Sustainability **2014**, *6*, 1203-1221; doi:10.3390/su6031203

OPEN ACCESS

sustainability

ISSN 2071-1050

www.mdpi.com/journal/sustainability

Review

Governing Harmonious Human Engagement with the Spatial Capital

Shukui Tan [1], Haipeng Song [1], Ghulam Akhmat [1] and Javeed Hussain [2,*]

[1] College of Public Administration, Huazhong University of Science and Technology, Wuhan 430074, China; E-Mails: tansk@126.com (S.T.); shp0808@hust.edu.cn (H.S.); ahmad_choudary@hotmail.com (G.A.)

[2] College of Life Science and Technology, Huazhong University of Science and Technology, Wuhan 430074, China

* Author to whom correspondence should be addressed; E-Mail: javed_choudary@msn.com; Tel.: +86-027-8755-9342.

Received: 4 November 2013; in revised form: 7 February 2014 / Accepted: 24 February 2014 / Published: 5 March 2014

Abstract: The unprecedented rate and scale of activities, simulated by human abode in its entirety, is having large and accelerating effects on the integrity of biophysical elements of spatial capital, at local, regional, and global scales. Real appreciation of these effects demands a dramatic change in human manipulation of the spatial capital. Spatial capital can be viewed as processes or a complex matrix, in which not only our spatial but social, economic, and intellectual needs are embedded. Through an extensive synthesis of literature, this study strives to situate as well as manage human abode in context of spatial capital. It focuses on the need of crafting spatial governance, which secures today's needs without compromising the needs of abode for our future generations. For harmonious human engagement with the spatial capital, we focused on following major requisites: (i) filling gaps in the understanding of processes of the respective spatial capital; (ii) integration of this intellectual capital; (iii) and spatial government supported by seamless institutionalisation, and governance processes in a global context. All modes of human abode are unique when analysed in the milieu of their social, economic, cultural, and intellectual yield, and their respective ecological footprint on spatial capital. An essential component of the sustainability of spatial capital is fundamental knowledge of the relevant biophysical processes, which yield the respective social, economic, cultural, and intellectual services we obtain from it. Action-oriented and integrated intellectual capital will yield the required awareness about the spatial capital, which when crystallised into proper institutions their

processes will certainly produce promising outcomes for spatial management. Sustainable spatial constructs can only be produced through horizontal and vertical harmonization in governance institutions from the local to global level. It will not only help in the rehabilitation of the spatial capital but can also enhance it.

Keywords: spatial capital; human abode; domestication of spatial capital; institutionalisation; spatial governance; spatial literacy; harmonious human engagement with the spatial capital

1. Introduction

The immense variety of ecosystem services, on which human enterprise depends and has been acquiring from the entire natural capital, can be categorized into provisioning services (e.g., provision of food), regulating services (e.g., regulation of climate), cultural services (e.g., spiritual and aesthetic values), and supporting services (e.g., soil formation) [1]. All of these services not only make this planet livable, but enrich human life with aesthetic pleasure and spiritual inspiration [1,2]. However, the current mode and scale of procuring these goods and services is seriously affecting the integrity of natural capital [3,4]. It is endangering the very provision of these goods and services.

We have domesticated most of the natural capital, and our activities affect the rest [3,5,6]. Human activities cause three general classes of change in the natural capital, which include: (i) transformation of land and sea; (ii) change in major biogeochemical cycles; and (iii) addition or extinction of species and genetically distinct populations [3,7,8]. The unprecedented rate and magnitude of recent and projected changes is going to have large and accelerating effects on the climate, environment, and ecosystems of the Earth, thereby degrading many ecosystem services at local, regional, and global scales [5,8].

Real appreciation of these changes in their totality, magnitude, and implications demands a dramatic change in human relationships with the environment and life-support systems of the planet [8,9]. Humanity's dominance of Earth needs to be crystallised into an active management of the planet for the foreseeable future [3]: a management which secures today's needs without compromising the ability of future generations to meet their own needs [10].

2. Our Abode in Context of Spatial Capital

Human abode in its entirety can be taken as a sum total of human economic, social, cultural, and intellectual needs. To ensure the provision of this sum total of needs, our abode is held in the natural capital in a delicate balance. Spatial capital can be viewed as processes, or a complex matrix or medium, in which not only our spatial but social, economic, and intellectual needs are embedded [11–13]. Based on an extensive synthesis of literature, this study strives to situate as well as manage human abode, in the context of spatial capital. In this article, we will take human engagement with the spatial capital regarding human abode in its entirety *i.e.*, including social, economic, and intellectual needs.

Human engagement with the spatial capital, in the 20th century, attained new heights of complexity, in all forms. The magnitude and scale of consumption of spatial goods and services is more apparent when we look at the urban manifestations like city, but it is usually ignored for urban forms in which

human abodes are scattered. City finds due attention from most of the administrative hubs, but human abodes lying far off from the cities are usually ignored. Actually, the spaces where human beings live should be considered as urban fabric, and should be considered equally for all kind of assessments and developmental works.

All modes of human abode are unique when analysed in the milieu of their social, economic, cultural, and intellectual yield, and their respective impact on the spatial capital. Some forms of human abode may keep us attached to food production enterprises like agriculture, whereas others make us dependent for food on a farm situated elsewhere. Some modes of human abode keep the ecological footprint at a low level, while others may increase it to have negative consequences for spatial capital. Human abodes, in their collectivity, also create the effects of habitat fragmentation [14,15], with far reaching consequences for biodiversity.

City's static and dynamic structures reflect and shape a range of significant cultural understandings for its occupants [16]. It is made by a large number of actors, who are involved in producing all the important dimensions of the spatial landscape [17]. It is more than just a way of life in a particular context. It looks stationary, but its metabolism is capable of consuming entire landscapes.

Human abodes in the form of a city collectively create communication hubs and thus have greater potential to be the site for participatory culture. This participatory culture brings about significant transformations in socio-cultural, economic, and political domains [18,19]. Cities can support large-scale business and investment networks that create economies of scale in absorbing and extending innovation. Cities present a concentration of the intellectual and material resources, which if properly utilized, may in some cases translate into a higher capacity to act.

Some of the social scientists argue that anthropogenic disturbances may positively contribute to ecological sustainability, rather than simply being a source of environmental threat [20]. This expansion in our spatial understanding has changed our view about urbanization, and asks us to imagine the cities as potential sites of ecological regeneration and the spaces of hope [21,22]. The complex urban socio-ecological change comes from interwoven social, political, economic, and ecological forces at multiple scales. Here, the delivery of ecosystem services links society and ecosystems at higher magnitudes [23–26].

Economic growth, combined with demographic changes, produces more demand for services, consequently putting huge pressure on the natural resources and ecosystems [27]. The expanding city sizes in the developing world are already struggling to keep up with rapid urbanization pressures. It holds horrible statistics: of the three billion urban residents in the world today, one billion live in the slums. The unprecedented rate of urban growth creates an urgency to find smarter ways for the management of accompanying spatial challenges [28].

