainability issues with a goal of reducing EF by higher education. For this research topic, the most crucial issue is to define a specific ecological footprint calculator especially

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for Hong Kong, or even better particularly for students or universities to ensure the reliability and credibility of data collecting during research. However, there are a variety of challenges and opportunities for the students, schools and universities to move towards sustainability and aim at a more sustainable future.

A Workplace Education Project to Promote Healthy and Sustainable Food Consumption. Barilla's "Sì.Mediterraneo" Project

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As part of its business strategy "Good for You, Good for the Planet", which the Barilla Group has promoted since 2011 with its educational project "Sì.Mediterraneo", it has a twofold purpose of improving Barilla employees' well-being and increasing their awareness of the environmental impacts of their food consumption. This paper will present and discuss some of the most interesting results of the research that have been carried out on the impacts of the experiment. The initiative began in 2011 in the two company cafeterias at the Barilla Group headquarters in Pedrignano (Parma), and in 2013 it became a global commitment of the Group. The scientific basis, on which the project relies, is the Double Pyramid model promoted by the Barilla Center for Food and Nutrition. The Double Pyramid shows that food products whose consumption should be limited have a high environmental impact, while food products whose consumption is recommended to be more frequent are also those associated with low environmental impact. Canteen menus were modified to be sustainable from an environmental perspective and balanced from a nutritional point of view. Carbon, Water and Ecological Footprint have been used to assess and communicate the environmental impact of the menus proposed. The canteen spaces were adorned with posters and other notices, to provide information on the nutritional value of the Mediterranean Model and the environmental impacts of different food choices. Results show that nutritional messages do have a significant influence on employees' eating choices. From an environmental point of view, the activity led to significant reduction of greenhouse gases emissions, water use and land ecosystem use. In the Pedrignano canteen alone, the project has achieved savings of 65 kg of CO₂-eq every day, as well as 40 m³ of water and 1000 m² of Ecological Footprint per day.

Market-Based Solutions to Seafood Sustainable Consumption

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Around the world, more than 350 million people rely on fishing for their livelihoods and one billion depend on seafood as their main source of protein. A sustainable approach to fishing is therefore required to safeguard seafood stocks for future generations. A number of market-based tools have been developed as a means of leveraging purchasing behavior to incentivize the sustainable use of marine resources and to reduce the impacts fishing has on the marine environment. Of these, the use of certification and ecolabeling has been the fastest-growing and most popular market-based instrument for ecological stewardship. The Marine Stewardship Council (MSC) is the world's leading certification and ecolabeling program for sustainable seafood. The MSC has developed a scientifically-robust standard against which fisheries can be assessed in order to demonstrate that they operate sustainably with low environmental impacts. Certification can help fisheries access new markets, while the presence of ecolabels on certified products allows seafood consumers to make informed sustainability choices. Here, we present an overview of the role for market-based solutions in shaping sustainable seafood consumption. We outline the characteristics of the MSC's ecolabeling program and show that demand for ecolabeled seafood products is high in OECD countries: 9 out of 10 seafood consumers believe that ocean sustainability is important and 41% actively look for fish from a sustainable source. On average, there has been an 11% increase in seafood consumers purchasing products carrying the MSC ecolabel since 2010. We also present examples of fisheries that have made environmental improvements to their practices as a result of MSC certification. Such improvements include measures to reduce unwanted bycatch of endangered species and restore habitat, demonstrating how fisheries certification can contribute to meeting the UN Sustainable Development Goal for marine conservation.

The Double Pyramid of the Barilla Center for Food and Nutrition: A Tool for Informing Consumer Choice and Promoting Sustainable Food Consumption

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It is well known that our daily food choices significantly affect, not only our personal well-being, but also the environment. Food production is very intensive in terms of land and water resources, and greenhouse gases emissions. Starting from this premise, in 2010, the Barilla Center for Food and Nutrition devised the Double Pyramid, a graphic framework aimed at relating the environmental and nutritional impacts of food consumption in order to increase people's awareness on these issues. This paper will present the scientific underpinnings of the Double Pyramid, as well as its usefulness as a framework for appraising and comparing the impacts of different consumption patterns. The Double Pyramid consists of two frameworks, outlining the relationship between food products and nutritional value according to the principles of the Mediterranean diet (Food Pyramid), and food products and environmental impacts in terms of water, land, and CO₂ intensity (Environmental Pyramid). The Double Pyramid shows a strong correlation between healthy and environmentally-friendly products. Food products, of which consumption is recommended to be more frequent, such as fruit, vegetables, and cereals, are also those associated with a low environmental impact. The concept has been tested by assessing the environmental impact of two different menus, with a similar macronutrient profile, but different quantity and quality of animal products. The results suggest that a diet based on the principles of the Double Pyramid generates lower environmental impacts than a diet relying mainly on a daily intake of meat. Thanks to its communicative efficacy, the Double Pyramid is certainly a valuable tool for helping consumers decide what to eat on a daily basis in order to adopt a sustainable diet. This paper will also provide an estimation of the impact generated by the use of the Double Pyramid model on consumption patterns of the general population.

Urban Sustainability: Plantain (*Musa* spp., AAB genome) Cultivar Preference, Local Processing Techniques and Consumption Patterns of Plantain Based Foods Mostly Consumed in Urban Area of Abidjan, Côte d'Ivoire

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In Côte d'Ivoire, the shortage of a reliable database on the population eating habits sometimes makes the implementation of sustainable food safety policy difficult. Thus, this survey aimed at identifying plantain consumption patterns based on the most preferred plantain cultivars purchased according to their maturity and processing techniques in the urban area of Abidjan, Côte d'Ivoire. A Focus Group was formed to assess the availability of plantain on markets and data mining techniques have been used for the evaluation of data collected from household interviews. Data showed that only four cultivars of plantain, locally named *Kpatregnon*, *Ameletiha*, *Agnrin* and *Afoto*, are available on the markets of Abidjan. Quantity-wise, *Afoto* cultivar is the most widely available. The *Ameletiha* variety at the following maturity stages: full yellow with black spots (stage 7); and half green, half yellow (stage 3) are the most preferred by consumers. Further, the physical parameters, such as the shape of the fingers, the size of fingers and the aspect of plantain fingers are not relevant to consumer's choice. It also appears that the *Agnrin* variety at the full yellow stage (stage 6) and full yellow with black spots (stage 7) is the most used for *aloko*. As for the *Afoto* variety, the light green stage of maturity (stage 2) is the most used to make roasted plantain (*banane braisée*). The *Ameletiha* variety—at the green maturity stage (stage 1) and all black (stage 8)—is the most used to do chips and *doclou*, respectively. *Ameletiha* and *Agnrin* varieties—at the stage of maturity half green, half yellow (stage 3) and more yellow than green (stage 4)—are both appreciated for *futu* (pounded banana). *Ameletiha* variety at the maturity stage 8 (all black) is preferred for *klaclo*. According to variety and maturity, plantain is used in several food preparations of which 11 are preferred by consumers in the Abidjan area.

Stream 5:
Sustainability in Economics, Business,
and Management

Cartographic Standard Accuracy Analysis of Digital Models from UAV Images

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The advances of new technologies in embedded platforms are inspiring the development of new mapping techniques. For example, UAV's have been used in small-scale surveys for environmental assessment purposes. The main advantage of UAV-generated images, compared with satellite images, is the higher resolution of the images produced. However, evaluation studies concerning the accuracy of metric images and 3D models generated by UAV sensors have been neglected. This study aims to evaluate the Cartographic Standard Accuracy (PEC) of products provided by this photogrammetric technique. We have performed experimental tests at the Vale do Rio dos Sinos University in São Leopoldo, Rio Grande do Sul state, with data collected in flights employing a SenseFly UAV equipped with a Canon IXUS 125HS camera. To cover the whole study area, 11 flight tracks were necessary; there are a total of 191 photographs. In the study area were deployed ground control points, which were suitably marked for georeference and orthophoto creation. The geodetic coordinates of the control points were determined with the use of GNSS receivers and the geodetic network was adjusted by the least squares method. From the 19 vertices of the network, 14 were used for georeferencing, orthophoto creation, and 3D models, and to study the Map Accuracy Standards. We conclude, by analyzing the PEC; both generated orthophotos and the 3D model can be used in environmental studies with a couple of advantages, relative to other mapping techniques. The primary advantages are reductions in the mapping time and the obtaining of higher geometrical resolution, high detail levels, and 3D models with dense point clouds.

Future Logistics System Based on Using Mobile Robots

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With the aggravation of an ageing population and the increasing cost of labor, labor-intensive logistics system will not meet sustainable development requirements. The world's major e-commerce and logistics companies (such as Amazon, Alibaba, DHL, and S.F. Express) are testing the use of mobile robots, such as UAVs (Unmanned Aerial Vehicles) or UGVs (Unmanned Ground Vehicles), to perform tasks, for example, cargo handling and express transportation. However, thus far, these companies have utilized such technology on a small scale. The logistics system based on using mobile robots at the large scale has not yet been established. In order for the logistics industry to develop sustainably, and to overcome problems like staff shortages, this paper demonstrates how future logistics system can use mobile robots at the large scale. Future logistics systems will merge mobile robots, warehouses, automatic receiving stations built in residential areas, and information interactive systems. Three main chapters in this paper describe the future of logistics system. They are logistics system architecture, mobile robots, warehouses and automatic receiving stations. The chapter on logistics system architecture describes the basic functions of warehouses, mobile robots, and automatic receiving stations, and the interactive relationship between them. The relationship between UAVs and UGVs, and how tasks are assigned or combined are also described. The chapter on warehouses and automatic receiving stations describes the requirements and the approach to realizing the construction of information systems in warehouses and automatic receiving stations, including the functions of auto-tagging, automatic sorting, and automatic reception of a parcel. The chapter on mobile robots describes the required functions of mobile robots and the approach to realizing these functions, including dynamic path planning based on variable destinations and traffic flow forecasts, mobile functionality with night vision capability, and delivery capability based on using mechanical arms. Finally, the application value and the major R&D direction of future logistics system based on using mobile robots are summarized.

Big Data in Sustainable Energy

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The energy industry is undergoing transformation from fossil fuel based to renewable energy. The rate of this transformation varies across different countries. It is obvious that the fossil fuel energy generation will be used for decades due to growing energy needs and the lagging rate of deployment of sustainable energy. All types of energy generation offer large volumes of data that can be used to make positive contributions to sustainability. Examples of big data approaches for improvement of efficiency of energy generation and reduction of energy consumption are presented. Example 1: Wind turbines produce energy, however, energy is needed to produce and assemble them, as well as power the electronics. Wind turbine life-cycle and operational data captured in the SCADA (Supervisory Control and Data Analysis) systems can be used to reduce their energy footprint. Various sources of energy savings are identified, beginning with the turbine design choices impacting materials, supply chain, and methods of its assembly and ending up with its life-cycle energy friendliness. Wind turbines that fail require costly and energy intensive repairs. Design decisions that failed to consider the end-of-the-life turbine will adversely impact sustainability. Example 2: HVACs (Heating Ventilation and Air Conditioning) systems fall into the energy consuming devices category. Similar to wind turbines, operational data from HVAC systems is stored in SCADA-type systems, usually called data historians. The stored data can be used to model HVAC systems. Optimization of HVAC models leads to meaningful reduction of energy consumption without impacting the in-door air comfort. Example 3: Wastewater processing constitutes a large-scale industry that seldom gets attention. Similar to HVAC systems, wastewater processing plants consume vast amounts of energy, yet, at the same time may produce energy, usually methane gas. The number data points recorded at a modern wastewater processing plants could be measured in their thousands. Such data can be utilized to reduce energy consumption and increase energy production of methane gas.

Quantification of the Water–Food–Energy Nexus as a Guiding Instrument for Enhanced Energy Production and Sustainability

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The increase in energy demand due to the growing population and access to new technology, together with the more restrictive requirements in terms of pollutants and CO₂ emissions, are raising pressure on Earth's natural resources. The concept of sustainability, introduced in 1987 by Brundtland, is under deep revision, due to the fact that technical sectors once perceived as completely separate are now understood to be deeply connected. It follows that an increased use of natural resources in one sector of production can strongly penalize other production systems. This is the case with energy and food. The production of energy from biomasses and, in particular, from biofuels can shift the use of natural resources (*i.e.*, water) from food to energy production. In this context, water is a key factor. Good management of water is essential, because misuse of that can be detrimental for the future supply of food and energy.

To address the production of both energy and food, especially in a country where competition for natural resources can arise, a simple tool to quantify the water–food–energy nexus was developed. By using this tool it is possible to study specific cases where water availability and/or food security can be a constraint in energy production from biomass. The analysis of the bioenergy production based on the water–food–energy nexus perspective allows to select the better bioenergy crop for the specifically analyzed situation. The results of the nexus analysis are useful not only to address the first generation of biofuel production, but also to evaluate new technologies already in the design phase, in order to increase energy recovery. It is also possible, on a country basis, to identify the critical points in first generation biofuel production and to use the tool as a guiding instrument for selecting the most sustainable cultivations for energy and food production. In addition to this, an integrated approach with second generation biofuel production is provided. Thanks to this, it is possible to evaluate the increase in both productions and to understand if new technology can really solve the existent problems, or if they just move the problems from one side to the other of the nexus.

Sustainable Machining of AISI 1045 Steel Using the Response Surface Methodology in Order to Achieve Minimum Energy Consumption and Maximize Surface Quality

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Nowadays, modern production is faced with the challenge of reducing the environmental impacts related to machining processes. Machine tools consume large amounts of electrical power. Additionally, the amount of carbon dioxide emitted in producing the electrical energy required for the machine tools contributes to global warming. The growing demand to reduce environmental impacts has encouraged manufacturers to pursue various green manufacturing technologies and strategies. Cutting parameters have been optimized to minimize cutting power, power consumed, or cutting energy. However, these response variables do not consider the energy demand that ensures the readiness of the machine tool. The present paper outlines an experimental study to optimize cutting parameters during turning of AISI 1045 steel, in order to minimize the energy consumption and the surface roughness of the work piece. Dry machining was employed to diminish the environmental impacts generated during the usage of coolant. The Response Surface Method was used to obtain the regression model for the variables being studied. The desirability method was employed to define the values of the variables that achieved a minimum quantity of electrical energy consumed and minimum surface roughness while the material removal rate was maximized. According to the results obtained, it is possible to reduce the environmental impacts from the machining process by reducing the energy consumption of the machine tool and to get a lower cost per part when the optimum cutting parameters are employed.

The Production of NPK Fertilizer: The Choice of the Less Polluting Process

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Phosphorus is an element that is widely distributed in nature and occurs, together with nitrogen and potassium, as a primary constituent of plant and animal life. Phosphorus has a series of functions in plant metabolism and is one of the essential nutrients required for plant growth and development. Phosphorus, in the form of phosphate, is a non-renewable resource. It cannot be artificially produced. It is well known that fertilizers enhance the growth of plants and that phosphate rock is the raw material used in the manufacture of most commercial phosphate fertilizers. Phosphate rocks can be decomposed by acids in manufacturing units into phosphate fertilizers using different processes.

Generally, chemical fertilizers are produced with complex compounds, such as the following: Sulfuric acid–Phosphoric acid–NPK–Ammonia–Nitric acid–Ammonium Nitrate.

Almost all of the aforementioned compounds are involved in manufacturing processes that discharge into the environment various effluents (gases, liquids, and solids) that are often harmful to health and the environment in general. It is, therefore, important to identify the pollutants generated by this industry, to study their impact on the environment, and propose processes that are "clean" and environmentally friendly.

The manufacture of NPK fertilizer can be done in two ways: The dissolution of phosphate rock with sulfuric acid; and the dissolution of phosphate rock with nitric acid.

Each of these processes has advantages and disadvantages. In the present work, two processes are compared from an environmental perspective. This comparison will enable investors to choose the method that is least harmful to the environment. To do this, all possibilities were explored for recycling effluent by processes that are currently available. We found that the second method (*i.e.*, the nitrophosphate process) is less polluting than the process involving sulfuric attack. This process enables the production of phosphate and nitrogen fertilizers, while using all the nutrient components in an integrated process without producing solid wastes, and with minimal gaseous and liquid emissions.

The Means of Implementation for Sustainable Development Goals: Reversing Thinking from Means for Goals to Goals as Means

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Ensuring sufficient and effective means of implementation (MOI) is a key but contentious aspect of the Sustainable Development Goals (SDGs). There is a sharp North-South division, and many governments view MOI as a competitive struggle over how much money and technology developed countries should provide to developing countries. Despite this, past sustainable development agreements have defined MOI much more broadly. Agenda 21 includes science, education, public awareness, information, and institutions. The latest negotiating document for the July 2015 FfD3 in Addis Ababa adds data and information, enabling laws and policies, institutional measures, and trade. The document also expands the emphasis on capacity building, while highlighting ways of increasing domestic sources of financing, such as stronger taxation systems, before discussing ODA. This paper tries to explain why many governments are not persuaded by this broad vision and may not implement it, even if they sign it, and seeks to develop more persuasive reasoning. Simply spending more money will not be enough to achieve the SDGs. In particular, greater emphases on governance and institutional development is necessary to enhance the effectiveness of capacity building and money spending. This paper argues that many current goal areas themselves can be considered as MOI, either as resources or enabling factors. A greater focus on the interlinkages and synergies among goals can further enhance the effectiveness of implementation without requiring significant additional financing. However, this approach would need more institutional innovation, governance, and various kinds of human capacity. This paper illustrates the conceptual and practical linkages among the goals, showing that goals themselves are MOI, and that SDGs need to be implemented as a mutually supporting package. Interlinkages among goals may be obvious, but have been lost within the SDG framework's "list" approach, which may have led governments to cherry-pick some goals and targets while neglecting others. Such cherry-picking would unnecessarily increase costs and reduce effectiveness, including for the various governments' preferred areas. Viewing the goals as means can incentivize all stakeholders to see a more integrated nexus perspective and cooperate more.