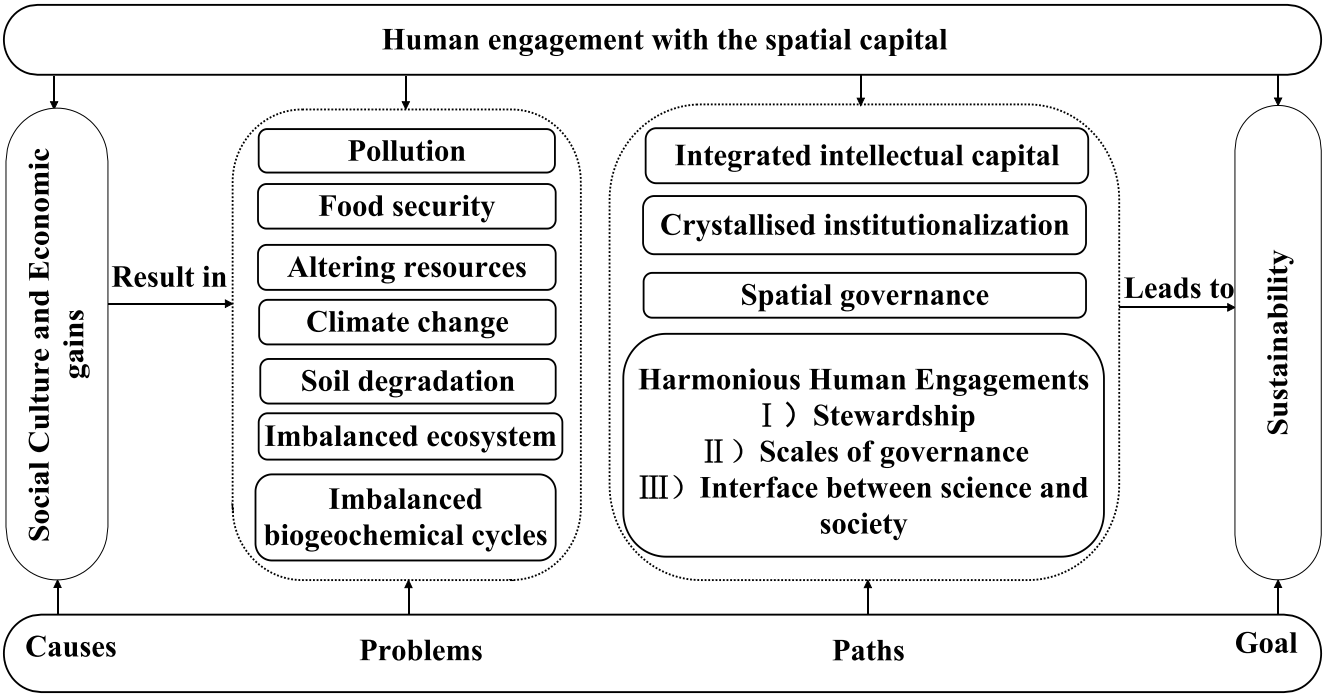
Administrative apparatus focuses its energies on cities and large agglomerations which creates room for the exploitation of spatial capital. The real estate sector is ruling spatial development, especially in the developing countries. It starts the process of spatial development on the basis of richness of some place in its natural capital and puts it on trade. This enterprise needs to be reconfigured through well-working spatial governance.

Spatial capital, in context of the production of goods and services which supports life and its processes as a whole, can be viewed as spatial matrix. It is a medium which holds life in a dynamic and delicate balance. The mode and scale of domestication of the spatial matrix, in milieu of human

abode, is seriously affecting the integrity of this precious resource. It holds major consequences for climate change, biotic diversity, ecosystem services, land degradation, and the vulnerability of entire complement of biophysical constituents [4,29–31].

Understanding the dynamics of these changes requires attention to the biophysical constituents and conditions of spatial capital, as well as the methods and scales of fulfilling human needs. It demands crafting a governance with sound processes, which situate and operate our abode in a way so that it acquires its spatial, social, cultural, and economic needs, along with ensuring the integrity of ecological networks, embedded in that particular spatial system. This study emphasises that all the development policies, related with the global use of the spatial capital, should strive to achieve a balance between sustaining vital biophysical processes and pursuing the worthy short-term goals of economic development [9]. It also emphasises building a sustainable relationship at all the interfaces of spatial processes, and human economic, social, and intellectual needs (Figure 1).

Figure 1. Governance for the harmonious human engagement with the spatial capital.



3. Integrated Intellectual Capital

There are many causes of global degradation of spatial capital. For sustainable management of spatial capital, this study focused on instituting governance processes and their integration from local to global scales. Major factors which affect the accomplishment of this goal include: gaps in scientific understanding and failures in integrating this understanding according to the context; lack of institutionalisation and policies, and dysfunction of already established institutions and policies.

Some scholars link the current scale of change in the natural capital with a new epoch in the planet's history, which is named as anthropocene [32]. Along with the destructive aspects, interestingly, this new epoch also coincides with the age of enlightenment and reason. It is further evolving into the globalisation of consciousness, which is helping to highlight the scale of destruction, and the required scale of management to counter these consequences.

Analysis of the current scenario reveals that our intellectual capital, in context of understanding the spatial capital, falls too short of the required level. An essential component of the sustainability of spatial capital is fundamental knowledge of the relevant biophysical processes, which yield the respective social, economic, cultural, and intellectual services we obtain from it. Only an essential level of spatial literacy would enable us to make informed decisions about the management and preservation of these processes, and the conditions under which they exist.

Intellectual capital in this regard must be characterised with attributes including: sufficient understanding of the respective spatial processes; integration of this understanding; and its capability of supporting the initiatives. Usual paths of scientific inquiry, which are put action outside the domain of study, do not hold any promises for the spatial sustainability [33]. Action-oriented and integrated intellectual capital will yield the required awareness about the spatial capital, which when crystallised into proper institutions their processes will certainly produce promising outcomes for spatial management.

Single intellectual perspectives are insufficient in understanding human-spatial relationships. Pluralistic approaches would yield integration in the diverse intellectual perspectives regarding space. Integrated and action-oriented understanding can be used in creative, design-driven processes for identifying synergies and trade-offs between functions [34,35]. It will be used to determine the priorities and new institutional arrangements for managing the spatial capital.

4. Awareness Crystallised into Institutionalisation

In the wake of environmental constraints and challenges, one of the interesting manifestations of human existence, in its collectivity, is the emergence of institutions. The qualities and capacities of institutions, which emerge in a community, depend on its ability of integrating the social and intellectual capital, which it possesses, according to a respective context. Institutions stabilize the interactions, between a diversity of realms of the members of a society, and make the patterns of interaction between them more durable and predictable. These institutions are implemented through rules that can range from mere conventions and informal codes of behaviour to formal laws in advanced societies [36].

Institutions arise when a need arises in specific circumstances. Society should be able to actualise an institution of required capacity, when it is needed. A society embedded in strong social and intellectual matrices can actualise effective institutions. Humans, in their collectivity, have been achieving landmark successes in institutional building. This paper focuses on the institutionalisation within the context of governance of the spatial matters.

Governance institutions should be able to develop strategies which look at the spatial matrix beyond economic values [32]. Transmission of the integrated understanding into policies also requires integration within governance institutions, and with other institutions attached with social and economic spheres of human existence. Diversity of spatial governance institutions, across the world, is in fact an asset. Nonetheless, the goal cannot be achieved without integrating them into a seamless whole.

5. Spatial Governance

Government is a process of the state or the formal apparatus of institutional power, which is responsible for making and implementing the policy decisions in a closed manner [37–40]. However,

the realm of governance is much broader than just government, which includes the whole range of relations between civil society and the state [41]. For instance, in spatial management, governance has to involve community, NGOs, political organizations, trade unions and associations, and all the concerned governmental agencies at national, regional, and local level to produce good outcomes for society [42].

To set the interfaces between the spatial processes and civic public realm, spatial government stands on an institutional framework and physical resources. To simulate and integrate the institutional and other physical resources into the processes of governance, it is characterised by the attributes of democracy and accountability [43]. It is also supported by sufficient intellectual capital regarding the spatial processes of the space, which is under consideration for appropriation. To appropriate the space means recognizing and getting to know it in a more cognitive sense [44]. In the context of human abode, spatial governance administers the delivery of the following needs: provision of infrastructure to enhance the efficiency of all the spatial operations; provisions for human resource development; improvement in the quality of life in the respective abodes; earnest regulation of all the private activities which affect the welfare of the community; provision of the services and facilities which enhance production activities and allow private businesses to work efficiently [45,46]. It is also supposed to ensure the integrity of respective spatial capital.

6. Harmonious Human Engagement with the Spatial Capital

In today's interconnected global systems, maintaining the integrity of spatial processes is indeed a grand challenge. Now distant realities are linked in such intricate ways that local happenings are shaped by events occurring many miles away [47], making the long-term or global effects often unintentional and unanticipated [48]. It demands for the initiation of a new epoch in spatial management, which we will name here as "harmonious human engagement with the spatial capital". Its prerequisites include: the integrated understanding of the respective spatial processes, and spatial government supported by seamless institutionalisation and governance processes, which when needed should be capable of integration across the national and geographical bounds. Sustainable spatial constructs can be produced only if we act together as a global society.

To achieve a transformative power, governance processes should be reconciled with the understanding of the processes of prospective spatial capital. It would institute new concepts and new ways of thinking, and change the way the spatial resources are used, distributed, and allocated. This mirror will reflect the real costs of spatial plans, and their effects on the relevant stakeholders as well as the spatial capital. It would also be helpful in involving all the relevant stakeholders at the critical steps of the plan, and, consequently, spatial plans are more likely to be implemented effectively. It would also help to create a balance between the ambitions and practical feasibility [49–51]. This kind of spatial governance would be able to steer the community towards socially desirable outcomes.

With the aim of a balanced development, governance processes should be focused on the articulation of initiatives of all the relevant stakeholders. To create a synergistic environment for the development of space, governance processes require radical changes in bureaucratic approaches and traditional land use regulations. To increase the intellectual and social capital, governance should put special emphasis to increase the skills and knowledge of residents, develop intangible assets, such as

inclusion, tolerance, public participation, and democratic governance, in the community [52–54]. Inclusiveness requires governance systems to listen to all voices. It demands transparent mechanisms to moderate, synthesize, and prioritize inputs to allow for effective decision making [55,56]. Moreover, governance processes should be able to organise the civil society in such a way as to operate on the principles of mutuality and reciprocity [57].

With the aims of building, maintaining or extending large-scale extractive and agro-industrial enterprises, some rich countries, and transnational, and national economic actors from various big business sectors are acquiring spatial capital in the form of entire landscapes [58–60]. An effective framework of spatial governance, integrated at the global scale, will not allow the treatment of spatial capital, for instance land, only as a commodity to be bought and sold on the market, and as an instrument of economic and political power. Rather it will instill an understanding in the communities, from local to the global level, that spatial capital is an integral part of their social and spiritual life [61].

Harmonious engagement with the spatial capital can be actualised by seeing the spatial capital in its entirety. For example, a particular pattern of land system might be crucial for a particular culture [62,63]. Therefore, before setting out to modify a particular land system, it is also important to address the cultural aspects, which are being nourished by this system [64–67]. Sustainable spatial management cannot be realised without achieving a certain level of ecological rationality [68].

Harmonious engagement with spatial capital needs a strategic vision in the processes of governance. This strategic vision focuses on the sustainable human development, along with a balance in social, economic, and environmental needs, in the context of the present as well as future generations. It demands for a more strategic, implementation-led, and development-led approach. By concentrating on the critical issues, the spatial plans are seen through the lens of long term vision, and reflect a will to create a particular future [69].

Harmonious engagement with spatial capital demands a more open, multi-level type of governance, where all the actors from the economy and civil society can work together in partnership [70]. Participation of all the relevant stakeholders ensures accountability. It creates room to engage more actors in the processes of governance [71]. Multiple interpretations articulated by a range of stakeholders when contributed in the process of decision-making, present a different perspective and significance to any issue [72]. This process helps to build participatory spatialised knowledge which is an important strategic resource [73].

In traditional governance structures, another major impediment to sustainable development is the short length of political cycles. Focus on the issues which produce results in a short period of time gives more edge to the political parties. Therefore, implementation of the sustainable development paradigm creates a significant challenge to governance processes. The traditional governance approaches in the countries of the developing world are incapable of promoting the integration of actors and knowledge. Here, the basic frameworks of spatial governance do not have the appropriate geographical scale needed to achieve sustainable spatial development.

The contemporary neoliberal society and the rapidly changing spatial dynamics demand for a change in all the dynamics of the spatial governance. Power needs to be shared widely with a range of actors from the civil society [73–75]. These are some of the important pre-requisites to enter into the era of truly harmonious human engagement with spatial capital [76–78]. The government institutions

should not look like the formal organizations and procedures established in the law, but should refer to the norms, standards, and morals of a society that shape both the ways of thinking and acting [79].

The powers of institutions should be adjusted in a way to rescale the issue agendas down from the national or state level, and up from the municipal and neighbourhood level [50,80]. Changing the way the regulatory powers are used can bring about a change in the concepts of how the resources are used, distributed, and allocated. Further, with the passage of time, the ways of thinking that accumulate sufficient power become routinized and permanently crystallized in the cultural ground, which makes the communities conscious of sustaining on-going spatial processes, and look for new ones [80,81].

In harmonious engagement with spatial capital, governance, in its current processes, should be able to invent the future. The future environments are created by making all the important decisions in the present [80]. It demands that every part of the community be provided with ample opportunities to participate in this process of decision making. Participation of the population right from the beginning helps to ensure greater dynamism throughout the development of spatial designs. It also creates public awareness about the planning processes [82].

7. Spatial Capital and Sustainability

7.1. Stewardship

Governance for integrative economic, social, and spatial sustainability must respect some limits to human intellectual and natural resources, and simultaneously ensure just and equitable development and stewardship [32]. It must be capable of generating legitimate and effective policy responses to potential irreversible changes in the natural capital [83]. This requires that institutions and governance processes for sustainable spatial development be adaptive [84], and should be capable of inducing a shift to stewardship of spatial capital in the society [85,86].