Comparative Testing for Corporate Impact Assessment Tools: Results from Case Studies in the Global Value Project

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Environmental and social pressures have increased substantially over the few last decades, and have been accompanied by growing political pressure (*e.g.*, mandatory economic, environmental, social, and governance reporting) and respective societal demands (*e.g.*, critical media reports). Companies are increasingly challenged to be ready to respond to these demands.

This paper critically examines the following question: To what extent do the measurement tools currently available, in practice and in literature, effectively measure companies' impact on sustainable development goals (SDGs)? The focus issues of our study are: poverty, water and sanitation, education, food and agriculture, climate change, and human rights in three industries, namely: footwear, coffee, and paper and pulp. The paper develops a protocol for the selection and quantification of indicators that can be used in selecting the appropriate tools for measuring impacts in the selected sectors on SDGs.

Background: In the Global Value Project, a long list of indicators was compiled covering the main thematic areas and challenges of sustainability. In a second step, this long list was reduced using predefined criteria as well as other criteria, such as the feasibility and scalability of different tools. As a result, a protocol was developed to help compare the different tools that measure corporate impact and to interpret the results in relation to the SDGs. The protocol was pre-tested with a limited number of tools in two case studies that compared the impacts of two multinational companies operating in developing countries. Data collection was based on desk research, and expert opinion.

The paper concludes with reflections on the applicability and usefulness of the investigated tools that measure corporate impact. The study aims to help companies apply the most appropriate tool for measuring their impact and to enable these companies to easily compare the available tools. The study also endeavors to contribute to a better understanding of the practical challenges users of such tools face.

A Critical Review of 200 Tools for Corporate Impact Assessment and Management

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In order to provide their products and services, Multinational Corporations (MNCs) maintain relations with suppliers and customers in broad variety of countries. Due to the difficulties in observing the various possible impacts on sustainability issues, several organizations, such as university institutes, consultancies, Non-Governmental Organizations (NGOs), multilateral donors or public offices, offer tools, guidelines or methods for supporting MNCs by this task. For the first time, a comprehensive stocktaking and review of these tools have been carried out in the context of the EU-funded GLOBAL VALUE project. The stocktaking compiled around 200 existing tools for corporate impact measurement and management across all dimensions of sustainable development and covering a broad variety of impact areas pertinent in the context of the upcoming Sustainable Development Goals.

The paper gives an overview of this process, the experts involved, and the types of tools compiled in the stocktaking database, including their most important features. In addition, the results of the stocktaking were analyzed in an empirically grounded, iterative, qualitative clustering process, which provides additional insights for an emerging typology of available tools and methods.

The database, including the results of the clustering exercise, is the basis of a tool navigator currently being developed in the course of the project, and contributes to providing orientation among the plethora of available tools for corporate impact measurement and management to Multinational Corporations operating in or sourcing from countries in the Global South. Furthermore, this stocktaking of tools provides an entry point to identify blanks and weak points in these offers. The presentation will give an overview on the state of the art and critically discuss the tools currently available for assessing corporate impacts on development, especially those geared at application in countries in the Global South.

Corporate Accountability and the Transparency of Impact on Development within the Panel Managing Business and Its Influence on Sustainable Development—Corporate Responsibility and the SDGs

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Multinational corporations (MNCs) are pressured to set sustainability goals and report on their fulfilment. The issues that fall under the umbrella of social responsibility of a corporation should be intrinsically linked to the given company's values and objectives. Therefore there is no blueprint about what actions to take and, consequently, there is no regulation on the topics, content, structure, extent and depth of such reports. The international guidelines available for specific issues provide an orientation. but leave wide room for the company's discretion.

The lack of a standardized framework for corporate reporting, results in the fact that negative events rarely appear in the reports because sustainability reports are used as tools to improve the company's brand. However, the lack of completeness of the reports underlines their credibility and hinders the objective measurement of impact of sustainability actions of MNCs. MNCs publish sustainability reports on their websites which makes them easily searchable for research purposes. MNCs with a less open communication culture might not provide much information on the internet, yet their actions might be relevant from a sustainability point of view. Research on the impact of sustainability measures purely based on web sources runs the risk of being incomplete and biased.

Several international initiatives exist to harmonize the reporting standards of MNCs. These attempts are based on the logic of collective action that engages all stakeholders and requires a basic level of trust. The principles of balance, completeness and transparency are frequently not met in sustainability reports, which results in difficulties in measuring the impact of such actions. Once the credibility of the content of sustainability reports is questioned, it has a deteriorating effect not just on the company but also on trust between the members of the collective action. The paper explores the consequences of this transparency gap in sustainability reporting.

The paper will provide a critical approach about the impact of sustainability reporting on development within the panel '*Managing business impacts on sustainable development—corporate responsibility and the SDGs*'.

Grand Challenges in Measuring and Managing Business Impacts on Development

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Through impact assessment and a strategic sensitivity to global sustainable development challenges, business activities may contribute to social value creation by enhancing positive impacts (e.g., poverty alleviation, livelihoods, health, and education) and reducing negative ones (e.g., resource consumption, pollution, human rights violations) across bottom lines. However, effectively measuring and managing business impacts on development is no easy task. Socio-ecological effects of business activities materialize along complex pathways spanning global value chains, affect diverse stakeholder groups, and involve trade-offs that can be daunting to deal with. Currently, corporate practice in impact measurement and management is most established in the area of sustainability reporting. The paper compares and contrasts current best practice in sustainability reporting, as exemplified by the Global Reporting Initiative's G4 Guidelines, with advanced best practice for impact measurement in adjacent fields of application, namely:

- Programme and project evaluation, as regularly carried out by development agencies and civil society organisations
- Results-measurement in development partnerships
- Impact assessments of policies and programmes

We posit that in these communities, where accountability for impact is traditionally well-established and part of the organisational mandate, impact measurement and management is much more mature. Nevertheless, impact measurement, as applied in the development, policy, and business communities, needs to deal with a common set of challenges related to normative groundwork (e.g., determining the sphere of responsibility, scoping), ontology and methods (e.g., determining causal relationships, metrics, and data availability), and sense-making in management (e.g., valuation, weighting, and aggregation of impacts across issue areas).

By comparing best practice in business with standards applied in the development community along a set of overarching challenges, we explore the space for business to learn from more mature fields of application and provide an outlook of where corporate impact measurement and management will likely need to evolve in order to satisfy increasing demands for accountability for impact from the international community, stakeholders, investors and policy makers in the context of the Sustainable Development Goals.

Systems of Governance in a Developing Country Context: Co-Governance, Complementarity and Competitiveness

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A system of governance is issue specific and defines and implements a set of global rules (Scherer and Palazzo, 2001). These systems can consist of a set of rules, norms, tools, and instruments to bring about changes in behaviour, such as, in this case, sustainable development goals. They can use various different mechanisms of influence, and can be instigated by government, business, or civil society, or a combination of all three. These mechanisms of influence can be markets, hierarchies or networks, and within a system of governance, different configurations and combinations of rules, tools and mechanisms can exist. This results in different processes of co-governance, where public, private and civil society actors aim to solve sustainability problems and create social opportunities through institutions (Kooiman 2000). The question is which configurations are most effective in solving these sustainability issues and in what contexts? This paper assesses three key aspects to answer this question: 1) How does the configuration of a system of governance influence the co-governance process and how does this in turn influence the magnitude of impact on sustainable development goals; 2) How do certain configurations of a system of governance influence the alignment or misalignment of development agencies, civil society and business actors' actions. When alignment occurs, we propose that complementarity exists, which enhances the magnitude of impact from the co-governance process; 3) We assess how the configuration of the system of governance and the resulting co-governance process influences competitiveness of both the corporations and the local economy. Comparative case studies of different issues and systems of governance will be presented.

The Contribution of EU Funded Research to Advancing SDG Themes—Budgets, Gaps, and Future Challenges

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Designing and implementing R&D programmes is a challenging task: while the theory of innovation systems has become more and more complex, policy makers ask for clear evidence-based guidance from the evaluation of impacts on the economy, the environment, and society. When it comes to assessing the contributions of R&D programmes to sustainable development, the fuzziness of interrelated objectives and the complexity of diffusion and dissemination mechanisms have to be considered. Measuring the impacts of R&D programmes by looking at sustainable development indicator sets do not show any effect at all, while scientific output indicators do not allow for monitoring of effects on the economy, the environment, and society. Monitoring the contribution of EU funded research poses an additional challenge: with a total budget of several billion Euro per year, a broad variety of themes, and several thousands of research topics and projects, the EU Framework Programmes are extremely extensive. Therefore, monitoring each research project or new technology is simply not feasible. In order to deal with these challenges we developed and implemented a monitoring system that links policy objectives with research activities and combines a scientific screening by a group of experienced researchers with external expert validation, feeding into an interactive database (www.FP7-4-SD.eu). Although we used the EU Sustainable Development Strategy as a reference framework for setting up the monitoring system, we are also able to use its comprehensive database to analyse the contribution of EU funded research to the upcoming SDG themes. In this presentation we will identify which SDGs have been addressed so far, what budgets have been allocated, which gaps can be found, and which future challenges lay ahead. By doing so, we will identify priorities for Horizon 2020 and derive conclusions for future responsible research for sustainable development.

An Exploratory Study on Sustainability Management Systems: Standards and Corporate Models

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Sustainability management practices have been increasingly implemented by companies during recent years, so as to meet stakeholder concerns, while improving internal efficacies and efficiencies. Since the theorization of Corporate Social Responsibility (CSR), which explains the integration of sustainability goals into business strategy, many tools and standards have been developed. Actually, in literature, many sustainability management tools have been analyzed. Research on the application of these tools to business practices is, however, infrequent. In addition, several companies have implemented and combined several sustainability instruments, so as to design models that are tailor-made to corporate features, and which are in agreement with the specific stakeholder requests.

This paper aims to present the current state of the art of both the research and the corporate practices concerning sustainability management systems. To this end, as a first step, an exploratory study and a literature review has been conducted. Papers, research projects, and other applicative studies, as well as corporate documents on sustainability management systems have been searched for, collected, and then, analyzed. Such contributions have been classified on the basis of the tools used, the level of integration between economic, social, and environmental aspects, and sectors of application. The second step involved a specific focus on models developed by companies; *i.e.*, a case study was carried out. Specifically, the uses of sustainability tools, indicators, and reporting and communication tools, as well as the set-up and implementation phases of these instruments, have been investigated. The results disclose the spread of sustainable management systems, the factors that drive companies to implement these models, and the main differences and gaps that exist, compared with international standards. Such evidence poses some criticalities with regard to the standardization of sustainability management systems, as discussed by the paper, thus further advancing the topic of sustainability management systems, so as to define new practical paths that are able to meet sustainability goals.

Developing a Radical New Model of Sustainability Education in Business School

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Most business schools that attempt to add sustainability to their curriculum do so via a few elective courses or as a specialization stream of a handful of courses. However, such add-on curriculums do not change the core DNA of business programs that are embedded in neo-classical economic paradigm. Students from such programs graduate with an awareness and empathy for the interface between business and environmental and social sustainability, but they are not equipped to become change agents who can transform organizations to can address major global sustainability challenges, such as climate change, clean water, poverty, access to communication, health, *etc.* To achieve meaningful integration requires real work: Extended team building and cross-functional collaboration with faculty learning each other's perspectives, along with the time and resources to engage in real curricular innovation and new case and pedagogical material development. When programs integrate sustainability into the core curriculum, faculty members that normally conduct research and teach only in core functional areas become exposed to possibilities of examining their research and teaching through the lens of sustainability. This could open up avenues of new research ideas, the potential to ask new and interesting research questions, and the potential for collaborations across disciplines. In an attempt to become acceptable for publication in top tier discipline based journals, sustainability research has, over the years, tended to adopt an increasingly narrow functional discipline based approach, with research questions embedded in traditional received theories. Integration offers the exciting potential for exploring beyond these tight research boundaries into questions and realms that provide interesting and radical insights for business that can not only inform the core disciplines but educate students who become entrepreneurs to address sustainability challenges. The paper will present a bold new approach where a major University has fundamentally reinvented business education and the MBA degree to address the challenges we face in the 21st century—environment, ethics, entrepreneurship, poverty, and inequality.

Employee Engagement as a Critical Factor for Achieving Organizational Sustainability

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Organizations need to develop and sustain new human-related capabilities for achieving change towards sustainability. The human element is often a neglected factor in the studies of organizational sustainability, and only recently has it been considered as a critical factor. In practice, human-related factors can act like barriers or slow down the processes for sustainability in organizations. Exploring the resistance factors and understanding communication processes are found to be important for advancement in this area [1]. A 2011 survey found that 82% of employees stated that their employers do not have an official engagement policy on sustainability (Brighter Planet, 2011). Hence, the function of human resource management has key responsibilities in supporting sustainable business organizations [2]. This study aims to explore the employee-engagement processes of three organizations that are working towards achieving organizational sustainability. The setting of the study is Turkey. The perspective of employee engagement suggested by [2] is used in studying the topic. A case study approach is used to detail the human resource management processes behind the change management programs and explore the improvements made in the engagement of employees. The qualitative study uses a series of semi-structured interviews with officials of the case companies. In addition to the interviews, publicly available documents are utilized to supplement the study. The results of the study are expected to provide insights into how organizations tackle the problems of employee engagement in practice and what are the practices that contribute to successful change management programs for achieving organizational sustainability through people. The research is also expected to guide academics and practitioners to evaluate the role of the human resource management department in its increasing role in value creation.

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Empowering the Environmental Manager: Drivers and Obstacles to the Integration of Environmental Aspects into Decision-Making

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The study concerns a new approach to transform environmental information into environmental performance at product and corporate levels by focusing on actors and decision-making pathways in all activities of the company.

Today's environmental or sustainability management systems focus essentially on an environmental impact analysis to collect environmental data which shall be transformed thereafter in environmental action in order to lower environmental impacts of products and companies.

However, the loop from environmental information to "better" products or companies has not shown satisfying results in the past. Action will only be taken when the right people take the right decision, at the right time, based on the right information. In other words, data must be shaped into actionable knowledge and decisions in all activities of the company.

Thus our research focusses on actors and decision-making pathways and investigates what kind of environmental information is necessary, at what moment and for which actor, within an organisation in order to transform environmental information into environmental performance at product and corporate levels.

The study is based on a survey of 10 middle-size to large companies in Switzerland and neighbouring parts of France. At least five people from different departments were interviewed in each company.

The key learning of the research will be presented as follows:

- Scope and maturity of the environmental management in the company.
- Organisation, field of action and perception of the environmental service.
- Key requirements for individuals to take action within the company both in terms of information required, motivation, organisation and strategy.
- Key requirement at the organisational level for the successful integration of environmental performance in overall management.

Criteria for Sustainable Research: A Framework to Conduct Socially Responsible Science

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There is an emerging discussion among scientists and scientific managers about the necessity to consider science as a sustainable research process being part of a general responsibility for the development of the society. So far, research contributes to sustainable development almost solely through their work on particular research topics such as climate change, water management, soil degradation, *etc.* With respect to internal responsibility, science mainly focused on safeguarding good scientific practices such as fairness issues in publication processes and on the proper handling of scientific methods within the research process. However, next to these approaches, a broader reflection on issues of socially responsible research processes is requested, particularly by scientific managers, civil society, business partners and politicians. These requests include, among others, the transparent transfer of scientific knowledge into the society, ethical reasoning, or inter- and transdisciplinary approaches in research. A systematic understanding and categorization about such issues is still missing. Based on the work in the collaborative German research project "Guidelines for Sustainable Research (Leitfaden Nachhaltigkeitsmanagement)" and a thorough literature review we will present 10 preliminary criteria for a socially responsible research process. These criteria include "reflection of impacts", "resource efficiency", "transdisciplinarity/participation", "transparency", "user orientation", "managing complexity and uncertainties", "ethics", "interdisciplinarity", "integrative approaches", and "reflection of applied methods". The 10 criteria interlink with each other and jointly form a conceptual framework enabling researchers and scientific managers to assess their research processes from a perspective of social responsibility. This paper is part of the panel proposal "Responsible Research for Sustainable Development" by Katharina Helming, Aranka Podhora, Rainer Walz and Jürgen Kopfmüller.

Enhancing Social Entrepreneurship through Education

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Social entrepreneurship, in all its variations, offers a model for 21st century business that balances financial, social, cultural, and environmental needs. Social entrepreneurs are agents of change, as individuals and groups who are passionate about improving the lives of people and communities. Social entrepreneurship in Croatia has only recently been recognized as a form of entrepreneurship. The aims of the research are: 1) to analyse the theory and practice of social entrepreneurship in Croatia and selected EU countries; 2) to offer more appropriate and accurate terminology of social entrepreneurship in Croatia; and 3) to create a model of education for social entrepreneurship, based on Triple and Quadruple Helix platform. Education regarding social entrepreneurship could help different stakeholders, disadvantaged and marginalised in the society, to resolve their fundamental problems. Empirical research has been carried out via various focus groups of stakeholders in Croatia. The results confirmed the hypothesis that social entrepreneurship, enhanced through suitable education, could be a source of opportunities for social innovations and sustainability.

Are R&D, Technological Capability and Performance Related? An Empirical Study of the Survival and Sustainability of Virtual Enterprises

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Virtual enterprises or organizations are widely adopted, and are based on IT developments, so as to manage intensive competition. However, previous literature indicated that these organizations are temporary in view of survival and sustainability. This paper intends to understand the contribution of R&D spending and technological capability to the survival and sustainability of virtual enterprises or organizations. Hypotheses about R&D spending, technological capability, and sustainability are formed and tested by empirical data. Five-hundred thirty-two samples of high-tech industries were collected in six cities. Unlike previous studies, this research finds that technological capability does not have a direct influence on survival and sustainability; instead, the influence is indirect. R&D spending and equipment capability have greatly impacted the survival and sustainability of virtual enterprises. The impact and influence of the path of R&D spending and of technological capability on the survival and sustainability of virtual enterprises will be explicated. Data of Chinese firms are collected and tested, so as to deliver scholarly and managerial advice.

Innovative Governance Solutions for Sustainable Business: Collaborative Experiences from the Field

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This presentation bridges the fields of economics, business, and management with that of sustainability through innovative leadership and governance ideas, and is supported by examples from the field.

Discourses on sustainable business increasingly take into account the role of leadership in creating an awareness for business's social and ecological impacts (*i.e.*, their 'footprint'). The need for responsible leadership behaviors and stakeholder engagement practices is stressed, while the overall competitive financial bottom line focus usually remains in place. On the other hand, social initiatives working for sustainability have made considerable progress in developing forms and practices of organization and communication that allow for sustainable outcomes and thereby also create soulful workplaces and meaningful living places. In fact, an increasing number of business innovators has been bridging the two challenges by putting in place 'next generation' leadership, governance cultures, and practices.

This contribution presents a number of experiences from case studies on business and social innovators as well as results from years of empirical studies in *intentional communities*, which share certain elements, assumptions, and forms of organization that transcend the 'conventional wisdom' of governance through more collaborative approaches. We analyze the principles and practices of leadership and governance that all of these innovators have in common, and which have successfully been used to create win-win-win solutions. As a key feature of 'next generation' governance, these innovators create dynamic environments that are able to: (1) flexibly deal with complex adaptive challenges on a daily basis and (2) at the same time, offer more holistic working and living environments.

This presentation also shows how the aforesaid experiences can be transferred to other contexts. A stakeholder engagement process called the '*Collaboratory*' combines the essence of those governance innovations. This process has been successfully used in various European countries for joining forces to address burning topics and co-create sustainable solutions based on collective intelligence.

Professionalizing Sustainability Management in Corporations

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Studies have shown that corporations exhibiting high levels of sustainability are more successful than their peers [1]. However, many organizations struggle to effectively integrate sustainability into their core business processes and corporate culture. The topic «Performance Management» is of utmost importance in this context since it enables a systematic and long-term realization of «sustainability».

The authors identify two prototypes of sustainable companies: Those which follow a systematic approach to implement sustainability in their organization, and those who do it intuitively. In both cases, companies face obstacles and difficulties which can be overcome by integrating both approaches, equaling out weaknesses and taking advantage of each other's strengths in the process.

Companies with a systematic approach are often characterized by extensive structures, clear responsibilities and a high degree of transparency within their sustainability activities. Organizations following an intuitive approach usually have managed to make sustainability a natural part of their corporate culture.

The authors present an integrated model of « Sustainability Performance Management » (SPM) which allows a flexible adaptation according to the maturity degree and challenges of a corporation. The approach can be sub-divided into four modules:

1. Sustainability Roadmap: Contains the sustainability strategy and the planning of its implementation
2. Sustainability Enabling: Contains all elements of cultural, structural and business process development
3. Sustainability Monitoring: Contains key performance indicators (KPIs) and management reporting
4. Sustainability Valuation: Contains approaches to determine the value of sustainability-related activities

The model of Sustainability Performance Management contains a detailed methodology to integrate strategy and sustainability management which will be presented by the authors. The approach will be illustrated by several real case studies which have been developed in the context of an applied research project by FHS St.Gallen and Detecon (Schweiz) AG.

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Sustainable Innovation and Open Innovation Processes in SMEs

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Climate change, energy, and resource issues, as well as the impact of pollution on health, social security, and economic activity, will inevitably lead to changes in the business environment, relative costs, and competitive advantage. Porter and Kramer (2006, 2011) stress that CSR can be a source of opportunity, innovation, and competitive advantage, and emphasize the need to place sustainability at the core of a company's value creation activities and, thus, pursue initiatives which will benefit society and, at the same time, strengthen a company's competitiveness. However, to date, little is known about how innovation management can support CSR initiatives in business practice. In their concept of sustainability-oriented innovation, Hansen and Grosse-Dunker (2012) highlight that sustainable development can be advanced through the diffusion of more sustainable product and service offerings by transcending from a narrow focus on the direct customer value to an emphasis on a product's entire physical life-cycle. Sustainability orientation, however, also extends to process and organizational innovations. Current and future challenges that ought to be addressed include radical innovation, the concept of open innovation as well as sustainable entrepreneurship. Research findings highlight that SMEs' sustainable innovations are mainly driven by values. These values held by management influence the direction and the outcomes of the innovation process. Values deeply strengthen small- and medium-sized enterprises and their innovative power. Companies are aware of their substantial social responsibility and the impact of acting sustainably and highlight the importance of communication and raising awareness. CSR activities, however, need to be anchored to the overall business strategy. SMEs conducting business in a socially and environmentally responsible manner also stress the significance of using local networks as a means to exchange experiences and information on best practices and cite benefits, such as operational cost savings, partnership opportunities, along with a better approach to emerging consumer concerns.

Sustainable Innovations: Drivers and Markets

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Are income growth and environmental impacts compatible? It is underpinned how innovations generate income and reduce environmental impacts given demands for environmental qualities. The discussion starts with the IPAT model. Empirical tests of the model indicate a decoupling of environmental impacts and income growth throughout the last century. In nearly all high income countries the national income and private consumption have grown along with slower increase of environmental impacts and in several countries with a decrease of the impacts. This cannot fully be explained by higher international resource prices, outsourcing of the high impacts activities to the low income countries and countries policies. Production structure changes fast toward services but the share of services in consumption increases slowly. The observed relative and absolute decoupling are explained by innovations, which involve circulation of innovation-rents. The resource-reducing, cost-saving process innovations reduce environmental impacts and generate innovation-rents that are allocated in labour for the value adding product innovations entailing income growth. The innovation-rents approximate 13% of the global GDP, which is sufficiently large to explain this process. The decoupling evolves autonomously albeit slowly. How can sustainable innovations be enhanced? Opportunities and impediments for sustainable innovations are underpinned. The opportunities are due to private and social demands for environmental qualities. The demands increase because the growing knowledge work and leisure time need high natural and cultural qualities to perform. The traditional demands refer to resources use and pollution controls. The emerging demands address attributes of environmental qualities in man-made products. These natural blends cover ethical purchases, ecosystem services and cultural expressions. These demands create markets for sustainable innovations. The global markets of sustainable innovations approach USD 2.98 trillion, *i.e.* 4.6% of the global GDP. The impediments refer to policy support of the vested interests rival to sustainable innovators. The tax exemptions and subsidies for fossil fuels, environmentally harmful agricultural practices, unnecessary infrastructure and concessions for resource extraction are estimated to be about USD 2.75 trillion. Such policies impede shifts to sustainable development.

Patterns of Multidimensional Sustainability in a Global Perspective

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The transition towards a sustainable society requires knowledge about how prosperity can be achieved in the absence of economic growth. While a certain material living standard is an absolute requirement for prosperity, recent research has shown that additional prosperity does not correlate with continuing economic growth. Aiming at identifying the socio-ecological patterns of prosperity without growth in a global perspective, we present a theoretical concept of, and comparative empirical data on, prosperity. We analyze macro-structural data from 130 countries, from all parts of the world. As we understand that prosperity evolves from the interplay of three dimensions of sustainability, we study the following dimensions and indicators: the *social* dimension of prosperity includes indicators for equality, cohesion and political participation; the *individual* dimension considers both objective and subjective quality of life indicators; and the *ecological* dimension measures indicators on climate change and environmental impact. In addition, we group countries into four groups according to their stage of economic development. Then, we compare these four groups with respect to their performance on the three dimensions of sustainability. Finally, we apply an innovative method, dual multiple factor analysis, in order to discover how the different sustainability patterns created by the three dimensions and their respective indicators evolve and transform themselves through the four stages of economic development. Results show that there are substantial differences between the four groups, for example, the positive correlation between quality of life and ecological damages is much higher in rich than in poor countries. On the other hand, possibilities to decouple CO₂ emissions from the quality of life increase during the course of economic development. We enrich our analyses with visualizations and charts, showing the countries' positions in the multidimensional space of sustainability and tracking the changes in sustainability patterns.

The End of Intensive Economic Growth: Models, Signs and Policy Implications

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We investigate the possibility that early capitalist economies—those that industrialized first, and indeed the whole OECD group—may be reaching a natural growth plateau, in a manner that is similar to other complex systems in nature. Based on general developmental stages for dissipative systems, we identify likely variables that would mark the transition to maturity: p.c. energy consumption, GDP and energy consumption distribution, sector composition of labor and GDP, size and duration and distribution of recessions, and income inequality. Empirical findings suggest that observed groups of capitalist countries may have terminated their historic phase of intensive economic growth and are entering the mature stage. When we look at fossil fuels, most of the accessible gradients with the highest Energy Return on Investment (EROI) have been already used during the growth stage. We count decreasing EROI as additional evidence that capitalism is entering the mature stage.

In the systemic model of autocatalytic economic growth, we identify a set of four endogenous and two exogenous variables that provide negative feedbacks, which account for changes in the slope of the developmental curve. The paper also proposes a tentative explanation of the slowing down of long-run rates of GDP growth in G7 economies.

The conjecture that the observed groups of capitalist countries may have terminated their historic phase of intensive economic growth and are entering the mature stage is intriguing for several reasons. If true, this conjecture points to the uselessness of pursuing any kind of active growth policies in these mature, capitalist countries. Forcing economic growth and, consequently, extending the exploitation of fossil fuels into unconventional oil and gas reserves will only postpone the problem for a few decades and create multiple adverse environmental and climate consequences. Instead, a more reasonable political agenda would be to devise "post growth" institutional solutions to help work our way through the maturity stage.

Redefining the Energy-Growth Nexus with an Index for Sustainable Economic Welfare

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The paper inaugurates the study of the energy-sustainable welfare index for Europe, and estimates the relevant long- and short-term causalities. The paper is novel in that it inaugurates a new sub-field of energy economics research in the traditional energy-growth nexus, and also in that it calculates an ISEW index for a sample of European countries. We have estimated two long run and short run relationships between GDP/capita, ISEW/capita as dependent variables. Interesting differences arise with respect to the elasticities of energy consumption, capital, exports, labor, renewable energy, and inflation. Moreover, the paper aims at reformulating the four classical hypotheses: feedback, neutrality, conservation, and growth.

The Basic, the Solid and the Subjective Index of Sustainable Economic Welfare (ISEW) for Turkey

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The Index of Sustainable Economic Welfare (ISEW) has been calculated in various ways for various countries and for various time spans. Based on the degree of objectivity, we separate between the basic, solid and site-specific ISEW, whose sum constitutes the full ISEW. The paper proposes some guidelines for countries and smaller forms of state organization, to apply and re-state their sustainable GDP, thus rendering it a useful figure reported vis-à-vis the established GDP. To demonstrate our theoretical advancement, we use the Turkish economy for an application; Turkey is a dynamic emerging economy due to its rapid GDP increase over the past two decades and the population increase on the one hand; On the other hand it is afflicted by social inequalities and environmental problems that they were to be abated, they would certainly deduct from the increased income

Venture Capital Participation, Post-IPO Performance, and Sustainable Development of Companies Listed in China

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Extensive studies from American and some European stock markets have pointed out that venture capital (VC) has a constructive influence on sustainable developments of their invested companies. Seeking to test the effects of VCs on enterprises' post-IPO performances in China, this paper compares performance relative indicators between VC- and non VC-backed companies listed in China with principal component analysis. Additionally, share price volatility is a most critical external factor to the sustainable development of a listed company. To approve the significance of VC on monitoring harmful volatility of share prices, this paper compares the share price volatility of these two groups of companies with mean variance analysis. At the beginning of empirical study, RBF neural network is employed to ensure the rationality and reliability of financial indicators selection and the classification of VC- and non-VC backed companies. Data of this study were collected from CCER database, including industry category, date of the IPO and top 10 shareholders, daily share prices and fiscal data for acquiring financial indicators of enterprises which have initiated their IPOs between 2008 and 2010. To ensure data integrity, all data have been checked with the information from SSE and SZSE. Based on these data, we designated fiscal data from 2013 financial statements to calculate designed indicators and then evaluate sample companies. These indicators include OROA, OCFROA, Sample_Q, Wealth Relative, and Market Capitalization. For the part of share price volatility study, we employed closing prices from the dates of every sample company's IPO to their 700th trading day continuously. The empirical results indicate that venture capitals in China brought undesirable effects to both operating performance and market performance, but performed well in controlling harmful volatility. Therefore, we believe VC in China has a certain positive external but not internal influence on sustainable development of their invested companies.

Why is the Propensity to Consume of Urban Households in China Consistently Low? A Dynamic Panel Data Approach

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The rapid economic development in China over the past three decades faces many unsustainable problems. One of them is insufficient domestic demand, which reveals itself by the insufficient consumption demand of residents to a large extent. China's economic transition has lasted, and will last, for decades longer, and it is difficult to expand the rural consumer market, thus, it has become an important task for economists to analyze the consumer behavior characteristics of urban residents so as to find a way to increase the urban consumption rate of urban residents. Using household-level data from the China Health and Nutrition Survey for the period of 1989 –2006, this paper explores the misspecification of preferences as a cause of the poor empirical performance of the traditional Life Cycle/Permanent Income model in explaining Chinese urban households' consumption decisions. We estimate how household consumption evolves over time by using an Euler equation approach. The results suggest that both uncertainty and past changes in consumption play an important role in determining current changes in consumption. On one hand, the inter-temporal inseparability of residents' consumption preference, which means the service flow is inter-temporal and continuous, leads to the low propensity of residents to consume. On the other hand, China's urban residents have strong precautionary motivations, that is to say, the uncertainty in income and expenditure expectations result in the consistently low propensity to consume. In order to promote sustainable economic development, it is of strategic significance that the policy makers attach great importance to the habit formation and precautionary motivation in residents' consumption decisions.

Industrial Vulnerability against Climate Change Impacts: An Indicator-Based Analysis for Germany and the Stuttgart Metropolitan Area

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In recent decades, the research on climate change impacts has brought up many implications for decision makers in politics, society and economy. The call for sustainability is getting louder as well as the demands for corporate responsibility. However, modern concepts define sustainability to be more than just resource efficiency. This term also comprises attributes that make a system more resilient. Therefore, referring to climate change, the analysis of vulnerability on a high resolution level is indispensable for identifying and prioritizing actions for mitigation and adaptation in communities and companies. For supporting these activities in the Stuttgart Metropolitan Area in Baden-Wurttemberg (BW), we adapted and applied an indicator-based approach that allows for the assessment of industrial vulnerability in 480 communities. We identified four categories of vulnerability drivers along any prototypical supply chain: personnel, fixed assets, failure of critical infrastructure (e.g. energy, water supply) and supply chain interruptions. For each category we defined a set of indicators that quantifies these dimensions for 16 industries in Germany. The results were applied to the given social, climatic and economic conditions in the area of Stuttgart by combining high-resolution climate projections (A1b scenario) for BW provided by the Institute of Meteorology and Climate Research (IMK-TRO) at the KIT with data on the spatial distribution of industries in the region. For Swabian industry, we conclude that rising temperatures in summer might have the heaviest impact as machine-building and automotive companies highly depend on very well trained staff. Besides these health-related issues, heat waves and warm winters are likely to induce uncertainties for energy production and water supply. Our project findings demonstrate that the indicator-based model is a very flexible tool that can easily be applied to other regions. It is easy to visualize and can be a useful support for risk communication.