Stewardship of the spatial capital entails important trade-offs, particularly between efficiency and flexibility and between immediate and long-term benefits [87,88]. It shifts the resource-management philosophy, from reactions to observed changes to proactive governance, which shapes change for sustainability, while preparing for the unexpected [86]. Sustaining the spatial capital, and other socio-cultural assets connected with it, requires reconnecting people's perceptions, values, institutions, actions, and governance systems to the dynamics of the spatial processes, through active spatial stewardship.

7.2. Scales of Governance for Spatial Capital

A shift is needed, from the traditional centralized, top-down decision-making approach to the one in which local governments are provided with enough autonomy and capacity, to make their own decisions for resolving the problems at the local level [89,90]. In context of the management of spatial capital, several recent studies have proposed to support policy, management, and planning for spatial development, by analyses of the spatial distribution of multiple ecosystem services at global, regional, or landscape scales [91–95].

The close interaction with relevant decision makers at regional, national, and international levels is crucial in order to sustain as well as enhance the spatial capital. For better future foresight of grand

spatial plans, it is imperative to integrate the intellectual and physical resources across multiple geographic scales and multiple ecological dimensions [8].

The efficiency of the governance structures depends on the relationship between different levels of governance. Horizontal harmonization between global-level institutions is crucial to ensure that governance initiatives are mutually reinforcing [96,97]. Vertical integration *i.e.*, linking institutions from the global to local level is needed to achieve improved implementation of sustainable development [98,99]. Efficient and legitimate governance mechanisms at the global level are important to support efforts at other levels. Likewise, governance mechanisms at other levels can support governance initiatives at the global level [83].

Processes of governance for local government are complex. It performs a combination of delegated as well as autonomous tasks [46]. Planning and making decisions about the spatial capital at the local level can be seen as a big-stakes game of serious multiparty competition over an area's future land use pattern [61]. Local government can only fulfill the devolved roles and responsibilities when it is provided with the capacity to do it. Capacities of the local governance processes are related with the political arrangements and the financial, physical, legal, and human resources at their disposal [100,101].

The processes of local governance should be able to successfully integrate the traditional ideas of spatial management with the physical, economic, and social development of the society [102,103]. Local governments benefit greatly from coordination at the local levels by common learning and sharing of solutions [101,104].

All current processes of spatial governance in most of the developing countries, including jurisdictional fragmentation and decentralization of responsibilities, have made the boundaries of the local governments totally inappropriate to deal with the complex dimensions of spatial development [105]. In context of spatial management, cooperation at regional, national, as well as international level will help to discern the broader picture of economic, social, cultural, and intellectual capital. For example, the disintegration, which human abodes cause in the natural habitats, can be properly countered through eco-regional planning. Most of the aspects of spatial capital can only be properly appreciated at landscape or regional scales [106].

7.3. Interface between Science and Society

Effective governance and organisational and institutional capacities cannot be realised without awareness of and a comprehensive knowledge of the relevant spatial processes. This understanding situates and highlights the importance of relevant spatial services in society as a whole. Achievement of this goal demands robust interfaces between science and society, where individual opinions from the society are integrated with scientific knowledge. Where scientists lead the dialogue on scientific priorities, there are new institutional arrangements and improved mechanisms to disseminate and utilize knowledge more quickly [9,107–109].

A basic literacy is necessary for understanding the spatial capital and human interactions with it, and for making informed decisions about the conservation and management of spatial resources. Sometimes, there can be very strange kinds of flaws in integrating the understanding about spatial as well as natural capital. For instance, now few countries in the world want to buy those things from outside which create more environmental externalities. In pursuit of saving the environmental fabric of

one specific area, in the expense of tearing it off elsewhere, is dangerous. Integration of spatial governance at the international level will help to mitigate these flaws.

With tremendous increase in computational power, in the near future, we would be able to simulate our future needs through model based simulations over time periods that incorporate the short-term for policy design and implementation as well as the mid- and long-term effects on the spatial processes [110].

An effective flow of integrated and action-oriented knowledge from scientific enterprise towards the society, not only enhances economy, but also strengthens society's relationship with the spatial capital. Economic development strategies, which originate from this understanding of spatial processes, increase the skills and knowledge of residents and make them capable of contributing to the society's welfare [111,112]. This society then moves towards realising the intangible assets such as inclusion, tolerance, public participation, and democratic governance [113]. It results in harmonious human engagement with the spatial capital that is protected by the network of connections at local, regional, national, and global levels.

Processes of participation actualise an integration of intellectual capital. It enables knowledge sharing and helps participants make new connections so that the collective wisdom becomes more accessible, and possibilities for innovative actions emerge. Effective spatial governance needs the mechanisms to encourage enough representation of all the stakeholders. It includes different forms of knowledge through deliberative engagement and social learning to solve the local problems [114].

Scientific understanding should allow linking of the physical structure and functioning of the landscape to the economic, sociocultural, and ecological values demanded by its users [115]. It should also strive to yield an insight in society, about the proper relationship of spatial patterns and processes with society's socio-economic systems [116]. This insight would promote biodiversity, aid in the maintenance of ecosystem functions, and enhance the quality of human life [117].

The governance processes instill the understanding in society that its social order, identities and most of its attributes are constructed within the respective spatial matrix. With regard to cultures, the spatial capital is the mirror of our actions on the physical plane. Cultural landscapes are vessels of cultural values and contribute in the identity of communities [118,119]. The intangible aspects refer specifically to practices, representations, expressions, knowledge, and skills, and the cultural spaces in which these 'living heritage' traditions are played out. The tangible can only be understood and interpreted through the intangible: and society and values are thus intrinsically linked.

Spatial systems are central to understanding the relationship between people and their environment [120]. When appropriation of spatial capital will be supported by substantial understanding of the relevant spatial processes, then true value of the spatial services will be included in the economic decision making. Spatial services are part of people's wealth and they affect human well-being in multidimensional ways.

Our fundamental challenge is to understand the dynamics of ecosystem services and human well-being, as they interact from local to global scales, in the context of multiple changing drivers [121]. Only a proper understanding of the spatial services will establish feedback mechanisms to signal changes in their supply or in the deterioration of underlying ecological systems that generate them [122–124]. The sustainable provision of goods and services depends critically on managing spatial resources.

Biophysical assessment of the types and location of biophysical features and processes, which actually provide the spatial services, is an important step, before appropriating a specific land system

for human use. This assessment reveals the spatial and temporal flows of services, in relation to beneficiaries, and the impacts of land and water transformation on delivery [92,94,125,126].

There is a need to analyse and compare potential approaches to organize land use, water use, and energy systems, in ways that achieve sustainable energy, food, biodiversity, and ecosystem functioning [127]. Loss of genetic and species diversity and homogeneity of landscapes diminish options for management, and increase vulnerability of ecosystem services [128]. Biodiversity effects must be understood in social-ecological context [121].

Technologies are needed, to remotely monitor ecosystem services, in real time and at landscape scales. The impacts different patterns of land-use have on both society and the environment also must be tested and assessed. All this would not be possible without providing richer opportunities for scientific collaborations [127].