Measuring Resource Efficiency in Regions: Concepts and Recommendations for Policy and Business

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Purpose: Resource efficiency has become one of the main sustainability- related topics. At the macro level, increasing resource efficiency safeguards resources over the long-term; at the micro level, resource efficiency is viewed as a strategy aimed at reducing both material costs and environmental burdens. The principal objective of this project is to depict the resource efficiency for Upper Austria by using selected key indicators. For the first time, the indicators 'Regional Material Consumption' (DMC_{reg}), 'Regional Material Input' (DMI_{reg}) and 'Regional Raw Material Consumption' (RMC_{reg}) are calculated on a regional basis (for Upper Austria). Subsequently, the regional resource efficiency is displayed by comparing the gross regional product (GRP) with the Regional Material Consumption. In addition, industry-specific productivity indicators are calculated for individual business sectors, which allows a comparison between different business sectors as well as a comparison of single companies with the sectoral average in terms of a benchmarking.

Data analysis: The data required for the calculation are based on special analyses of Statistics Austria (material input statistics, foreign trade statistics), and on other sources comprising the extraction of minerals, fossil fuels and metals, agricultural statistics, and forestry statistics.

Results: The results show that in Upper Austria, the Regional Material Consumption for the year 2011 accounts for 27.3 million tons of material, which is an increase of 36% compared to 2002 (20.1 million tons). The Regional Material Consumption per capita in Upper Austria is 19.3 tons, which is 14% lower than the Austrian-wide consumption of 22.5 tons. The resource efficiency in Upper Austria amounts to 1,859 euros per ton. The industry-specific resource efficiency indicators show that the plastic producing industry uses their resources in the most efficient way. For the future, it is recommended to measure resource efficiency at the macro and meso levels by using the key indicator 'Raw Material Consumption' (RMC) instead of the indicator 'Domestic Material Consumption' (DMC), which has been the subject of some criticism. At the corporate level, resource efficiency should be measured continuously using relevant indicators, and be used as a basis for industry benchmarks and best practice examples.

Sustainability Assessment of an Urban Food System: The Case of Basel

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Food production and consumption are important aspects with respect to sustainable development. For example, food systems contribute to about one third of global greenhouse gas emissions. Meanwhile, a growing number of cities commit themselves to sustainable development. In contrast to, for example, transportation systems, entire urban food systems are not yet in the focus of in-depth reviews regarding their sustainability performance. We want to close this gap by developing an assessment method, which includes different aspects of an urban food system and covers all dimensions of sustainability. The SAFA-Guidelines (Sustainability Assessment of Food and Agriculture systems) published by FAO serve as the theoretical framework of our assessment. These guidelines are globally applicable and accepted, and cover each sustainability dimension (governance, environmental integrity, social well-being, and economic resilience). They define objectives for 58 subthemes of sustainability. For those objectives applicable in the urban context, we develop indicators. For the governance dimension, an emphasis is placed on the administration of the city. In all other dimensions, potential hotspots (of regulatory nature or in terms of impact) are identified for each subtheme by literature review and used for indicator development. These critical processes are related to different stakeholders (retail, consumers, administration, and producers) and supply chain levels. Finally, the indicators are weighted in a stakeholder workshop. To rate the indicators, we use data from three different sources: a) a stock flow analysis of several food items in Basel, b) interviews with administration and retail representatives, and c) statistical data, publicly available. Our assessment will allow identifying weaknesses and strengths in the sustainability performance of Basel's food system. Where possible, it will disclose areas of potential action to mitigate adverse impacts of the food system.

The Occupational Health and Safety Footprints

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In this study we extend monetary input-output (IO) analysis with data on Occupational Safety and Health (OHS) in physical units to calculate the OHS footprint of nations. This study addresses human rights and working conditions issues in terms of OHS (fatal and non-fatal accident footprints and days and wages lost footprints) for people suffering injuries from work demanded as a result of international trade arrangements. The methodology is exactly the same as that used in ubiquitous carbon footprint studies, *i.e.*, an economic multi-region IO table, a physical satellite, and Leontief's demand-pull impact calculation. The databases used are from the International Labor Organization (ILO), Asean Occupational Safety and Health Network (ASEAN-OSHNET), and various local agencies that report on work safety. To this end we use a database of 187 countries and an historical time series spanning from 1990 to 2010. Results: for every nation consumption bundle we are able to calculate the number of work-related accidents that occur throughout the world, that are directly and indirectly linked to production of the products consumed. The rationale for reporting on such an indicator falls within the corporate/national social responsibility (part of the Triple Bottom Line) nexus. The rationale is identical to the one applied to fair trade and child labor, for example. Our findings are intended to help the Global Reporting Initiative (GRI) improve its OHS sustainability indicators in future iterations.

Corporate Social Responsibility for Rural Development

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In recent years, the number of private firms involved in Corporate Social Responsibility activities has increased substantially. In this paper, we first assess the reasons for engaging in CSR, based on literature, after which we investigate empirically how firms from various industries and countries are involved in some form of support to rural communities. This paper identifies their key drivers, interests, as well as the main strategies applied. Additionally we evaluate the possible application of CSR as a mechanism to encourage endogenous strategies of integrated rural development. For our analysis we selected a sample of UN Global Compact supporting companies and analyzed the publicly-available information reported in their respective Communication on Progress (CoP) reports. For our analysis, we sampled a list of companies from different countries of the American continent. The sample was composed of 100 firms from all the listed industry sectors (*i.e.*, construction, mining, personal goods, financial services, chemicals, beverages, oil and gas processing, food producers, general industry, and retail, among others). In order to create a representative sample, we used a number of criteria, as described in the methodology part. Our findings suggest that CSR can act as a genuine driver for rural development. Companies engage in these activities to foster the socio-economic improvement of their rural stakeholders, presenting positive outcomes and ensuring the preservation of environment. The challenge for the future is to further encourage participation of firms in rural development, by matching common interests in the environment, wellbeing, and economic growth. The focus of the present paper is to contribute to the analysis about different corporative strategies employed to foster sustainable development of marginalized areas and non-traditional stakeholders.

Engagement of the Private Sector in Ecological Restoration: Lessons Learned from China

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Stewardship of the Earth for environmental protection and restoration of degraded ecosystems has become imperative to prevent biodiversity loss and irreversible environmental degradation. Relevant programmes have been launched by international organizations (e.g., the World Bank, UNEP, FAO) and local governments around the world to achieve both sustainable development and social progress. However, evidence suggests that such projects have not accomplished the dual objectives of ecological improvement and social progress. For instance, only 16% of World Bank poverty alleviation and biodiversity conservation projects have achieved major progress towards both objectives. One problem is that the private sector, with large financial resources and great capacity for innovation, has not been asked to play a role in such projects. In recent years, private-sector engagement in ecological restoration programmes has emerged as a powerful new force. In China, the private sector often enters into a contract with local government to restore degraded lands by developing their business. However, much evidence shows that private-sector participation does not always produce positive results, so the merits of such participation remain ambiguous. How can we increase the likelihood of successful engagement by the private sector in ecological restoration? What kinds of private enterprise are most likely to engage successfully? What roles does the public sector (governments and communities) play in private sector-led ecological restoration? In this paper, we answer these questions using a case study in Changting County, China, in which local ecological restoration succeeded due to crucial involvement by the private sector. We used data from dialogues between local authorities, private sectors and the local community. We conclude by exploring the characteristics of successful private sector engagement in ecological restoration programmes and the role of the public sector in encouraging such engagement.

How Businesses Face Global Warming: The Case of the Upper Rhine Region

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The reception of global change by enterprises in the Upper Rhine area has been covered by several very interesting studies in recent years (KWIS, SECIF, KIT).

One common aspect of these studies lies in the adoption of a systemic theoretical frame, which works with the enterprise as a system in its environment. This theoretical option is mobilized for the definition of different concepts such as sensitivity to meteorological and climate events, vulnerability to climate change and the resiliency of the businesses. The meteorological and climatic variations and modifications happen in the environment of the businesses as do other social, economic and political events. They exert an irritation in the environment of the enterprise. Everything which happens in the environment of an enterprise can be described as an event which happens outside of the system. Sensitivity and vulnerability mean that the businesses are structurally connected to these kinds of events. Resiliency refers to the structural responses of the system: the way it reorganizes itself or not in response to some events which are significant in its environment.

Research grounded on statistical and qualitative enquiries conclude that although it is impossible to generalise how each enterprise should reorganize itself in detail to face climate change, it is possible to distinguish some key issues which should receive attention if a business remains aware of climate change issues. The domains which can be affected by climate change within an enterprise include the following: human resources, the valorisation process within the chain of production; logistic and infrastructures should also receive the attention of management.

Each individual issue opens a field of knowledge and skills as well as some potential occupations and trades. Consequently, it is possible to adapt strategy in a business once the issues mobilized in response to some environmental irritation are faced and depending on actions chosen to resolve the issues.

Interpreting Why Some Business Leaders Are Emerging as Advocates for Stronger Public Policy on Sustainable Development: Business and the SDGs

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This paper offers a contribution to debates on the role of business in advancing and hindering progress towards sustainable development, and in particular the nature of business engagement in policymaking processes on sustainable development. It does this by examining empirically the role that business leaders have been playing in helping shape the UN Sustainable Development Goals. The paper draws on substantial longitudinal data collected over the period 2012-2015 on the nature of private sector engagement in the development of the SDGs (participant observation of key meetings and processes, interviews with individuals participating in these processes, and documentary materials generated through these processes).

The prevailing neo-liberal orthodoxy argues that business action is only ever motivated by short-term profit maximisation. Thus when it comes to engagement with public policy, business lobbies aim for this rather than the wider public interest, and this largely equates to less regulation, weaker standards and minimal government intervention [1].

Whereas there are clearly plenty of empirical examples which demonstrate companies behaving in this way, lobbying to block, weaken and delay government action on sustainable development; there are also increasingly many examples that are seemingly at odds with this stereotype, such as the Australian Business Roundtable on Climate Change formed to lobby for government action to reduce GHG emissions [2], or Unilever creating a 'Global Advocacy Team' within its public affairs function to proactively lobby for stronger public policy around sustainability challenges [3]. The process to develop the SDGs is a case in point, where there has been a substantial contribution from many business leaders to advocate ambitious goals.

Drawing on over 70 interviews with business leaders involved in the process to develop the SDGs, as well as documentary evidence and participant observation of key meetings over the period 2012-2015, this paper explores dynamics of why this pattern emerging, and what it might mean for achieving the SDGs.

Sustainability in Economics, Business, and Management
The Role of Private Enterprise

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The Role of the Private Sector in Forest Conservation and Restoration

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Today, we see increasing attention to the social and economic benefits that forests offer. Accordingly, protecting, restoring, and promoting sustainable use of terrestrial ecosystems is one of the proposed Sustainable Development Goals (goal 15). Whereas forest conservation has long been the terrain of governments, NGOs, and local communities, a positive role of the private sector in promoting sustainable forest management (SFM) is a more recent phenomenon. However, the private sector's role is also ambiguous: historically, private activities such as agriculture, logging, and mining are responsible for massive deforestation and forest degradation. Moreover, sustainability strategies and corporate responsibility policies often are criticized for not moving beyond tokenism. Accordingly, there is a need to address the conditions under which positive contributions of the private sector can be expected. It is well argued in the literature that governance—not just forest ownership—is an important factor for whether forests are managed sustainably or not (e.g. Agrawal *et al.* 2008). Most, if not all, of the proposed six essential elements for delivering on the SDGs—dignity; people; prosperity; planet; justice; and partnership—underscore this idea. However, how do we translate these elements to concrete governance structures and instruments? What forms and dynamics of engagement of the private sector with governments and communities are desirable? Additionally, how do we create transparency and accountability of private action? This paper seeks to answer these questions by drawing upon recent studies and projects on forest conservation and restoration. We use examples from landscape restoration in Indonesia and explore data from multiple sector dialogues that were recently held to discuss the role of the private sector in realising the SDGs. We conclude by identifying the potential of several modes of governance in relation to the SDGs and forest conservation and restoration in particular.

The Sustainable Corporate Responsibility Grid (*SCORE* Grid): From Corporate Responsibility toward Corporate Sustainability

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An unintended consequence of the diffuse attention on corporate responsibility (CR) is the bewildering array of conceptualizations, promises, and application propositions. The purpose of this paper is to empirically examine the central themes in CR and how they relate to each other as presented by the contemporary academic discourse around the globe in order to reveal some of the obstacles toward its wider adoption and implementation. We sampled 120 videos and podcasts recorded between January 2010 and September 2014 from workshops, university lectures, interviews, roundtable events, and conference presentations. The audio and video data were analysed using a two-step Hermeneutic Content Analysis, i.e. a combination between Content Configuration Analysis, a qualitative method of analysis that shares similarities with qualitative content and thematic analyses, as well as Multidimensional Scaling. Our results reveal two distinctive discourses in CR: a still dominant classical discourse defined by economic, legal, and ethical responsibilities, and an emerging discourse relating to sustainability, focusing on the relations between economic, social, and environmental outcomes. Based on these findings, we created a heuristic framework, the *SCORE* Grid (Sustainable Corporate Responsibility), which classifies CR narratives according to CR motives, outcomes, and their interconnectedness. By applying the *SCORE* Grid, several understandings of CR were identified in the academic discourse that may lead to confusions, contradictions, and conflicts with business-related stakeholders due in part to various shortcomings in the theorizing, empirical study, expectations, and applications of CR. They include ethical expectations dissociated from business or societal concerns and a disproportionate linkage between CR and economic outcomes despite a lack of evidence or weak case studies. As a more general analytic and negotiation tool, the *SCORE* Grid may overcome some of these shortcomings and allow contemporary research and applications to be more advantageously pursued due to its explicit framing of CR motivations and outcomes, as well as its explicit integration of stakeholder positions. It furthermore provides business, government, communities, and other stakeholder groups with a tool to develop specialized CR strategies, which can be designed according to needs, current conditions, local context, and cultural norms.

Scaling up or Crowding Out? An Explorative Analysis of the Relationship between Corporate Social Responsibility and Corporate Philanthropy

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Corporate Social Responsibility (CSR) is one of the most prominent approaches to both, business management and academic analysis of the social dimension of corporations [1]. Today, companies have to address the interests and expectations of many stakeholders. Especially, they face the demands of advocacy and lobbying groups in social, environmental, and political issues. As a consequence, CSR is a required asset of all kinds of companies, from small ones to big global players [2].

Together with CSR, corporate philanthropy has gained a lot of attention in recent years, especially through the establishment of corporate foundations throughout the world. Corporate philanthropy consists of all voluntary actions by a company for a public purpose. While Godfrey (2005) termed non-reciprocity to be the “acid test” of corporate philanthropy [3], Porter and Kramer hold that “the acid test of good corporate philanthropy is whether the desired social change is so beneficial to the company that the organization would pursue the change even if no one ever knew about it.” [4].

In literature, we find a strong ambiguity on the connection of CSR and corporate philanthropy. While sometimes included into CSR, corporate philanthropy may as well be excluded based on the argument that CSR is not desired but at least expected [5].

Based on the assumption that the voluntary nature of corporate philanthropy follows a different logic than the more regulated CSR-approach, we analyze in this study the relationship of CSR and corporate philanthropy using a sample of US-based companies.

Method

We collected data from a sample of 469 US-companies. First, we derived sustainability ratings for the years 2004 to 2011 from two sources, Inrate and Sustainalytics. Second, we compared the two datasets and selected 160 cases with either comparable least or maximum values. By this procedure, we were assured to have a distinguished set of companies with high and low performance in sustainability. Additionally, we collected desktop research data on corporate foundations of these companies. A total of 96 companies had a foundation and in 78 cases the relevant data was available.

Sustainability in Economics, Business, and Management (Contrasting) Approaches to CSR

Our research analysis was conducted with an OLS multiple regression analysis with the annual foundation spending as dependent variable and sustainability, company profits of the year before, and different industries as independent variables.

Major Findings

Our main finding is that there is no clear relationship between sustainability rating and the annual spending of a corporate foundation. Hence, we can claim neither a crowding out nor a scaling up effect of CSR on corporate philanthropy. As a consequence, we call for more investigations on the role of corporate philanthropy and a better definition of the components of CSR.

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Trading Organizational Complexity for Trust? How Management's Limits Point the Way to Organizing a Sustainable Future

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Taking stock of the irreducible incompleteness of formal tools to codify behavior of individuals and collective entities in complex situations, we focus in this paper on the consequence of our limited means of control, with a view of exploring alternative and complementary means of coordination necessary for organizing our sustainable future. The complexification of socio-technical systems raises the question of our collective ability to control them. While interconnected technological systems that we have developed such as nuclear plants, the electric grid, and the transportation systems may become too complex for their functioning to be taken for granted, their accumulated power over humankind opens the possibility of great disasters.

Furthermore, this technological system is interdependent with the formal and conventional system which organizes relationships between individuals, organizations, states, and is designed to ensure our social sustainable future. The ever more complex elaboration of contracts, laws, political alliances, international governance organizations leaves us with a feeling of powerlessness before the apparent inevitability of organizational, social and economic crises.

As the Internet invites us to a completed interconnection of complex technical and social formalized systems, the time has come, as a disaster prevention and mitigation strategy, to explore the possibility of a costly return to a certain simplicity.

To avoid the accumulation of destructive tensions in our social and physical environments this paper investigates the gradual and deliberate simplification of our technical and social collective elaborations as a contribution to sustainability. An alternative mechanism to formalization and control to organize collective enterprises, trust's potential to contribute to a sustainable future is outlined.