8. Conclusions

The elements of spatial capital—for instance land—phenomenally look like an object or container, but actually they are supported by an immense number of processes. Without understanding all the occurrences in spatial capital, in the context of processes, a sustainable management of this precious resource would be impossible. All the spatial goods and services are produced by the biophysical elements and the spatial processes working in the background.

Human abode, in its entirety, is one of the largest recipients of spatial goods and services. It is actualised by the domestication of most of the elements and processes of spatial capital, and its operations affect the rest. The mode and scale of fulfilling the needs of human abode is causing changes in the elements and processes of spatial capital including the land, biogeochemical cycles, and other biophysical features.

The scale of changes in the elements and processes of spatial capital in the last one hundred years has no match in the entire human history. This unprecedented scale of change calls for the initiation of a new epoch in the management of spatial capital. It demands for the start of harmonious human engagement with spatial capital. Harmonious human engagement with spatial capital demands crafting governance with sound processes, which situate and operate our abode, in the context of mode and scale of our spatial, social, cultural, and economic needs, in such a way as to ensure the integrity of respective spatial systems for future generations.

An outlook which the authors developed, from the synthesis of scientific literature in this context, is that to actualise efficient governance processes, for the preservation of spatial capital, we will have to take the following path: (i) An essential component of the sustainability of the spatial capital is fundamental knowledge of the relevant biophysical processes which yield the respective social, economic, cultural, and intellectual services we obtain from it; (ii) this basic intellectual capital regarding space when integrated together will provide us with a basic spatial literacy; (iii) we will realise the need for building institutions, for the management of spatial resources, through this spatial literacy; (iv) and when these institutions, according to the situation, are integrated together into seamless wholes, we can achieve harmonious engagement with spatial capital in the context of our abode. It will help to produce spatial constructs which are ecologically sound, economically feasible, and socially just.

Engagement with spatial capital, in the context of human abode, is a complex phenomenon, and different modes of human abode link it with the spatial processes at different scales. While making assessments and producing developmental plans, administrative processes should not consider only the cities and large agglomerations, but all the interactions between human abode and spatial capital. All modes and scales of human abodes leave different ecological footprints on spatial resources. The processes of spatial governance should be able to track all the footprints.

Acknowledgments

This work was financially supported by Social Science Research Fund (13YJA790101) from Ministry of Education, China. Authors are thankful for anonymous reviewers for their valuable comments and suggestions. Any remaining errors are the authors own responsibility.

Author Contributions

Shukui Tan and Ghulam Akhmat designed the study. Javeed Hussain and Haipeng Song collected the related material and wrote the manuscript with significant contribution from other authors.

Conflicts of Interest

The authors declare no conflict of interest.

References

1. Takeuchi, K. Rebuilding the relationship between people and nature: The Satoyama Initiative. *Ecol. Res.* **2010**, *25*, 891–897.
2. Haber, W. Biological diversity a concept going astray? *GAIA-Ecological Perspectives for Sci. Soc.* **2008**, *17*, 91–96.
3. Vitousek, P.M.; Mooney, H.A.; Lubchenco, J.; Melillo, J.M. Human domination of Earth's ecosystems. *Science* **1997**, *277*, 494–499.
4. Sala, O.E.; Chapin, F.S. Global biodiversity scenarios for the year 2100. *Science* **2000**, *287*, 1770–1774.
5. Haberl, H.; Erb, K.H.; Krausmann, F.; Gaube, V.; Bondeau, A.; Plutzar, C.; Gingrich, S.; Lucht, W.; Fischer-Kowalski, M. Quantifying and mapping the human appropriation of net primary production in Earth's terrestrial ecosystems. *Proc. Nat. Acad. Sci. USA* **2007**, *104*, 12942–12947.
6. Kareiva, P.; Watts, S.; McDonald, R.; Boucher, T. Domesticated nature: Shaping landscapes and ecosystems for human welfare. *Science* **2007**, *316*, 1866–1869.
7. Chapin, F.S.; Walker, B.H.; Hobbs, R.J.; Hooper, D.U.; Lawton, J.H.; Sala, O.E.; Tilman, D. Biotic control over the functioning of ecosystems. *Science* **1997**, *277*, 500–504.
8. Foley, J.A.; DeFries, R.; Asner, G.P.; Barford, C.; Bonan, G.; Carpenter, S.R.; Chapin, F.S.; Coe, M.T.; Daily, G.C.; Gibbs, H.K. Global consequences of land use. *Science* **2005**, *309*, 570–574.
9. Lubchenco, J. Entering the century of the environment: a new social contract for science. *Science* **1998**, *279*, 491–497.
10. Brundtland, G.H.; Khalid, M. *Our Common Future*; Oxford University Press: Oxford, UK, 1987.

11. DeFries, R.S.; Foley, J.A.; Asner, G.P. Land-use choices: Balancing human needs and ecosystem function. *Front. Ecol. Environ.* **2004**, *2*, 249–257.
12. De Groot, R. Function-analysis and valuation as a tool to assess land use conflicts in planning for sustainable, multi-functional landscapes. *Landscape Urban Plann.* **2006**, *75*, 175–186.
13. Raven, P.H. Science, sustainability, and the human prospect. *Science* **2002**, *297*, 954–958.
14. Robinson, G.R.; Holt, R.D.; Gaines, M.S.; Hamburg, S.P.; Johnson, M.L.; Fitch, H.S.; Martinko, E.A. Diverse and contrasting effects of habitat fragmentation. *Science* **1992**, *257*, 524–526.
15. Didham, R.K.; Hammond, P.M.; Lawton, J.H.; Eggleton, P.; Stork, N.E. Beetle species responses to tropical forest fragmentation. *Ecol. Monogr.* **1998**, *68*, 295–323.
16. Williams, A.; Dourish, P. Imagining the city: The cultural dimensions of urban computing. *Computer* **2006**, *39*, 38–43.
17. Hall, T. *Urban Geography*, 3rd ed.; Abingdon: Routledge, UK, 2006.
18. Jenkins, H.; Clinton, K.; Purushotma, R.; Robinson, A.J.; Weigel, M. *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century*; MacArthur Foundation: Chicago, IL, USA, 2006.
19. Leadbeater, C. *The Power of Mass Creativity Profile in We-think: Mass Innovation, not Mass Production;* Profile Books: London, UK, 2008.
20. Berkes, F. Understanding uncertainty and reducing vulnerability: Lessons from resilience thinking. *Nat. Hazards* **2007**, *41*, 283–295.
21. Harvey, D. *Spaces of Hope*; Edicoes Loyola: Berkeley, CA, USA, 2000.
22. Wolch, J. Green urban worlds. *Ann. Assoc. Am. Geogr.* **2007**, *97*, 373–384.
23. Parrish, D.D.; Zhu, T. Clean air for megacities. *Science* **2009**, *326*, 674–675.
24. Watson, V. The planned city sweeps the poor away: Urban planning and 21st century urbanisation. *Prog. Plann.* **2009**, *72*, 151–193.
25. Grimm, N.; Morgan Grove, J.; Pickett, S.; Redman, C. Integrated approaches to long-term studies of urban ecological systems. *BioScience* **2000**, *50*, 571–584.
26. Pickett, S.; Cadenasso, M.; Grove, J. Biocomplexity in coupled natural–human systems: A multidimensional framework. *Ecosystems* **2005**, *8*, 225–232.
27. Grimm, N.; Faeth, S.; Golubiewski, N.; Redman, C.; Wu, J.; Bai, X.; Briggs, J. Global change and the ecology of cities. *Science* **2008**, *319*, 756–760.
28. Nam, T.; Pardo, T.A. Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. In Proceedings of the 12th Annual International Conference on Digital Government Research, New York, NY, USA, 12–16 June 2011; pp. 282–291.
29. Daily, G.C.; Söderqvist, T.; Aniyar, S.; Arrow, K.; Dasgupta, P.; Ehrlich, P.R.; Folke, C.; Jansson, A.M.; Jansson, B.O.; Kautsky, N. The value of nature and the nature of value. *Science* **2000**, *289*, 395–396.
30. Turner, B.L.; Kasperson, R.E.; Matson, P.A.; McCarthy, J.J.; Corell, R.W.; Christensen, L.; Eckley, N.; Kasperson, J.X.; Luers, A.; Martello, M.L. A framework for vulnerability analysis in sustainability science. *Proc. Nat. Acad. Sci. USA* **2003**, *100*, 8074–8079.
31. Kalnay, E.; Cai, M. Impact of urbanization and land-use change on climate. *Nature* **2003**, *423*, 528–531.