Was Milton Friedman Against Corporate Social Responsibility (CSR)?

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In 1970, Nobel Prize-winning economist, Milton Friedman, published a well-known essay in *The New York Times*: “The Social Responsibility of Business Is to Increase Its Profits.” The article has been cited more than 9,000 times, mainly in critiques. Friedmans’ critics believe profit-seeking is the opposite of corporate social responsibility (CSR).

However, was Friedman wrong — and was he against CSR? Haven’t we reached a point where behaving responsibly is a crucial and necessary element of doing business and making profit? In this article (study), I will argue that Friedman was ahead of his time and addressed CSR as it should be addressed: as part of the company’s business. I will focus on three key elements of Friedman’s essay and show how these are crucial aspects of how businessmen and women should be addressing CSR today:

7. The corporate executive should “make as much money as possible while conforming to the basic rules of the society, both those embodied in law and those embodied in ethical custom.”
8. The corporate executive should act as an agent for the company, not a principal, and not spend “the money of his employers or the time or energy he has contracted to devote to their purposes.”
9. The corporate executive should “use [the company’s] resources and engage in activities designed to increase its profits so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception or fraud.”

Through concrete corporate examples/cases illustrating the arguments above, I will demonstrate that acting according to Friedman’s strategy and recommendations can form a truly responsible executive.

An Assessment of the Sustainability of the Material Flows of Birmingham, UK and its Hinterlands

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Cities are heavily dependent on their hinterlands for their function and survival. Hinterlands are defined here, as regions which supply goods and services to a city. There are three main types: *regional*, around the city itself; *national*, comprising of other regions within the city's country; and finally *international*, which supply resources from across the world. Boundaries can vary depending on the size of the city and its influence. Hinterlands provide resources such as people, materials, water, food and energy as well as providing areas for waste disposal. Over the last 50 years, commerce and trade has become increasingly global with resources being sourced from further afield often due to cheap labour costs, better transportation and a plentiful supply of energy or raw materials. More recently, it has become evident that the use and transportation of resources is becoming more and more unsustainable as the global population increases, fossil fuels and other raw materials become increasingly scarce, and energy costs rise. This paper builds on work undertaken as part of the Liveable Cities Programme on the resource flows of the City of Birmingham. It investigates how specific flows (people, materials and food) interact with the regional hinterland of the Black Country through road and rail transportation. It compares these movements with national and international flows. The sustainability of such movements is assessed from an economic, social and environmental perspective. The importance of the type and weight of goods is highlighted together with the costs involved and energy used. It is proposed that for a city to maximise its sustainability it needs to: (i) source as much as it can locally, to minimise transportation and energy costs ; (ii) re-use or recycle its waste; (iii) provide clean and efficient public transportation; (iv) ensure that all housing is fully insulated using sustainable materials.

Benchmarking Component Procurement Collaboration for Supply Chain Sustainability in the High Technology Industries

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The impacts of high technology industries, such as integrated circuits (IC) industry and optoelectronics industry, have been growing increasingly to technological innovations and global economic developments, while the industrial energy consumption and CO₂ emissions can lead to severe concerns in sustainability. Efficient use of resources and green materials to facilitate cleaner production thus become an urgent issue in the high technology industrial chains. To bear higher industry and sustainability standards in the globally competitive environment, today's manufacturing companies are not competing for individual capabilities but the efficiency of the entire green supply chain management. Cost down pressure would be one of the most critical successful factors for working with green components suppliers, especially for the electronics OEM companies often costing 80-90% of the final product prices or even higher for their component procurements. Therefore, cost control for component procurement and optimizing shipping time of components are important for improving green supply chain practices. Taiwan is recognized as one of the world's largest manufacturing clusters of high technology components and products. Empirical data were collected from Taiwanese manufacturing chains and their global green suppliers to examine the effectiveness of component procurement collaborations in terms of costs and shipping time. Two different supply chain collaboration models for multi-layer ceramic capacitor (MLCC) and universal serial bus (USB) wire 3.0 procurements were benchmarked and statistically validated. The results suggest that the practices of collaborative planning for purchasing quantity with suppliers are significantly related to cost advantage and shipping time, by 21.6% cost down and 79.1% time efficiency improved as the best practices. Although the price negotiation of upstream raw material for the collaborative suppliers can also help cost reduction, no statistically significant benefit of the shipping time is supported by the empirical evidences.

Effects of Urban Growth on Sustainability

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Urban expansion has led to an exponential growth in demand for resources, especially food, fuels and raw materials that generate also a higher volume of wastes. The four most important cities in Colombia (Bogotá, Medellín, Bucaramanga and Cali) were selected for a case study to analyse and determine how urban growth affects sustainability in relation to material and energy flow. This analysis was conducted using several indicators to characterize trends in sustainability from population, urbanization, social, economic and environmental issues. The main data sources were the databases and reports produced by the National Department of Statistics, National Department of Planning, and the planning offices of the selected cities. The material and energy flows were determined for each city through input and output analyses, and the relationship between urbanization and sustainability was evaluated by the application of correlation analyses. Results indicate that the urbanization process has a relationship with sustainability indicators, where higher population, urban density and resource uses affect environmental and social performance; the relationship between inputs and outputs are directly and linearly related; and it is important to achieve equilibrium between urbanization, resource use and sustainability issues. Findings of this study are relevant to indicate aspects of urbanization on sustainable development in Colombian cities that can be considered when formulating comprehensive regional developmental policies to improve welfare, sustainability and habitability in cities, and particularly for vulnerable populations.

Sustainable Vendor Management in the Procurement Wing of a Supply Chain

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Business sustainability is about managing the triple bottom line instead of one single bottom line; it is a process of managing social and environmental risks in addition to managing financial risks. By adopting sustainable business practices, organizations can be resilient over time; *i.e.*, they can survive tremors and shocks. Hence, they allow businesses to gain a competitive edge, increase their market share and promote their value amongst shareholders. As per recent surveys, companies that have adopted sustainable practices have been helped by capturing value through growth and a greater return on capital. The same survey highlights that more than 50 percent of the companies are now more effective than their competitors by adopting practices such as reducing energy and water use in operations, reducing waste from operations, and by managing the impact of products throughout the value chain. A lot of businesses have defined a long-term vision in sustainability and drafted measurable goals. The focus areas of the goals are:

- Conservation of resources
- Use of renewable resources
- Waste recycling and reducing landfills

Some of the most critical goals aim to achieve reduction in carbon emissions, waste generation, water use and truck transportation per unit of production, and ensuring renewable resource use such as renewable energy for production and raw materials sourcing by environmental friendly farms. Actively integrating sustainability in supply chain activities can help businesses achieve these targets.

Supply chain is a business imperative, critical to the success of an organization. The supply chain, after all, accounts for between 50 percent and 70 percent of both total expenses and greenhouse gas emissions for most manufacturing companies. Further, effective supply chain management has a tremendous impact on an organization's bottom line(s). While adjusting the supply chain to changing demand and opportunities, it is important to consider factors of current as well as future resource prices, operational costs and competitive threats. With energy costs soaring, risks of all kinds being on the rise, and shortages of even basic natural resources such as water, companies need to take as broad a view of sustainability as possible.

A sustainable supply chain is management of business, economic, environment and vendor characteristics, by systematically monitoring and measuring the factors that can make the supply chain operations cleaner and more efficient. Improving the supply chain sustainability would allow the organization to cut costs, drive revenue, and manage risks more effectively, all while complementing other initiatives throughout the company. Using an Advanced Analytics approach, we can help businesses manage their sustainable vendors at present by consolidation and, in future, by predicting vendors that will be most profitable (using the concept of sustainability measurement). The paper presents mathematical techniques that can be used for vendor consolidation and future profitable vendor prediction.

Raising Awareness of Liveability Issues in Post-Graduate Sustainability Studies

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The world in which we live is constantly changing, and never more rapidly than in the last two centuries. Population densities and demands for resources (not in the least for energy and water) within cities are at all-time-highs. Therefore, a business-as-usual approach is no longer sufficient to meet the "wants" and "needs" of burgeoning city populations, whose "liveability" options now require closer scrutiny. However, available liveability options depend on how the term "liveability" is defined. Definitions of liveability will undoubtedly change, depending upon who one asks. Definitions of liveability will likely take into consideration people's priorities in life and their local living conditions. When considering only three liveability requirements (*i.e.*, an 80% reduction in carbon emissions, moving toward one planet living/resource security, and enhanced well-being), a clearer picture of the lack of awareness of the issues at hand, amongst those who will be affected most, begins to emerge.

This paper considers one fundamental step in addressing the above issues by raising awareness within the next generation of engineers, who will be able to generate more radical (*i.e.*, truly transformational) solutions as cities evolve. The context is an MSc postgraduate course in Sustainable Construction. Our study considers an innovative method of teaching and data collection in addition to observations made over a period of four years (from 2012 to 2015).

Developing Guidance for Companies to Master Current Challenges in Sustainability Reporting: Two Case Studies from Banking and Tourism in Switzerland

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Sustainability reporting is an increasingly applied instrument for companies to systematically communicate about the relevant impacts of their business operations on nature, society, and the economy. Recently, both the new guideline of the Global Reporting Initiative (GRI G4) and the Integrated Reporting (IR)-framework of the International Integrated Reporting Council have been published. As a consequence, companies worldwide face a changing reporting landscape and need to address, amongst other things, the following challenges: (i) the choice of the most suitable guideline, (ii) the incorporation of the changes of GRI G4 and of the new requirements of IR in their reporting, (iii) a decision on the degree of integration (of sustainability topics in the financial report), and (iv) of how to customize the report in accordance with the different needs of specific target audiences. There is currently no approach that assists companies in mastering these issues.

Our paper presents the conception, and some first findings, of an application-oriented research project that aims to support companies in the transformation of their reporting practices. In a first step, a framework is established with reference to GRI G4, IR, and related literature that allows for the systematic analysis of the new reporting requirements. This analysis grid is then tested by application with two large case study companies from the Swiss banking and tourism sectors by using expert interviews and document analysis. Based on the empirical testing phase, implementation guidance for overcoming critical issues will be developed, which will focus on the four modules of “stakeholder inclusion”, “materiality”, “value chain”, and “target audience”. Elements of the guidance include, for instance, concepts for appropriately mapping impacts across the whole value chain and concepts for better customizing a report with regard to target audiences or best-practice examples. Finally, the guidance elements will be applied to the concrete sustainability reporting of the two case study companies, in order to test their feasibility and practical value.

The research findings will be useful for companies worldwide to improve their reporting practices and to master current challenges in sustainability reporting.

Promoting Sustainability through the Application of the EMAS Regulation: A Survey Examining the Critical Factors for Italian Organizations

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One of the tools set by the European Community (EC) to reduce the environmental impact of firms is the EMAS Regulation (EC Reg. n. 1221/2009), setting up an Environmental Management System (EMS), which allows a continuous improvement of environmental performances. Italy has the highest number of certified organization among all European Member State, accounting for over one thousand registrations. The paper presents the result of a survey conducted through a questionnaire on EMAS implementation in all Italian registered firms. The main goal is to understand how organizations experience the scheme, focusing on main drivers for its adoption, main difficulties encountered, and perceived benefits. According to survey's findings, the main drivers and benefits relate to corporate image and regulatory compliance improvements, while high costs, the environmental review, and the environmental statement bear the main difficulties, especially for smaller organizations. In particular, the presented survey results contributed to the defining of a reflection on the relevance of analysing the difficulties regarding EMAS diffusion. Aspects identified as critical can lead to a contraction of registration requests, especially those formulated by Small and Medium Enterprises (SMEs), which constitute the majority of Italian companies. Moreover, perceived difficulties might affect the firms' willingness to renew EMAS registration. The Italian Institute for Environmental Protection and Research (ISPRA) statistics highlight the increasing rate of firms deciding to not renew their registration. This study offers interesting inputs related to main critical issues in EMAS implementation, which can be the baseline for future research on companies that abandon the certification scheme, in order to provide suggestions for the improvement of its effectiveness both for national and communitarian institutions.

Public-Private Partnerships and the Incorporation of Sustainability Principles in Africa: A Critical Review

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Africa's infrastructure stock and quality is among the least developed in the world. This situation presents a challenge that significantly hinders economic development. The last twenty years have seen the rise to prominence of Public-Private Partnerships (PPP) as a means of harnessing investment and expertise from the private sector to deliver public goods and services. Today, society is challenged to implement a plan for progressing economically that remains ecologically viable and socially impartial. The incorporation of sustainability principles into PPP has been canvassed to boost the sustainable development agenda worldwide. The focus of this review article is to examine the current situation regarding the inclusion of sustainability principles in public-private partnerships in selected African countries. The incorporation of sustainable development considerations into PPPs and their uptake in Africa are discussed through a comparative study of the relevant guiding legislation, policies and practices, barriers, and concerns. The findings of this paper contribute to the sustainable development agenda by providing useful preliminary observations that can help government policy makers, businesses, and NGOs in formulating and incorporating sustainability principles in urban environmental infrastructure and developments in developing economies.

A CSR Measure for Chinese Pharmaceutical Companies: Based on the Stakeholder Theory

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The pharmaceutical industry in China, dominated by non-branded generic drugs, has grown steadily over the past two decades. According to official statistics, the pharmaceutical industry is one of the most rapidly growing industries during the “Eleventh Five-Year Plan” (2006–2010). The total industrial output has increased to nearly \$200 bn in 2010, representing more than a 20% growth in five years. The total profit has increased more than 30% annually and reached nearly \$23 bn in 2001. Today, pharmaceutical sales have surpassed \$50 bn from \$21 bn in 2008, and they are expected to reach \$63 bn in 2015 (IMS Health, cited in Mathurin, 2013). After the US and Japan, it is now the third largest market globally, and it is expected to move to second position in 2020 (Pharmaceutical Market China, 2014). The total export value of China’s pharmaceutical industry increased from \$3.4 bn in 1998 to \$39.7 bn in 2010, an increase of more than 20% annually. According to European Union customs officials, China is among the world’s top four exporters of counterfeit pharmaceuticals, and more than 40% of active pharmaceutical ingredients used in the U.S originate in China or India [1,2].

Despite these considerable achievements, the threats and problems associated with China’s rapidly growing pharmaceutical industry cannot be overlooked: Poor quality or counterfeit drugs, commercial bribes, excessive profiteering, and environmental pollution not only impede the sustainable development of China’s pharmaceutical industry, but they also potentially damage consumers’ health and diminish the trustworthiness of Chinese corporations beyond the pharmaceutical sector.

The reasons for these threats and problems are multifaceted. An administrative explanation would include inadequate supervision, insufficient or unenforced laws and regulations, questionable administration systems, as well as opaque governance associated with this industry [3]. While the pharmaceutical industry is indeed highly regulated in many countries [4], it is unrealistic to address these threats and problems solely by relying on government and regulation: (1) because it is impossible for the Chinese government to micro-regulate drug companies, considering the disparate power relation between regulation agents and regulation subjects; (2) it is impossible for a government to obtain accurate facts considering the information asymmetry between government and companies [5]; (3) a culture of regulation will create a system in which regulators will continuously lag behind the corporations’ legal creativity and technical advance in their attempts to

circumvent government regulation; (4) regulations are not designed to benefit the industry, such that they may not only protect consumers or markets, but may inadvertently introduce elements unsuitable for the Chinese pharmaceutical industry. Thus, it is in the long-term interest of drug companies to contribute, even propose pro-actively, standards to tackle their industry's threats and problems. This is likely to foster positive relations with relevant stakeholders, including consumers, government, civic society, and international bodies.

Corporate social responsibility (CSR) has drawn much attention in China in recent years. It has been associated with various problems and crises in the Chinese pharmaceutical industry [6,7,8]. However, despite scholarly and industrial attention in recent years, CSR is a relatively new and ambiguous concept for Chinese pharmaceutical companies [9]. In this paper, we aim to establish a CSR measure for Chinese pharmaceutical companies, based on the results of the Delphi Method (Dalkey and Helmer, 1963; Adler and Ziglio, 1996). The results of this study reveal the CSR expectations among relevant stakeholders of the pharmaceutical industry in China, outline a CSR strategy formulation, as well as propose important first steps toward an implementation plan.

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Developing Transnational Sustainability Strategies That Work: Locating Solutions amidst the Challenges

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There is increasing pressure on multinational corporations (MNCs) to conduct business ethically and to foster prosperity in the developing countries from which they source raw materials. In response, many companies are trying to report on their social impact. However, for a number of these firms, social challenges are unfamiliar and evaluating them is unprecedented. As a result, their attempts have not necessarily added value to the organization, or made sense in their environments of implementation. I use the attention-based view of the firm (Ocasio, 1997) to study how organizational strategies emerge in transnational and transcultural environments of change. By exploring how decision makers at a multinational corporation in a western country developed a baseline social needs assessment for international sourcing markets, I explore how information from the bottom of organizational hierarchies moves to the top, and how decision makers pay attention to it when developing strategy. The company's coffee supply chain in a sourcing country serves as a sub-case for uncovering some of the producer- and market-level challenges employees at headquarters were trying to address. I conducted research at multiple points in the MNC's international sourcing hierarchy, and at strategy workshops in which decision makers and NGO allies developed the assessment. This research contributes to theory on attention by showing how social discourses influence processes of attention allocation and strategy development in dynamic environments of change. Findings indicate that discourses, which are embedded in organizational attention structures, shape decision makers' attention allocation through rigid patterns of linguistic cues, guiding them away from emergent issues and back to existing issues in the search for answers. The resulting strategic response may not make sense in its environment. These findings are expressed as a revision of Ocasio's original (1997) model of situated attention. Learnings from the MNC's strategy development process are delineated in the conclusion to help practitioners and policy-makers achieve more streamlined processes of transnational collaboration for complex projects in the future.