32. Kanie, N.; Betsill, M.M.; Zondervan, R.; Biermann, F.; Young, O.R. A charter moment: Restructuring governance for sustainability. *Public Admin. Develop.* **2012**, *32*, 292–304.
33. Kates, R.E.A. Environment anddevelopment: Sustainability science. *Science* **2001**, *292*, 641–642.
34. Tippett, J.; Handley, J.F.; Ravetz, J. Meeting the challenges of sustainable development—A conceptual appraisal of a new methodology for participatory ecological planning. *Prog. Plann.* **2007**, *67*, 9–98.
35. Opdam, P.; Pouwels, R.; van Rooij, S.; Steingröver, E.; Vos, C.C. Setting biodiversity targets in participatory regional planning: Introducing ecoprofiles. *Ecol. Soc.* **2008**, *13*, 20.
36. Walliser, B. Game Theory and Emergence of Institutions. Available online: http://www.pse.ens.fr/users/walliser/pdf/games.pdf (accessed on 24 February 2014).
37. Harper, B. Governance for urban growth management: A greater Christchurch case study. Master Thesis, University of Otago, Dunedin, New Zealand, 2010. Available online: http://hdl.handle.net/10523/1674 (accessed on 17 October 2013).
38. Lemos, M.; Agrawal, A. *Environmental Governance and Political Science*; Cambridge University Press: Cambridge, UK, 2009.
39. Stoker, G. *Public-Private Partnerships and Urban Governance*; Macmillan: London, UK, 1998; p. 34.
40. Hewison, K.; Rodan, G.; Robison, R. *Introduction: Changing forms of State Power in Southeast Asia*; Allen & Unwin: St Leonards, Australia, 1993; pp. 2–8.
41. McCarney, P.; Halfani, M.; Rodriguez, A. Towards an understanding of governance: The emergence of an idea and its implications for urban research in developing countries. *Urban Res. Dev. World* **1995**, *4*, 91–141.
42. Devas, N. Does city governance matter for the urban poor? *Int. Plann. Stud.* **2001**, *6*, 393–408.
43. Cowling, R.M.; Egoh, B.; Knight, A.T.; O'Farrell, P.J.; Reyers, B.; Rouget, M.; Roux, D.J.; Welz, A.; Wilhelm-Rechman, A. An operational model for mainstreaming ecosystem services for implementation. *Proc. Nat. Acad. Sci. USA* **2008**, *105*, 9483.
44. Abrahamsson, K.V. Landscapes lost and gained: On changes in semiotic resources. *Hum. Ecol. Rev.* **1999**, *6*, 51–61.
45. Rakodi, C. Politics and performance: The implications of emerging governance arrangements for urban management approaches and information systems. *Habitat Int.* **2003**, *27*, 523–547.
46. Davey, K. *The Structure and Functions of Urban Government*; Avebury: Aldershot, UK and Sydney, Australia, 1996; pp. 47–102.
47. Leemans, R.; Redman, C.; Schimel, D. Sustainability or collapse: What can we learn from integrating the history of humans and the rest of nature? *Ambio* **2007**, *36*, 522–527.
48. Gobster, P.H.; Nassauer, J.I.; Daniel, T.C.; Fry, G. The shared landscape: What does aesthetics have to do with ecology? *Landscape Ecol.* **2007**, *22*, 259–972.
49. De Graaf, R.; Dewulf, G. Applying the lessons of strategic urban planning learned in the developing world to the Netherlands: A case study of three industrial area development projects. *Habitat Int.* **2010**, *34*, 471–477.
50. Halla, F. A SWOT analysis of strategic urban development planning: The case of Dar es Salaam city in Tanzania. *Habitat Int.* **2007**, *31*, 130–142.

51. Wong, S.; Tang, B.; van Horen, B. Strategic urban management in China: A case study of Guangzhou Development District. *Habitat Int.* **2006**, *30*, 645–667.
52. Bernstein, S. Legitimacy in global environmental governance. *J. Int. Law Int. Relat.* **2004**, *1*, 139–166.
53. Biermann, F.; Betsill, M.M.; Gupta, J.; Kanie, N.; Lebel, L.; Liverman, D.; Schroeder, H.; Siebenhüner, B.; Zondervan, R. Earth system governance: A research framework. *Int. Environ. Agreem.-Polit. Law Econ.* **2010**, *10*, 277–298.
54. Dellas, E.; Pattberg, P.; Betsill, M. Agency in earth system governance: Refining a research agenda. *Int. Environ. Agreem.-Polit. Law Econ.* **2011**, *11*, 85–98.
55. Biermann, F.; Gupta, A. Accountability and legitimacy: An analytical challenge for earth system governance. *Ecol. Econ.* **2011**, *70*, 1854–1855.
56. Dryzek, J.S.; Stevenson, H. Global democracy and earth system governance. *Ecol. Econ.* **2011**, *70*, 1865–1874.
57. Levy, C. Urbanisation without Social Justice is not Sustainable. Available online: http://www.whoseolympics.org/sustainable-cities/results/gcsc-reports/levy.pdf (accessed on 21 October 2013).
58. Borras, S.M., Jr.; Franco, J.C. Global land grabbing and trajectories of agrarian change: A preliminary analysis. *J. Agrar. Change* **2012**, *12*, 34–59.
59. Deininger, K. Challenges posed by the new wave of farmland investment. *J. Peasant Stud.* **2011**, *38*, 217–247.
60. Cotula, L. The international political economy of the global land rush: A critical appraisal of trends, scale, geography and drivers. *J. Peasant Stud.* **2012**, *39*, 649–680.
61. Angotti, T. *New York for Sale: Community Planning Confronts Global Real Estate*; The MIT Press: Cambridge, MA, USA, 2008.
62. Farina, A. The cultural landscape as a model for the integration of ecology and economics. *BioScience* **2000**, *50*, 313–320.
63. Krausmann, F.; Haberl, H.; Schulz, N.B.; Erb, K.H.; Darge, E.; Gaube, V. Land-use change and socio-economic metabolism in Austria—Part I: Driving forces of land-use change: 1950–1995. *Land Use Pol.* **2003**, *20*, 1–20.
64. Tuan, Y.I.F.U. Discrepancies between environmental attitude and behaviour: Examples from Europe and China. *Can. Geogr.* **1968**, *12*, 176–191.
65. Ostrom, E. Crossing the great divide: Coproduction, synergy, and development. *World Dev.* **1996**, *24*, 1073–1087.
66. Nagendra, H. Drivers of reforestation in human-dominated forests. *Proc. Nat. Acad. Sci. USA* **2007**, *104*, 15218–15223.
67. Young, M.N.; Peng, M.W.; Ahlstrom, D.; Bruton, G.D.; Jiang, Y. Corporate governance in emerging economies: A review of the principal–principal perspective. *J. Manage. Stud.* **2008**, *45*, 196–220.
68. Braun, B. Environmental issues: Writing a more-than-human urban geography. *Prog. Hum. Geog.* **2005**, *29*, 635–650.
69. Steinberg, F. Strategic urban planning in Latin America: Experiences of building and managing the future. *Habitat Int.* **2005**, *29*, 69–93.