Why Companies Do Not Renew Their EMAS Registration: An Exploratory Research

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The Eco-Management and Audit Scheme (EMAS) is the official Environmental Management System (EMS) issued by the European Union (EU). Italy is the country where EMAS is most widespread, accounting for over 1 600 registered organizations, representing more than a third of the total. Since the entry into force of the Regulation in 1997, the number of registrations has constantly grown until 2008, when the figures started to drop. The phenomena is due to both the decreasing of the annual registration rate and the lack of renewals. According to the Italian Institute for Environmental Protection and Research (ISPRA), in the last years, an increasing number of organizations decided to not renew their EMAS registration. The purpose of this paper is to analyze the reasons of this negative trend. The first step consisted in a literature review concerning the main barriers, difficulties, and costs incurred by EMAS -registered organizations. This information was integrated with results coming from a previous survey, which involved the entire population of registered firms. On this baseline, semi-structured interviews were constructed. An explorative survey has been carried out involving relevant stakeholders, in particular Italian firms, Accredited Verifiers and National EMAS Coordinator. The output of the investigation allowed us to identify stakeholders' priorities intervention areas. The goal is to suggest an operative strategy to reduce EMAS cancellation rates, addressed to Member States (MS) Competent Bodies. The present exploratory research highlighted economic and operational domains concerning cancellation trends, which deserve a deeper investigation, which will be conducted through a questionnaire addressed to Italian firms that did not renew the registration in the last lustrum.

Sustainable Development of Forest-based Paper and Pulp Industry in China: A Comparative Analysis of Domestic and International Companies

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Forests are increasingly recognized as a critical element of the global ecosystem given its importance in providing multiple environmental services. Forest-based paper and pulp industry plays a critical role in economy and the activities of these companies have many negative impacts on the environment such as deforestation and biodiversity deterioration. Their sustainable performances are drawing great attention regarding global voluntary standard assessment system for environmental reporting by Global Reporting Initiative (GRI). Moreover, eco-certificate such as FSC and PEFC in forest-based industry which concerning the sustainable production of forest-based industry are growing rapidly. The Chinese Forest Industry Association designed a corporate social responsibility report guide for forest-based companies in terms of the Chinese Corporate Social Responsibility Guide. Sustainable development of forest-based paper and pulp industry in China, which is important to the global market, is a critical issue. Hence, several fieldworks are implemented to investigate the sustainable development of forest-based paper and pulp companies in China in two forest-intensive provinces such as Guangxi and Hainan provinces. The data were collected in three representative domestic companies and three international company (APP, Stora Enso and UPM), as well as forest industry corporation. It was found that the sustainable awareness of forest-based paper and pulp companies in China are in an infant stage but growing rapidly. The international companies and Chinese company have different sustainable performances. International companies in developing countries are more and more cautious in social and environment domain compared to their past behaviors. They are informative and have a standard international reporting framework. They are easy to integrate sustainable guideline in applying FSC and PEFC certificate. Domestic Companies are less standard. They engaged in some sustainable practices, but they were not aware of them. They are facing market and social pressure in sustainable production. In addition, they are eager to adopt sustainable development due to the driver of international certificate.

Vitamin A Stability in Nigerian Retailed Flour and Fortification Compliance Level

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Background: Wheat flour has been mandatorily fortified with vitamin A in Nigeria. This study aims to determine vitamin A stability in retail flour and assesses compliance status. **Methods:** Seventeen flour samples were randomly selected from twelve bakeries across six Local Government Areas in Lagos, Nigeria and stored for 30 days at room temperature. Pre- and post-storage retinol analyses were carried out using High Performance Liquid Chromatography. The stability results were grouped under 1, 2, and 3 month conditions using sample production dates. Fortification compliance was calculated based on three assumptions, using Nigerian Industrial Standards (NIS). The number of samples that met the required ranges, based on the aforesaid assumptions, were calculated in percentages. The data were analyzed using descriptive and inferential statistics at $p < .05$.

Result: The pre- and post-storage vitamin A contents of flour were 18.2 ± 10.7 IU/g and 6.4 ± 5.2 IU/g, respectively. Vitamin A stabilities in flour at 1, 2, and 3 months were 60.7%, 30.6%, and 21.4%, respectively. Only 11.8% of samples met the NIS standard (≥ 30 IU/g). The initial rate of vitamin A compliance in flour was 23.54%, based on WHO guidelines (Feasible Fortification Level/Range (FFL)) of approximately 30% loss (22.5-30 IU/g), and the rate of non-compliance was 76.5%. After the stability studies, compliance rate decreased to 5.9%, while the non-compliance rate increased to 94.12%. Only 29.4% and 17.7 % of the flour were compliant with the 50% acceptable compliance range (ACR) for vitamin A (15-30 IU/g) at pre- and post-storage levels, respectively. A significant difference existed between the vitamin A content of flour and the Nigerian NIS. **Conclusion:** Low stability and compliance were observed. High premix quality and monitoring should be ensured.

4

Poster Presentation Abstracts

1 Additional External Costs Analysis and Environmental CBA

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Sustainable development requires policies and measures of which negative impacts will not be spilled over onto another area, or has trends that pose severe or irreversible threats to the future quality of life. For the adoption of such policies, a common method for decision making is to conduct an environmental cost –benefit analysis (CBA), as well as multi criteria analyze using the methodology for quantifying external costs. However, reducing one type of externality usually generates another due to the fact that the problem is shifted from one area to another. Thus, there is one important issue which has to be considered in environmental CBA, because CBA is usually done by comparing only investment, and operating and maintenance (OM) costs, and all benefits using avoided damages by taking into account at least two scenarios, e.g., a scenario of business as usual and a scenario with applied measures for the decreasing of emissions. For both scenarios, the external costs have to be calculated and their differences represent avoided damages. However, for newly installed equipment there are costs other than investment costs. Life-cycle costing (LCC) is a tool which evaluates the costs of an asset throughout its life cycle. In addition to usual costs (investment and OM), LCC also includes end-of-life and disposal expenses as its externalities. Using LCC end-of-life and disposal expenses as external costs of newly installed equipment should be calculated and added to the cost side in CBA before comparing to benefits. Thus, for the purpose of the decision-making of retrofitting existing power plants in B&H, such a calculation is done, highlighting that DeSO_x is carbon extensive equipment, which, for operation, needs the production of limestone ore causing additional external costs.

2 Assessment of Environmental Sustainability Based on Potential Risk

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Surface water is an important source of irrigation and is widely used on agricultural soils throughout the world. However, the surface water may contain various organic pollutants at a trace-level concentration, such as pharmaceuticals and personal care products (PPCPs), plasticizers, endocrine disrupter substances, *etc.* They possess an unknown risk to human health and the environment due to the characteristics of environmental persistence, bioaccumulation and the endocrine disruption. Even though their concentrations are very low they may have detrimental impacts on ecological and human health. The study has investigated the distribution and environmental risk assessment of (phthalate esters, PAEs) in river basin (*i.e.*, Fazih River and Wu River) in the middle of Taiwan, which contain two hospitals and three industrial parks. This study explored the distribution of seven PAEs, for which quantitative analyses were executed by solid phase extraction (SPE) and ultra-performance liquid chromatography combined with quadrupole–time-of-flight tandem mass spectrometry (UPLC/Q-TOF/MS). The risk quotient (RQ) was calculated based on the ratio between the measured environmental concentration (MEC) and the predicted no-effect concentration (PNEC). The results showed that among seven PAEs, DBP at a detection frequency of 100% was the most abundant emerging contaminant in the aquatic environment. The high risk judged by the RQ values ($RQ \geq 1$) existed in cases of DBP, DEHP and DINP, which affected the reuse of water resource and environmental sustainability.

3 Environmental Assessment of Densified Refuse Derived Fuel Produced by Biowastes and Waste Bioplastics as Energy Sources

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As the energy crisis and resource shortage continue, the development of new energy, energy conservation and carbon reduction have become important objectives of the current policy for governments. The usage of densified refuse derived fuel (RDF-5) produced from biowastes assisted in reducing the emission of greenhouse gases so as to possess high potential to be used as the biomass energy. Based on the international environmental consciousness, the life-cycle assessment (LCA) has become an important product design environmental assessment tool for improving product design to achieve goals of pollution prevention and sustainable development. The objectives of this study were to manufacture RDF-5 from waste bioplastics (polylactic acid, PLA), biowastes (rice straw), with/without waste glycerol in a pilot scale. The physicochemical properties of obtained RDF-5 were investigated. Besides, a suitable boiler was used to examine the combustion characteristics and pollutant emissions in order to explore the feasibility of RDF-5 as an energy source. The production rate of RDF-5 reached 50 kg/h under the lack of heating equipment. The ratio used in the manufacturing process was rice straw: PLA: waste glycerol equal to 8:8:1. The density, bulk density, durability, water content of the resulting RDF-5 were 1.28 g/cm³, 648.6 kg/m³, 95.6%, and 2.78%, respectively, which showed that the obtained RDF-5 possessed good quality as biofuel. The combustion of the mixture fuel of palm kernel shell (PKS) and RDF-5 at a ratio of 2:1 produced 2.4 ton steam/h/ton fuel. The emission of air pollutants during the combustion process satisfied the emission standard of boiler. Therefore, the results showed that the development of RDF-5 in this study has the benefits of reducing carbon as well as high energy efficiency so as to provide a feasible alternative energy source.

4 Management of Urban Wastewater on One of the Galapagos Islands

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The paper relates an experience conducted on one of Galapagos islands, known as one of the most important naturalistic and environmental sites on the planet. In recent decades the increase in the local population and the flow of tourists are giving the first signs of unsustainability in this fragile ecosystem. Among the major issues that are emerging is that there is an uncontrolled population growth with a corresponding increase in the demand for water and the related need to treat wastewater. The wastewater management system presently adopted, presents numerous criticalities. Over the years, various types of action to deal with this emergency have been proposed; a project of a centralized system for drainage and wastewater treatment is currently undergoing a slow realization. The main objective of the present study is the evaluation of the actions to be taken to ensure a healthy environment for tourists and residents of the island, and, especially, to maintain the ecosystems of this extraordinary island, identifying a model of wastewater management that is economically and technologically sustainable. The study was carried out according to the Millennium Development Goals, national legislation, and following the suggestions of the Pan American Health Organization.

5 Microorganisms' Role on Environmental Sustainability and Using as a Feedstock for Eco-Friendly Fuel Biodiesel Production.

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Land-crops derived biodiesel may not be able to fulfill the increasing worldwide demand for transportation fuel, due to the competition with food, and need for large areas of land, water and synthetic fertilizers for their cultivation. Microalgae have been recommended as adequate feedstock surrogates for biodiesel production. These microorganisms minimize competition with conventional agriculture, have fast growth rates, utilize a wide variety of water source, recycle stationary emissions of carbon dioxide, and have high areal productivity. The present study compares the efficacy of diverse lipids extraction and fractionation methods applied to the oven and freeze-dried biomass of *Chlorella vulgaris*, autotrophically cultivated in 10-L photo-bioreactors. This study points to the Bligh and Dyer extraction technique as the most productive among the tested methods; however, in view of its high toxicity, the Hexane/ Isopropanol method was indicated as the most adequate for being the second most productive and low toxic in this research, besides showing the higher neutral lipid content when applied to both, the oven and freeze-dried algal-biomass. The correlative models applied to the fatty acid profiles showed that microorganism based biodiesel has high quality as fuel, which may be suitable for countries with colder climates, without any modification. Moreover, microorganisms such as algal, fungus and bacteria which act as producers and decomposers in an ecosystem if scientifically and adequately explored, may play an important role in energy production, environmental sustainability and natural socio-ecological systems.

6 Minimizing Energy Loss of MicroGrids via Network Reconfiguration

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The aim of MicroGrid (MG) reconfiguration is to improve the operation efficiency via modifying the network topology by changing the status (open/close) of the circuit breakers or switches. In this paper, a new reconfiguration algorithm for unbalanced power flow calculation is proposed. This algorithm is based on network connection matrices, which are the modifications of bus injection branch current (BIBC) and branch current bus voltage (BCBV) matrices. Next, an objective function that is composed of the power loss, and the operation constraints is proposed for minimizing energy loss of the MG. Further, both the prediction of generation of the PV units and load demand was also considered in this study. Finally, the proposed approach, which consists of an objective function and a new reconfiguration algorithm is tested by the IEEE test systems and the first outdoor test bed that is established by Institute of Nuclear Energy Research (INER) in Taiwan. The simulation results demonstrate that the effective and robust proposed approach can operate in the real MG for minimizing energy loss.

7 Planning and Management Options for Pastoral Resources: The Case of the Mecheria Region (Algeria)

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The pastoral crisis in Algeria has its origins in rangeland degradation, which is the main factor in any activity in the steppe zones. Indeed, because human and animal populations are increasing within a shrinking living space, the remaining steppe rangelands are being overused. Knowing the amount of biomass available and the practice of grazing options, an accounting of the "Use Factor" factor remains an essential method for managing pastoral resources. This factor has three important values: at 40%, pastures can be conserved; at 60 %, pastures begin to be overgrazed; at 80%, destructive grazing commences. The accessibility of the pasture is based on our field observations of a type of flock during a grazing cycle. The main purpose of these observations is to highlight the speed of herd grazing. Several individuals from the herd were timed to spend an average duration of about 5 seconds between two tufts of grass that are separated by a distance of one meter. This gives a rate of 5 s / m (0.72 km / h) flat. This speed varies, depending on the angle of the slope. Knowing the speed and slope of each pixel of the study area, as given by a Spot Image (MNE) digital elevation model, and whose pitch is 15 meters, a map of the pasture, according to distance, is generated. Knowing the stocking and biomass available, our examination of the commons in Mécheria, at regular distances (*i.e.*, 8.64 Km or 12 hours of grazing, 17.28 Km or 24 hours of grazing, and 25.92 Km or 36 hours of grazing), offers three different options (conservation grazing: utilization at 40%; overgrazing: use at 60%, and destructive grazing: use that exceeds 80%) for each distance traveled by sheep. The starting point is the town of Mécheria.

8 Recent Advancements in the Control of Chlorinated By-Product: An Analytical Review

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Sustainability of drinking water has become a global concern due to an increase in microbial contamination in drinking water sources. Trihalomethanes (THMs) are frequently detected disinfection by-products (DBPs) during chlorine disinfection to control microbial contaminants in a drinking water supply. These THMs were formed during the disinfection process when halogen reacts with Natural Organic Matter. Chloroform is the most prominent Trihalomethanes Species, formed during the chlorination of drinking water. Epidemiological studies have deciphered close association between chloroform and cancer. Chloroform elicits a non-genotoxic- cytotoxic mechanistic approach towards hepatic and renal hyperplasia. Vulnerability to these hazardous compounds has been found to cause other long term health repercussions as well. However, various scientific efforts have been made to mitigate the adverse effects of these halogenated by products. This review provides insights into contemporary DBP reduction technologies in terms of their efficiency, efficacy and feasibility. Recent scientific approaches have deciphered 'Nanoremediation' as the most efficient technology to reduce chlorinated by-products. Nanomembrane filtration elicits 99% efficiency in Trihalomethanes elimination followed by Fenton's reaction dependent process with 90% removal rate. Regenerative magnetic TiO_2 has exhibited NOM elimination efficiency by 86%. Activated Carbon adsorption technique is another effective alternative which has been found to reduce these carcinogenic by-products by 68%. Zirconium Coagulation has also contributed to the remediation perspective of trihalomethane removal.

9 Research on the Grid-Connected Photovoltaic Control Strategy Based on Cascaded Multilevel Inverter

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As a clean, well-resourced and green renewable energy, solar energy has become the focus of human exploitation. Grid-connected photovoltaic (PV) generation technology can transform solar energy into grid-connected electricity, and it has become the most important development trend of PV generation in the world.

This thesis analyzes the study status and development prospects of the PV system worldwide, and compares the topology and control strategy of an inverter in the PV system. Further, the PV grid-connected system with a cascade multilevel inverter is selected as the study object. Then, based on the V-I (voltage-current) characteristic of PV arrays, this thesis focuses on the incremental conductance control method of the maximum power point tracking. Studies on cascaded multilevel topologies, control strategies and Cycle Carrier Disposition PWM (CCDPWM) control method were used. This necessitates an improved double-loop control strategy in the grid-connected PV system with cascade multilevel inverter, including the inner current loop, the outer voltage loop, and MPPT tracking control loop. Lastly, Matlab/Simulink is used to simulate this method as it can make the output current and grid voltage the same frequency and phase.