70. Geitler, L. Zur Entwicklungsgeschichte der EpithemiaceenEpithemia, Rhopalodia und Denticula (Diatomophyceae) und ihre vermutlich symbiotischen Sphäroidkörper. *Plant Syst. Evol.* **1977**, *128*, 259–275. (In German)
71. Albrechts, L. Public involvement: The challenges of difference. *Plann. Rev.* **2003**, *39*, 18–28.
72. Hajer, M.A.; Wagenaar, H. *Deliberative Policy Analysis: Understanding Governance in the Network Society*; Cambridge University Press: Cambridge, UK, 2003.
73. Baud, I.; Pfeffer, K.; Sydenstricker, J.; Scott, D. Developing Participatory "Spatial" Knowledge Models in Metropolitan Governance Networks for Sustainable Development. Available online: http://www.chance2sustain.eu/fileadmin/Website/Dokumente/Dokumente/Publications/Developing_Participatory_Knowledge_Models.pdf (accessed on 28 October 2013).
74. Parnell, S.; Pieterse, E.; Swilling, M. *Democratising Local Government: The South African Experiment*; Juta Academic: Cape Town, South Africa, 2002.
75. Hajer, M.A. Rebuilding ground zero. The politics of performance. *Plann. Theory & Pract.* **2005**, *6*, 445–464.
76. Kabir, S. Strategic planning in municipal government: The case of City of Ottawa. *Can. Soc. Sci.* **2010**, *3*, 5–14.
77. Bryson, J.M.; Roering, W.D. Applying private-sector strategic planning in the public sector. *J. Am. Plann. Assoc.* **1987**, *53*, 9–22.
78. Halachmi, A. Strategic planning and management? Not necessarily. *Public Prod. Rev.* **1986**, *10*, 35–50.
79. Healey, P. Creativity and urban governance. *Policy Stud.* **2004**, *25*, 87–102.
80. Albrechts, L. How to enhance creativity, diversity and sustainability in spatial planning: strategic planning revisited. In *Making Strategies in Spatial Planning*; Springer: Dordrecht, The Netherlands, 2010; pp. 3–25.
81. Healey, P. Relational complexity and the imaginative power of strategic spatial planning. *Eur. Plann. Stud.* **2006**, *14*, 525–546.
82. Amado, M.; Santos, C.; Moura, E.; Silva, V. Public participation in sustainable urban planning. *Int. J. Soc. Hum. Sci.* **2010**, *5*, 102–108.
83. Folke, C.; Jansson, Å.; Rockström, J.; Olsson, P.; Carpenter, S.R.; Chapin, F.S.; Crépin, A.S.; Daily, G.; Danell, K.; Ebbesson, J.; *et al.* Reconnecting to the biosphere. *AMBIO: J. Hum. Environ.* **2011**, *40*, 719–738.
84. Folke, C.; Hahn, T.; Olsson, P.; Norberg, J. Adaptive governance of social-ecological systems. *Annu. Rev. Environ. Resour.* **2005**, *30*, 441–473.
85. Berkes, F.; Colding, J.; Folke, C. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*; Cambridge University Press: Cambridge, UK, 2003.
86. Chapin, F.S.; Kofinas, G.P.; Folke, C.; Chapin, M.C. *Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World*; Cambridge University Press: Cambridge, UK, 2009.
87. Liu, J.; Dietz, T.; Carpenter, S.R.; Alberti, M.; Folke, C.; Moran, E.; Pell, A.N.; Deadman, P.; Kratz, T.; Lubchenco, J. Complexity of coupled human and natural systems. *Science* **2007**, *317*, 1513–1516.

88. Kareiva, P.; Chang, A.; Marvier, M. Development and conservation goals in World Bank projects. *Science* **2008**, *321*, 1638–1639.
89. Choguill, C. Crisis, chaos, crunch? Planning for urban growth in the developing world. *Urban Studies* **1994**, *31*, 935–945.
90. Batterbury, S.; Fernando, J. Rescaling governance and the impacts of political and environmental decentralization: An introduction. *World Dev.* **2006**, *34*, 1851–1863.
91. Gimona, A.; van der Horst, D. Mapping hotspots of multiple landscape functions: A case study on farmland afforestation in Scotland. *Landscape Ecol.* **2007**, *22*, 1255–1264.
92. Naidoo, R.; Ricketts, T.H. Mapping the economic costs and benefits of conservation. *PLoS Biol.* **2006**, *4*, e360.
93. Naidoo, R.; Balmford, A.; Costanza, R.; Fisher, B.; Green, R.E.; Lehner, B.; Malcolm, T.; Ricketts, T. Global mapping of ecosystem services and conservation priorities. *Proc. Nat. Acad. Sci. USA* **2008**, *105*, 9495–9500.
94. Chan, K.M.A.; Shaw, M.R.; Cameron, D.R.; Underwood, E.C.; Daily, G.C. Conservation planning for ecosystem services. *PLoS Biol.* **2006**, *4*, e379.
95. Willemen, L.; Verburg, P.H.; Hein, L.; van Mensvoort, M.E.F. Spatial characterization of landscape functions. *Landscape Urban Plann.* **2008**, *88*, 34–43.
96. Alter, K.J.; Meunier, S. The politics of international regime complexity. *Perspect. Polit.* **2009**, *7*, 13–24.
97. Biermann, F.; Pattberg, P.; van Asselt, H.; Zelli, F. The fragmentation of global governance architectures: A framework for analysis. *Global Environ. Polit.* **2009**, *9*, 14–40.
98. Cash, D.W.; Adger, W.N.; Berkes, F.; Garden, P.; Lebel, L.; Olsson, P.; Pritchard, L.; Young, O. Scale and cross-scale dynamics: Governance and information in a multilevel world. *Ecol. Soc.* **2006**, *11*, 8.
99. Kern, K.; Alber, G. Governing Climate Change in Cities: Modes of Urban Climate Governance in Multi-Level Systems. In Proceedings of the OECD Conference on Competitive Cities and Climate Change, Milan, Italy, 9–10 October 2008; pp. 9–10.
100. Bird, R.M. Setting the stage: Municipal and intergovernmental finance. In *The Challenge of Urban Government: Policies and Practices*; World Bank Institute: Washington, DC, USA, 2001; pp. 113–128.
101. Greasley, S.; John, P.; Wolman, H. Does government performance matter? The effects of local government on urban outcomes in England. *Urban Stud.* **2010**, *48*, 1835–1851.
102. Davey, K.J. *Elements of Urban Management*; The World Bank: Washington, DC, USA, 1993.
103. Yigitcanlar, T. Urban Management Revolution: Intelligent Management Systems for Ubiquitous Cities. In Proceedings of the International Symposium on Land, Transport and Marine Technology, Seoul, Korea, 5–6 November 2010.
104. Puppim de Oliveira, J.A.; Balaban, O.; Doll, C.; Moreno-Penaranda, R.; Gasparatos, A.; Iossifova, D.; Suwa, A. Cities and biodiversity: Perspectives and governance challenges for implementing the convention on biological diversity (CBD) at the city level. *Biol. Conserv.* **2011**, *144*, 1302–1313.
105. Wheeler, S.M. The new regionalism: Key characteristics of an emerging movement. *J. Am. Plan. Assoc.* **2002**, *68*, 267–278.