10 Research on the Sustainable Development of Power Sector Considering the Regional Differences in China

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With 35 years fast development, China has become the biggest energy and electricity consumer in the world. The rapid process of industrialization and urbanization leads to immense energy demand and accompanied GHG emissions. The low carbon electricity is one of the key issues of its sustainable development. Due to the vast territory, in China different regions have different energy resources and different load demand characteristics, such as about 80% wind resource locates in the northeast, north and northwest regions; solar resource concentrates in the northwest region; the maximum load demand throughout the year usually appears in August in the North, East, Central and South regions, while other regions have their maximum load demand in December. It is a great challenge to make full use of these different resources and characteristics. As the interconnecting smart grid technology continues to mature, from 2009 China has begun to build a strong smart grid and the optimization of resources and characteristics covering a wide range has become possible. The paper first gives the overview of energy resources and load demand characteristics of six regions in China, and then introduces the model of Integrated Resource Strategic Planning (IRSP) which is a useful tool to implement cross-region power planning and demand side management. By using this IRSP model, two scenarios are projected, and we study the impact of regional differences of energy resources and load demand characteristics on low carbon electricity until 2025 in China. It can be found that with the help of interconnected smart grid, China can better use the different resources and characteristics between regions to promote the development of renewable energy and demand side resources, and achieve greater emission reduction. Some important development paths are also discussed. Finally, we give some suggestions about future sustainable development of the power sector in China.

11 Run off Simulation in Urban Watershed by Using an SWMM Model

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In accordance with the trend of expanding cities and the increase in building in cities, the argument of runoff and floods as a problem in cities has been raised. One of the existing difficulties is drainage. In this research, we show that urban flood drainage systems do not have enough capacity for runoff. Similarly, by evaluating the Marivan Watershed and other existing solutions, the analysis of the prepared result of the SWMM model has been used to manage runoff and urban floods. The result indicated that nodes that are located near the basin outlet and devoted to a higher volume of runoff should be more robust because the discharge values of the main outlet of the Marivan drainage network in the 2,5,10,25,100 are 7.495,10.62,12.66,15.93,18.36,20.82m³ /s return periods, respectively. In addition, the output of the model showed that, on average, 45% of junctions of drainage systems in the urban areas are in a position that could lead to floods, and extreme rainy periods cause passage water logging in urban areas.

12 Sustainable Bricks for Buildings

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With the increase in the amount of plastic waste globally on a daily basis, modern communities have to provide practical and strategic ways to recycle such materials. Several methods are currently available to deal with plastic waste. In this work, plastic waste in forms of post-consumer high density polyethylene (HDPE) jugs, containers, *etc.*, were converted to long term usage applications as bricks for buildings. This method offers an environmentally friendly and sustainable solution to the massive usage of concrete in making bricks for buildings. Dust emitted from cement factories may also be harmful to human health. The method suggested here is a practical and environmentally sound solution to this problem where bricks can be made from the mixtures of plastics waste (HDPE) as a major phase and concrete as minor phase. The bricks made by this method are clean, stiff, and have good properties in comparison to concrete, such as specific gravity and thermal insulation. Furthermore, and most importantly, such bricks are recyclable while conventional building bricks are not.

13 The Design and Optimization of a Molten Carbonate Fuel Cell, Gas Turbine and Organic Rankine Cycle Hybrid System

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An optimized hybrid system is proposed, which integrates a molten carbonate fuel cell (MCFC), a gas turbine (GT), and an organic Rankine cycle (ORC). In this work, the cathode outlet is split into two streams, one that is recycled to the fuel cell stack and another that is sent to a gas turbine for recovering residual energy. This case deals with waste heat recovery from gas turbine exhaust gas using an ORC as a bottoming cycle for additional power production, which yields high electrical and overall efficiencies. After designing and simulating the process, a sensitivity analysis was performed to determine the effect of key design and operating parameters on system performance. Finally, an optimization method was utilized to determine advantageous operating conditions and an optimal thermal design. The main advantage of this kind of hybrid system, in addition to efficiency improvement and cost reduction, is the ability of the system to decrease harmful emissions and negative impacts on the environment.

14 The Impacts of Droughts on Carbon Cycling of Grassland Ecosystems: A Review

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A comprehensive understanding of the impact of droughts on grassland carbon (C) cycling will provide significant information for making decisions about drought mitigation policies and carbon management programs. With global change occurring rapidly, increases in the frequency and/or intensity of droughts can dramatically shift the structure and function of sustainable grassland ecosystems. However, the full scope of drought-carbon dynamics has not yet received much attention in climate-impact research on grasslands. This paper provides an overview of the current state of knowledge on the relationship between drought and grassland C cycling, which is characterized by the intensity, frequency (duration) and timing of the drought. Surprisingly, droughts are one of the most prominent natural threats of grassland C cycling, although the magnitude of this threat is uncertain due to the different drought scenarios. To some extent, the other disturbances induced by droughts can more or less change the impacts of droughts on grassland C cycling, either singly or in combination. Moreover, a conceptual model has been proposed to explain the mechanism of the influences of droughts on grassland C cycling. At present, studies that have assessed the impact of droughts on grassland C cycling are qualitative, and there are less quantitative researches. It is possible that data-model fusion has become essential for assessing the fate of grassland C from the perspective of global change and sustainable-development time.

15 The Social Impact Arising from Risks Associated with Healthcare Waste Management

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Ensuring the quality and safety of human life is unequivocally connected with the establishment of a sustainable healthcare system. Unfortunately, the provision of health services is associated with the generation of waste that might be infectious or otherwise hazardous. Therefore, it can have a detrimental effect on human health and on the environment. On the other hand, reducing this waste stream is very difficult because of issues surrounding the quality and safety of the healthcare services. This paper analyses the possible social impact related to the occurrence of adverse events in the medical waste management system (understood as improper healthcare waste handling and treatment). The concept of social impact refers to (in the case of the healthcare waste management system) all cases where there is a risk of causing ill health or loss of life, or the possibility of trauma and the deterioration of healthcare services. Exposed groups are people directly related to the healthcare waste management system: healthcare workers, patients and the employees of waste treatment companies. The main sources of risk, in this case, are not only hazardous (e.g., infectious) substances, but also the possibilities of trauma (e.g., cases of contact with pathological waste). In addition to the direct effects, secondary impacts arising from the exposure to environmental damage caused by healthcare waste should be taken into account. The causes of these impacts are emissions during waste transport and processing but also the impact of illegal disposal of healthcare waste. Such impacts will primarily affect people living near waste generation areas (hospitals), or waste disposal sites, and, in the worst scenario, living in the vicinity of the illegal storage of healthcare waste.

16 The Status of Biodegradable Polymers for Packaging Applications

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This paper provides an overview of the latest developments in biodegradable polymers for food packaging. These materials, *i.e.*, biodegradable polymers, offer a sustainable solution for replacing non-environmentally friendly packaging materials, such as those made of synthetic polymers and hazardous metals. More emphasis will be given to poly-lactic acid (PLA), as it has been gaining great attention lately, due to superior properties and commercial availability. PLA alone, without additives, is vulnerable to gas and moisture permeability. However, by adding traces of fillers, such as clay platelets, one may improve the gas barrier properties of PLA films. The latest research view of modified PLA films for food packaging will be given here.

17 Towards an Innovation of Integrated 'Online Sustainability Interventions': Exploring Users' Technology Acceptance of Current Situations and Future Directions

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The revolutions in Internet online services delivery approach have transformed the way of people interact with technology, resulting in the exponential growth in the number of online users. However, various consumers' characteristics and the way of providing services online make a dramatic change in user acceptance and perceived value of technology Innovation. Therefore, user perception is a vital issue for investigating user intentions to adopt the online sustainability interventions services. The scope is to examine the perceptions of users' adopters and non-adopters of online sustainability interventions in terms of their experience towards existing service delivery approach and their expectation of future innovation perceived characteristics. User perceptions paved the way to contribute to defining an initial roadmap for exploring the evolution of 'interactive sustainability interventions services' in the Internet and their approaches to online service delivery.

We highlight the general need for a value-added, integrated intervention solution and the specific demand of Internet users for the integrated online interactive delivery of services to serve their particular interests.

We discuss several traditional approaches in related fields of electronic service delivery and show how the current situation demands a shift towards an integrated intervention service management solution that considers the interests of all stakeholders.

18 What are the Socio-economic Impacts of Genetically Modified Crops Worldwide? A Systematic Evaluation of the Research Evidence Available in Six Languages

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Massive increases in the quantity of studies are making possible progresses in analyzing and understanding major societal issues, such as the socio-economic impacts of genetically modified (GM) crops. Governments and stakeholders display a growing interest for evidence-based policy-making. Policy decisions based on flawed single research may affect millions of people. Decision-makers do not access to sufficient information to comprehensively evaluate key societal issues. Doing so requires a review of the available evidence across an entire range of socio-economic effects. We are systematically evaluating research evidence to determine what sorts of studies have been conducted related to the socio-economic impacts of GM crops, what sorts of outcomes the studies have been assessed, in which populations, and using which methods. We are analyzing the evidence issued from 1996 to-date available in Chinese, English, French, German, Spanish, and Portuguese; based on standardized systematic review methods as specified in our protocol, published in a peer-reviewed journal. The work focuses on six areas of socio-economic research: farm-level, co-existence regulations, supply chain, consumer-level, food security, and environmental economics. It is expected that this work will allow us to ascertain the current structure of the evidence, identify research gaps, and guide the allocation of future research resources.

19 A Methodological Framework for Developing Sustainability Nudges

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Policy-makers and companies, aiming at promoting sustainable consumer behavior and choices (*e.g.*, conserving energy, avoiding food waste, buying “green products”), have increasingly become interested in the concept of nudging. Nudging makes use of the fact that people’s behavior and choices are not always based on rational decision making. Consumers frequently rely on mental shortcuts, heuristics, and biases, which can be instrumentalized, such that people are gently nudged towards the desirable behavior or choice. Scientific research suggests that nudges can successfully influence a variety of sustainability outcomes (*e.g.*, thermostat settings, meatless food choices, recycling) in a variety of settings (*e.g.*, at the point of sale, in consumers’ homes). However, the application of nudges in practice usually proceeds atheoretically, without the monitoring or evaluation of its effect on consumers. Thus, we would like to promote an interdisciplinary, methodological framework, which relies on contemporary insights from behavioral economics, psychology, sociology, and marketing. The framework, presented in detail in our conference poster, serves as a “cookbook” for the development and evaluation of evidence-based nudges in the area of sustainable consumer behavior and choices. Our main sustainability goal is to provide policy-makers and companies with applied, evidence-based nudges, which can directly be implemented in their sustainability policy and marketing strategy.

20 An Acceptance Research of Using Electric Vehicle Sharing for Rail Transit Connection

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Electric vehicle sharing (EVS) can, not only reduce the private cars transport costs, energy consumption, and greenhouse gas emissions, but also ease the parking, congestion, and other issues. It is an important way to supplement the existing transportation system and realize social sustainable development. This study attempts to explore the acceptance of respondents' attitude towards using EVS as rail transit connections. To do this, a paper questionnaire was conducted with residents who often use rail transit in the Jading district of Shanghai. Then, using 272 responses of the 300 participants (a response rate of 90.7%), binary logistic regression models were developed for four types of charging modes: (1) annual fee charging mode, (2) non -annual fee charging mode, (3) mileage pricing mode, and (4) the fare share mode. After a comprehensive analysis, these modes suggested that factors influencing the acceptance of EVS for rail transit connections were job and housing, transportation costs per month, time for going home from railway station, and the number of owned private cars. According to the results, the non -annual fee charging mode affected most by the number of owned private cars was more popular, but the attraction by consumers to the most economical mode, *i.e.*, the fare share mode, was relatively low. Thus, we suggest that cities with high per capita vehicle ownership should not adopt the non -annual fee charging mode, and that the annual fee charging mode is more suitable for the cities that have long travel distances and more migrant workers. In addition, consumers were sensitive to the price range of this new transportation pattern. Therefore, in the initial development period, research is needed to formulate reasonable prices to expand the number of users and, finally, promote the sustainable development of society.

21 Assessment of the Urban Heat Island in Morocco Using Satellite Tools for Sustainable Cities

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Cities are great for social living and development. They allow the sharing of natural resources and thus must play a role in the sustainability of the climate and the environment. This research is multidisciplinary in nature and involves both sides of the natural and social sciences with a deep understanding of sustainability. This study focuses in the impact of urban and build-ups on the surface climate. One of the ecological consequences of urbanization is the urban heat island (UHI) effect, which leads to higher temperature in urban areas than surrounding suburban/rural areas. This urban heat, combined with warming due to climate may have impacts in terms of energy use and human health. Landsat and Modis are complementary instruments with a unique opportunity to describe the effects of the urban in its immediate environment. In this study we will use satellite data “LST,NDVI,LULC and % ISA” in a spatial analysis to assess the urban heat island generated by buildups, its amplitude, its size and its relationship to different ecological setting for the most populous cities in Morocco between 2000 and 2014. We will also explore the relationship between the UHI and the shape of the urban settlement. The results of this study will facilitate the development of a set of mitigation and adaptation measures for decision makers and urban planners to create socially and environmentally sustainable cities.

22 Data for the Center's Healthy and Sustainable Food Program of Cote d'Ivoire: Study of Glycaemic Index and Load Values Tested in Normoglycemic Adults for Five Staple Foodstuffs

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The food we eat determines how healthy we are; however, our food may do more harm than good, both to our health and to the health of the land and oceans that provide it. There is currently an increased global interest in the published glycaemic index (GI) and glycaemic load (GL) values of foods. At the same time, the Center's Healthy and Sustainable Food program of developing countries, such as Côte d'Ivoire, a country that aspires to be among emerging countries by 2020, have, unfortunately, very limited data on choices for diet. Thus, the study aimed at finding the GI and GL (two nutrition indicators) of the main food staples in Côte d'Ivoire. Following the International Standard Organisation's protocol (ISO/FDI 26642:2010), a selection of five staple foodstuffs were tested for their GI and GL. Fasted healthy subjects were given 50 g of available carbohydrate servings of a glucose reference, which was tested twice, and test foods, which were tested once, on separate occasions. Except attieke (GI 63), the majority of foods tested had a high GI (GI > 70). Attieke (agbodjama) had a high GL (GL 29), while placali (GL 17) and maize meal stiff porridge (GL 16) had medium GLs. The GLs of pounded cassava-plantain and pounded yam are 26 and 22, respectively. Consumption of attieke could minimize postprandial blood glucose spikes, in spite of a high GL, and potentially have benefits for the management and prevention of some chronic diseases. Such data would be of prime importance for the policy makers of the Ivorian Ministry of Health and Public Hygiene in order to promote sustainable consumption by the healthy consumers.

23 Energy Usage of Residents on Offshore Islands in Taiwan

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A field study was conducted through interviews on offshore islands in Taiwan to investigate the energy usage of local residents. A comparison of household appliance usage in mainland Taiwan with that on the offshore islands revealed that, overall, the most commonly used household appliances are steam cookers/rice cookers, water dispensers, and washing machines. For other household appliances, Levels 2 and 3 offshore islands have lower use penetration rates compared with those in mainland Taiwan and on Level 1 offshore islands, particularly for the use of computers. By contrast, the use penetration rate for chest freezers on Levels 2 and 3 offshore islands is high, and each household has one or more freezers on average. This appliance is not a commonly observed household product in Taiwan or on Level 1 offshore islands. Furthermore, because of the government policy, every household on parts of Level 2 offshore islands and on all Level 3 offshore islands has a fixed monthly charge of electricity. The transportation of liquefied petroleum gas is also inconvenient, and the gas price is slightly higher, leading to the tendency of residents to consume excessive amounts of electrical energy, which does not correspond with the aim of the government to conserve energy and reduce carbon emissions; thus, the relevant authorities' review and improvement on energy consumption on Levels 2 and 3 offshore islands are required.

24 Finding Solutions for Sustainable Fish Consumption

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Healthy and safe food produced in a sustainable way is a priority for every modern society. Fish is a food for which these three priorities conflict. Because fish consumption is considered good for health, health organizations provide dietary advices on how much fish to consume. But how would such advice look, when sustainability is taken into account? Would it focus on wild or farmed fish? Would it suggest alternative sources of n-3 fatty acids? These questions are addressed using two recently developed sustainability tools. The first is the Sustainability Assessment Identification Key, which is a question articulation tool that helped us to transparently select methods based on articulation of the question, the context, and the view on sustainability. The second tool is a procedure that is followed to structure the process of finding possible solutions, and compare their score on sustainability with a multi-disciplinary team and stakeholders.

25 Innovative Concepts for a Demand - Oriented Supply

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The research project deals with the acceptance behavior of consumers with respect to the penetration of infrastructure measures. The main question to be answered is: How can energy-consumers be supplied with decentralized systems in a sustainable way and under what conditions are consumers motivated to change their behavior in such way so that the existing and expected drawbacks will be avoided. For the qualitative study, a two-round Delphi study was conducted with adequate experts. The experts are practicing politicians, economists, and scientists. Moreover, a choice experiment was conducted. Therefore, a specialized questionnaire and choice set were developed respective decentralized energy systems. The purpose of the choice experiments with 500 data sets is to find out the different factors influencing decisions regarding sustainable consumer behavior, as well as the willingness-to-pay for changes meeting requirements of sustainability. Results to date have shown that global trends and political guidelines will have an impact on the environment and will change consumers' behavior. Nevertheless, adjustment measures of consumers, which will result in an efficient usage of raw materials, deployment of new effective technologies and other behavioral changes, are required. The Delphi study gave a comprehensive overview of how diversified the opinions are regarding a sustainable development and the corresponding social, ecological, and economic aspects. It also showed that the consumer plays a crucial role in this interaction and makes a significant contribution in this progress. All experts agree with the assumption that decentralized energy systems will increase as time passes. This will first have a positive effect on the environment due to, e.g., less air pollution, and, second, will enhance flexibility, as well as independence from foreign countries. Moreover, the choice experiment indicates specifically to what extent consumers are willing to change their behavior in a way that will protect and enhance the environment.

26 Perceptions of Climate Change and Lifestyle Implications in Saudi Arabia

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While a number of studies reporting public views on climate change have been conducted in the Western world, public perceptions and responses in developing economies remain unknown. The paper focuses on Saudi Arabia, one of the world's largest oil producers and consumer of fossil fuel energy per capita, and reports results from a recent survey (n=1173), undertaken in April 2015, exploring Saudis' overall perceptions on climate change. In particular, the survey explores: (i) the link between impact of noticed signs and perceived importance of climate change; (ii) perceived concerns and ways these translate into obligations in collective actions and responsibility; (iv) perceived climate induced localized risks; and (v) willingness to change daily lifestyles or negative behavior.

27 Social-Economical Evaluation of Sustainable Urban Development Using Regional Planning Models: a Case Study in Bam City, Iran

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Today, in the new doctrine framework for urban development, "the constant development paradigm" has been considered to be the basic procedure in urban planning for the purpose of overcoming the current challenges of the third thousands. In the framework, urban societies and urban people and the people they are living with, are taken into account altogether and in a concrete way, since in urban places, constancy means ensuring that a balance is made among human and social, economical and environmental dimensions. Bam city faced great changes in social and economical aspects after that earthquake in 2003. Because of the importance of this issue and lack of spatial uniformity of the studied regions, this researcher became interested in investigating the current state and constancy level of Bam districts. The research method is descriptive–analytical, based on formal secondary data. The TOPSIS rating model and human development composite index model (HDI) are used in the current research in order to rank the districts in Bam city based on social and economical index of constant development and of course in order to validate the research findings. A geographical information system (GIS) is used to draw and provide maps. Results indicate that according to social-economical criteria, the 5th district is in a better and more constant state compared to other districts in Bam. Moreover, district 4 is the least constant part of Bam city; it clarifies the development priority and necessitates focusing much more attention on district 4 in following and future development plans in accordance with constant development of these areas.

28 The Concept of Binary Evaluation of Freight Quality Partnership's Impact on the Principles of Sustainable Development in Cities

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The aim of this article is to present the essence, the key features and characteristics, as well as to identify barriers and conditions related to the implementation of Freight Quality Partnership for the idea of sustainable development in cities. It was assumed that it is a strategic platform for cooperation between all stakeholders, which promotes integrated actions to reduce the negative effects generated by urban freight transport. The achievement of this theoretical aim primarily involved the “case study” method and the analysis of “good practices”. Moreover, the achievement of the cognitive aim involved empirical research based on the model of the so-called “Pyramid of Stakeholders”. Based on the binary approach, *i.e.*, the optics of decision-makers, using the expert method and focused optics of beneficiaries in the form of a survey conducted among suppliers, which apply both to expectations of senders and recipients of goods (vendors and service providers), it was possible to obtain a precise picture of the functioning of urban freight transport in the surveyed area in the city center of Szczecin. The final result of this article was to propose an original concept of evaluation of the implementation of Freight Quality Partnership, which will be used in the project GRASS (Green And Sustainable freight transport Systems in cities), in the form of a “Sail Model”, which should become a recommendation for such partnerships. It is based on the quality of interventions undertaken (merit-quality) and its value, seen primarily in economic terms (worth-value).

29 The Impact of Space-Time Constraints on E-Shopping Behavior: Evidence from Nanjing, China

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The prevalence of e-shopping has raised concern that traditional in-store shopping might be replaced by e-shopping because of its potential for saving shopping travel and supporting sustainability on both the local and global scales. Recent studies have examined what factors affect people's preferences for e-shopping in developed countries. However, to date, exploration of the impact of space-time constraints on people's e-shopping behavior in the context of China's fast, increasing share of on-line consumption from the geographical perspective is rare. In light of this, taking the Chinese metropolis Nanjing as a case, this study examines the relations between space-time constraints and people's e-shopping behaviors. It focuses on how shopping accessibility and daily working time exert influence upon an individual's practice of e-shopping and frequency of buying online. Using a shopping survey dataset, this paper presents a logistic regression model to examine this question. The results reveal that people with lower accessibility to local in-shopping sites and more working hours are more likely to engage in e-shopping. The underlying explanation is that e-shopping improves shopping efficiency and removes the distance constraint. Given the spatial residence distribution, it can be inferred that the prosperity of e-shopping is expected to reduce car travel in the suburb areas of Nanjing.

30 Urban Sustainable Development Based on Agglomeration Economy: Evidence from Chinese Cities from 2005 to 2011

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Agglomeration economy plays an important role in promoting urban sustainable development, and externality is the source of agglomeration economy. From an agglomeration economic perspective, we used the panel data of Chinese municipalities and a fixed effect model to analyze the relationship between externalities and urban economic growth. Generally, the specialized industrial structure brought in Marshall-Arrow-Romer externality, while the diversified industrial structure produced Jacobs externality. In contrast to Marshall and Jacobs' views, we found a U-shaped curve between the diversified industrial structure and output per capita of a city, based-on the theoretical analysis and empirical test. Also, we found an inverted U-shaped curve between output per capita and specialization. Our results further indicated that whether the specialization and diversification of industry had a positive impact on economic growth depended on the city-size. Overall, a highly specialized industrial structure has a detrimental effect on economic growth of a city as the city-size increases, and a diversified industrial structure was more beneficial to the city's economic growth. In order to promote the sustainable development of urban economy, small cities and middle sized cities can take advantage of the benefits of a specialized industry structure. In contrast, a diversified industrial structure could be encouraged to accelerate knowledge spillover in large cities. On the whole, the paper endorses the agglomeration economy theory and contributes to research on urban sustainable development.

31 An Integrated Organizational Management Model for Overcoming Sustainability Challenges

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Unprecedented global environmental, social, and economic issues require innovative solutions from different worldviews and perspectives. Diminishing natural resources, environmental pollution, and persistent social inequalities in many countries clearly indicate that the current economic model is increasingly inconsistent with public expectations. Corporate interests are increasingly determining economic globalization, and the development of private business interests is increasingly at odds with public interests.

Due to the negative effects of economic development on society and the environment, private businesses (especially large global corporations, which have gained more power over the years) have been successfully exploiting free market ideology. To change the destructive direction of this established practice, it is necessary to involve business in the decision processes concerning the world's most pressing issues, and work together to create a sustainable future for the world. This paper aims to develop and validate scientific and practical solutions for presenting a conceptual, integrated organizational management model while expanding upon the relationships among organizational management systems, social responsibility management, and stakeholder management, in pursuit of sustainability.

This paper makes several contributions. First, it enriches the literature on sustainability by extending the existing understanding of, and discussions on, the development of stakeholder management issues. Second, the paper enhances the theoretical foundation of analyzing, and contributes to the body of knowledge concerning, relations between organizational sustainability and stakeholder management. As a result, an all-embracing organizational management model is presented. The model accounts for the practical and theoretical implications of socially responsible and stakeholder-oriented management in pursuit of organizational sustainability. The theoretical discussions have been inspired and deducted from theories concerning stakeholders and the management of their relationships, corporate social responsibility, and sustainability by revealing their interfaces in organizational management. The benefits of an integrated management system model in an organization are reasoned. Also, the model may be used to explain the actual behaviors of organizations, with respect to their aspirations for sustainability.

32 Are Co-Operatives Key to a Sustainable Development in Europe?

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According to Angela Merkel, co-operatives are role models for pooling economic, ecologic and social interests as well as for future-orientated management, and the UN regards co-operatives as key to a sustainable development (SD). As co-operatives are institutions which allow us to address several problems related to the profit-oriented capitalist economy, the extent to which co-operatives can contribute—or even be key to—a SD in Europe was investigated along the 17 Post-2015 SD goals (SDG) proposed by the UN. It could be found that co-operatives can contribute significantly to most of the SDGs, especially in the areas of health promotion, education and energy provision, environmental protection, equity enhancement and the creation of strong, resilient communities. While co-operatives have to cope with the threats of an over-commercialization entailed by a disregard of the core values and slow democratic decision processes, co-ops can facilitate behavioral change towards strong sustainable consumption and are well-suited to our post-industrial society. Therefore, the role of co-operatives in Europe should be strengthened. Especially, an intensified education about, and promotion of, co-operatives together with a reduction of legislative barriers, could amplify the positive impact of co-operatives on a SD.

33 Can Social Components Drive Sustainable Development? The Case of Family Farms in Southeast Spain.

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While it is widely accepted that sustainable development is rooted in the interplay of economic, environmental, and social pillars, the social aspect of sustainable development has received less attention. Although more recently, the close link between social and environmental objectives has been accepted (e.g., the eco-social perspective), analyses of the roles of social components in multidimensional sustainability are scant. The present paper, however, approaches the question from the viewpoint of the social dimension as a driver of sustainable development. With this aim in mind, social factors in the farming system in southeast Spain are analyzed. Pursuant to the case study method, several indicators were identified: i) socio-economic indicators: economic structure linked to society and social capital, and the participation of social organizations in the management of economic development and equity outcomes; ii) eco-social indicators: responsible use and management of natural resources, and the intergenerational transmission of environmental concerns. The analysis shows how family farms and their networks integrate socio-economic and eco-social goals, so as to contribute to the generation of synergies and trade-offs between the various dimensions of sustainability. This study provides a new perspective on social issues regarding sustainability policies, especially with respect to the role of family farms in the framework of European rural development.

34 Combatin Corruption in the Private Sector for a Sustainable Future: A European Legal Approach

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Corruption is one of the greatest obstacles to sustainable economic, political, and social development of countries. The national criminal laws and international agreements have focused on punishing the conduct of corruption that affect Public Administrations. Nevertheless, it is quite frequent that a person, who has any capacity to do so, directs or works for a private sector entity, by themselves or through an intermediary, receive, request, or accept benefits or advantages of any nature, not justified, in exchange for inclining his decisions in the favor of those providing the benefits, causing them to breaking their obligations in the acquisition or sale of goods or in the hiring of professional services. In this regard, private-to-private corruption has similar negative impacts on public corruption: fewer jobs and lower growth. In order to criminalize both active and passive corruption in the private sector in all Member States, the Framework Decision 2003/568/JHA was approved. The aim of this paper is to analyze, from a comparative perspective, the crime of corruption in the private sector in Europe.

35 Developing the Low-Carbon Chemical Industry: A Comprehensive Study on the Evaluation System and Strategic Measures

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Concerns about the anthropogenic climate change and fossil fuel depletion caused by continuously increasing greenhouse gas emission and energy demand make low-carbon economy a strategic alternative for sustainable development. It is well known that the chemical industry is one of the leading business sectors in the world, making a significant contribution to the global economy; while the high energy consumption and environmental pollution of the chemical sector has aroused not only wide public attention but also considerable scientific controversy. Thus, development and deployment of low carbon economy in the current chemical industry, namely the 'Low-Carbon Chemical Industry', is now the cutting-edge research topic. In this study, we mainly focus on the theory, evaluation system and strategic measures of the low carbon chemical industry. On the basis of conceptions corresponding to the low carbon economy, industrial ecology, green chemistry and sustainable development, we have built the basic theory of the low-carbon chemical industry, established an evaluation indicator system, and analyzed the state of the global and local low-carbon chemical industry, and systematically reviewed the global policy, institution and technology system related with development of the low-carbon chemical industry, aiming to provide decision-makers knowledge and guidance concerning engineering practices for low-carbon chemical industry construction, as well as to advocate and lead the way in low-carbon development.

36 Environmental Management Systems (EMS) Used in Green Public Procurement (GPP)

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Public authorities are major consumers who could make a significant contribution to the development and support of production for green products whenever they direct their buying power towards the acquisition of ecological goods, services and works. Under these circumstances, orientation towards green public procurement (GPP) through the introduction of requirements for environmental sustainability in the task agenda of public authorities could represent a strong incentive for eco-innovation. Our paper aims to analyze the national and community framework of the environmental aspects when public institutions make public procurement and deliver outcomes related to sustainable development from the perspective of environmental protection. At the same time, even if there are legal possibilities to use the environmental management systems to integrate the requirements for environment protection in the public agenda, certain aspects limit the effective application of green procurement. Our study highlights the potential benefits, as well as the main obstacles, that come in the way of the efficient application of green public procurement.

37 Financial Support and a Firm's R&D Innovation: The Impact of Energy Efficiency on Sustainable Development

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In recent decades, energy consumption has been accelerating as China's rapid economy grows. Improving energy efficiency has become a central issue for sustainable development. Previous studies show that the promotion of R&D innovation is a function of finance; enterprises can increase their R&D investment via financial support, and this process will eventually increase energy efficiency. In addition, changes in industrial structure and energy price will also impact the improvement of energy efficiency. In light of the above, we point out three main factors that affect energy efficiency: finance-investment rate, energy price, and industrial structure. By constructing a vector auto regression model, our results show that: (1) R&D investment is the main impetus behind the promotion of energy efficiency, and financial support is a powerful guarantee for realizing this process; (2) changes in industrial structure will have negative effects on energy efficiency; increases in the secondary sector in China have led to rising energy demand, but, this will not promote the improvement of energy efficiency; and (3) our results show that energy efficiency is more sensitive to changes in energy price; however, rising energy prices will have a significant impact on energy efficiency in the short term, but will not have lasting effects in the long run.

38 Study on the Influence of Political Connections on Enterprise Values of Listed Companies in Different Industries in China

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This research explored whether differences exist among companies from different industries in terms of influence of political connections (PC) on enterprise values. This cross-sectional study focused on the influence of such connections to reveal the comprehensive influences of the intensity, depth, growth, and other factors. Results show that PCs exert positive influences on enterprise values of industries with strong, comprehensive political connections, whereas they exert negative influences on enterprise values for industries with weak, comprehensive PCs. The intensity of PCs of natural monopoly industries positively influences enterprise values, whereas that of fully competitive industries negatively influences enterprise values. For industries with strong regional protectionism, the negative influence increased with depth of political connection. The rapid growth of political connections exerts negative influences on the promotion of enterprise values, whereas slow growth of political connections show positive influence on the promotion of enterprise values.

39 The Impact of the CDM Project on the Performance of Industrial Firms: Empirical Evidence from China

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The Clean Development Mechanism (CDM) is a flexibility mechanism defined in the Kyoto Protocol to deal with global climate change. It is very attractive for industrial firms in developing countries because certified emission reduction credits could be earned from CDM projects. However, it is not clear how the CDM projects impact the performance of participants. It looks like the CDM project can bring economic benefits from trading the certified emission reduction credits. Nevertheless, are there any other possible influences on the firm's performance, particularly in the core business of the company? This paper details an event study carried out to explore the relationship between the CDM project and participants' performance. Firstly, we used the list of companies participating in the CDM project in China, and used these companies as the sample group. Then a comparison was carried out between the performance before and after participation in the CDM project with the application of one-way analysis of variance. Moreover, a probit model is used to verify the determinants for industrial companies to participate in CDM projects, and the propensity scores for each company are calculated based on the model. Additionally, a comparison group is built with the companies that did not participate in the CDM project but have a similar propensity score with the companies in the sample group. A comparison of performance between the two groups is conducted. The performance data used is from the financial reports of each company. It is expected that the following result will be found: The CDM project has the potential not only to bring economic benefits, but also to be beneficial for the core business income. This might be due to the fact that the environmental image and publicity of the company is improved on participation in the CDM project.

40 Trading in Influence: Its Criminalization in the International Context

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The increased interest in the problem of corruption has produced a lot of national and international instruments, policy prescriptions and reform initiatives. This poster aims to draw a picture of the different types and forms of trading in influence previewed in various international anti-corruption instruments and agreements. These regulations may serve as models for the implementation and criminalization of trading in influence into domestic laws. By presenting and indicating the core issues connected with them, recommendations which may be of use to states obliged to sanction or to consider incorporating this offence, will be provided. The poster will cover the provisions of the only global instrument in this field (the United Nations Convention against Corruption) and of the most important European, American and African sources (especially -but not merely- the Council of Europe Criminal Law Convention on Corruption, the Inter-American Convention against Corruption and the African Unions Conventions on Prevention and Combating Corruption). The individual articles in the international instruments will be compared. The comparison will focus on the following aspects: structure and wording of the provisions, the offending actions, the potential perpetrators, the beneficiary of the advantage and the exertion of the influence within the private sector.

5

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