106. Opdam, P.; Steingröver, E.; Rooij, S. Ecological networks: A spatial concept for multi-actor planning of sustainable landscapes. *Landscape Urban Plann.* **2006**, *75*, 322–332.
107. Groffman, P.M.; Stylinski, C.; Nisbet, M.C.; Duarte, C.M.; Jordan, R.; Burgin, A.; Previtali, M.A.; Coloso, J. Restarting the conversation: Challenges at the interface between ecology and society. *Front Ecol. Environ.* **2010**, *8*, 284–291.
108. Regan, H.M.; Colyvan, M.; Burgman, M.A. A taxonomy and treatment of uncertainty for ecology and conservation biology. *Ecol. Appl.* **2002**, *12*, 618–628.
109. May, R.M. Threats to tomorrow's world. Anniversary Address 2005. *Notes Rec. Roy. Soc.* **2006**, *60*, 109–130.
110. Rounsevell, M.D.A.; Pedroli, B.; Erb, K.H.; Gramberger, M.; Busck, A.G.; Haberl, H.; Kristensen, S.; Kuemmerle, T.; Lavorel, S.; Lindner, M. Challenges for land system science. *Land Use Poli.* **2012**, *29*, 899–910.
111. Ovalle, M.; Marquez, J.; Salomon, S. A compilation of resources on knowledge cities and knowledge-based development. *J. Knowl. Manag.* **2004**, *8*, 107–127.
112. Yigitcanlar, T.; Velibeyoglu, K. Knowledge-Based Strategic Planning: Harnessing (in) Tangible Assets of City-Regions. In Proceedings of the International Forum on Knowledge Asset Dynamics, Matera, Italy, 26–27 July 2008; pp. 26–27.
113. Laszlo, K.; Laszlo, A. Fostering a sustainable learning society through knowledge-based development. *Syst. Res. Behav. Sci.* **2007**, *24*, 493–503.
114. Meadowcroft, J.; Farrell, K.N.; Spangenberg, J. Developing a framework for sustainability governance in the European Union. *Int. J. Sust. Dev.* **2005**, *8*, 3–11.
115. Haines-Young, R. Sustainable development and sustainable landscapes: Defining a new paradigm for landscape ecology. *Fennia* **2000**, *178*, 7–14.
116. Bazzaz, F.; Ceballos, G.; Davis, M.; Dirzo, R.; Ehrlich, P.R.; Eisner, T.; Levin, S.; Lawton, J.H.; Lubchenco, J.; Matson, P.A. Ecological science and the human predicament. *Science* **1998**, *282*, doi:10.1126/science.282.5390.879c.
117. Redman, C.L.; Grove, J.M.; Kuby, L.H. Integrating social science into the long-term ecological research (LTER) network: Social dimensions of ecological change and ecological dimensions of social change. *Ecosystems* **2004**, *7*, 161–171.
118. Stephenson, J. The Cultural Values Model: An integrated approach to values in landscapes. *Landscape Urban Plann.* **2008**, *84*, 127–139.
119. Daniel, T.C.; Muhar, A.; Arnberger, A.; Aznar, O.; Boyd, J.W.; Chan, K.; Costanza, R.; Elmqvist, T.; Flint, C.G.; Gobster, P.H. Contributions of cultural services to the ecosystem services agenda. *Proc. Nat. Acad. Sci. USA* **2012**, *109*, 8812–8819.
120. Reenberg, A. Land systems research in Denmark: Background and perspectives. *Geografisk Tidsskrift* **2006**, *106*, 1–6.
121. Carpenter, S.R.; Mooney, H.A.; Agard, J.; Capistrano, D.; DeFries, R.S.; Díaz, S.; Dietz, T.; Duraiappah, A.K.; Oteng-Yeboah, A.; Pereira, H.M. Science for managing ecosystem services: Beyond the Millennium Ecosystem Assessment. *Proc. Nat. Acad. Sci. USA* **2009**, *106*, 1305–1312.
122. Daily, G.C. *Nature's Services: Societal Dependence on Natural Ecosystems*; Island Press: Washington, DC, USA, 1997.
123. Myers, N. Environmental services of biodiversity. *Proc. Nat. Acad. Sci. USA* **1996**, *93*, 2764–2769.

124. Costanza, R.; d'Arge, R.; de Groot, R.; Farber, S.; Grasso, M.; Hannon, B.; Limburg, K.; Naeem, S.; O'Neill, R.V.; Paruelo, J. The value of the world's ecosystem services and natural capital. *Nature* **1997**, *387*, 253–260.
125. Kremen, C. Managing ecosystem services: What do we need to know about their ecology? *Ecol. Lett.* **2005**, *8*, 468–479.
126. Hein, L.; van Koppen, K.; de Groot, R.S.; van Ierland, E.C. Spatial scales, stakeholders and the valuation of ecosystem services. *Ecol. Econ.* **2006**, *57*, 209–228.
127. Arkin, A.; Baliga, N.; Braam, J.; Church, G.; Collins, J.; Cottingham, R.; Ecker, J.; Gerstein, M.; Gilna, P.; Greenberg, J. Grand Challenges for Biological and Environmental Research: A Long-Term Vision. Available online: http://www.science.doe.gov/ober/berac/BER_LTVreport.pdf (accessed on 21 October 2013)
128. Yachi, S.; Loreau, M. Biodiversity and ecosystem productivity in a fluctuating environment: The insurance hypothesis. *Proc. Nat. Acad. Sci. USA* **1999**, *96*, 1463–1468.