Responsible project management: beyond the triple constraints

Article (Published Version)

KEYWORDS responsible project management · project management · responsible innovation · irresponsible innovation · social demands · megaprojects

RESPONSIBLE PROJECT MANAGEMENT: BEYOND THE TRIPLE CONSTRAINTS

ABSTRACT

In this theoretical paper, we propose the concept of Responsible Project Management drawing upon perspectives from responsible innovation, accountability and sustainability in project environments, especially those of megaprojects, addressing their long-term impact, far beyond the traditional notion of project success on the triple constraints of time, cost and adherence to specifications. Megaprojects as multibillion dollar projects (e.g., the Channel Tunnel, organisation of London Olympics 2012 and the construction of Heathrow Airport Terminal 5) are very important parts of infrastructure in developed and developing countries, where traditional project management analysis focuses on the implementation or execution process (i.e. planning and control) usually incurring delays, cost overrun and financial risk. However, this analysis requires further understanding regarding their complexity and their effects on environment and society as a whole. Furthermore, management of megaprojects as a professional practice lacks a framework to provide lessons to support the improvement of decision-making process for the future generation of infrastructure for development, which increasingly has to be built up under sustainability and accountability premises. This paper proposes an integrative framework based on four dimensions of responsible innovation, four instruments of accountability and six principles addressing sustainability that help to define and implement megaprojects, aiming at an inclusive approach – to better inform practitioners, policy makers, academics, and the wider society - when decisions about building megaprojects are taken. This framework might help also to analyse megaprojects in order to extract lessons that might be useful in the controversial arena of infrastructure development.

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1. Introduction

Multibillion dollar investments in mega infrastructure projects in developed and developing countries are central to the politics in countries which have them and, in recent decades, these projects have been enabled by a mixture of public and private capital, development banks and national and supranational governments *(recent examples in the UK include the Channel Tunnel, London Olympics 2012 and the construction of Heathrow Airport Terminal 5)*. Moreover, these projects face political, environmental, social and economic supporters and detractors. However, most of these projects have strikingly poor performance in terms of economic, environmental, public and social issues *(e.g., the Athens Olympic Games 2004 is an obvious example whilst the Brazilian World Cup of 2014 is also considered by many to have been a failure)*.

The recurrent problem of overestimation of benefits and underestimation of costs in project management has been the persistent performance paradox that managers of private and public megaprojects have faced for decades without being able to address with the aid of planning and control tools *(Flyvbjerg et al., 2013)*. The paradox is about the increasing number of megaprojects implemented despite their performance being deemed as 'poor' *(overestimation of benefits and underestimation of costs)*. However, the paradox is artificially created because we tend to separate the content of the project *(i.e. the specific purpose of and sector/industry where the project is embedded)* from the function of the project *(i.e. the general processes used to manage the project)*. Focusing on the function of the project whilst neglecting its content makes for a fragmentary approach which, in turn, makes the evaluation of project success elusive *(or confusing)*. One recent example is the World Cup 2014 in Brazil. Before the World Cup, it was deemed as a failure due to cost overrun, delays, and not delivering according to the specifications required. But after its completion, it is not generally considered a failure. Future use of the stadia and of the event's legacy remain issues of concern.

The paradox of the performance of megaprojects needs to be addressed beyond the classical triple constraints of time, cost and adherence to specification. For instance, *(Shenhar and Dvir, 2007)* extend the dimensions of project success beyond the triple constraints to a consideration of the impact on customer, impact on team, business and direct success, and preparation for the future, which refers to new technology, new market, new product line, new core competency, and new organizational capability, that is, the future competitiveness of the firm. Megaprojects, due to their inherently complex nature, require a stronger emphasis on the aspects related to preparation for the future. However, we argue that this concern should include other criteria such as responsibility, accountability and sustainability. For example, for megaprojects such as the London Olympics 2012, an important aspect of project success is the legacy of the event in terms of infrastructure and the promotion of sport in the UK. Thus legacy, as part of the sustainability criteria, is an important aspect of megaproject success that is not adequately addressed by current frameworks which could use responsibility as an overarching concept to embrace accountability and sustainability.

Current literature in project and megaproject management addresses accountability and sustainability in a somewhat fragmented way. Bruzelius et al. *(1998)* and Flyvbjerg et al. *(2013)* provide some suggestions for improving accountability in megaprojects, while Romzek and Dubnick *(1987)* analyze the Challenger tragedy as a case of accountability in the public sector. Other authors focus on the social and environmental impacts of megaprojects *(e.g., Charest, 1995, Gellert and Lynch, 2003, Molle and Floch, 2008, Scudder, 1973)*. Gaafar and Perry *(1998)* discuss the limitation of design liability for contractors in the construction industry. The project owner is singled out by Zwikael and Smyrk *(2015)* as the main driver of accountability for the realization of project benefits. Mueller et al. *(2014)* identifies some organizational enablers for governance and governmentality of projects such as the development of self-responsible and self-organizing people. Self-responsible people are important for the delivery of sustainable outcomes in projects, but the notion of responsibility is supposed to transcend people and to consider wider environmental and contextual issues.

In the sustainability domain, Klakegg *(2009)* suggests strategies for improving the relevance and sustainability in the front-end for major public projects. Deng and Poon *(2013)* suggest ways to improve practices at the early stage of mega-events flagships in order to meet sustainability challenges for catalyzing the regeneration of urban areas. Silvius et al. *(2012)* address the various aspects of sustainability in project management. Edum-Fotwe and Price *(2009)* propose a social ontology to articulate the social dimension of sustainability appraisal for projects in the construction sector, while Zhang et al. *(2014)* provide a model to assess the sustainability of construction projects.

Finally, the professional project management associations such as the Project Management Institute *(PMI)* in the USA focus on aspects of ethics and code of conduct for the project management community *(PMBoK, 2013)*.

On the other hand, given the high level of uncertainty encountered within the development of megaprojects, innovation is put at a premium in the face of the complexity of the project and the environment. Davies and Hobday *(2005)*, Hobday *(1998)*, and Shenhar and Dvir *(2007)* discuss the management of innovation when deploying complex systems projects. Innovation in megaprojects is discussed by Rothengatter *(2008)* for shaping new institutional arrangements and new assessment tools to improve the front-end process. Barlow *(2000)* investigates innovation in megaprojects of complex offshore construction projects, and Davies et al. *(2009)* and Gil et al. *(2012)* investigate innovation in the construction of London Heathrow Terminal 5.

More than two decades ago, Laszlo *(1991)* raised the issue of 'responsible *(project)* management in an unstable world'. More recently, Bredillet *(2005)* addressed the issue of 'reconciling uncertainty and responsibility in the management of projects', and De Schepper et al. *(2014)* propose a stakeholder management tool in order to manage stakeholder responsibilities in Public-Private Partnerships. It seems this is an appropriate time to address 'Responsible Project Management' more extensively and in a more integrated way.

In recent years, the concept of 'Responsible Innovation' *(e.g., Stilgoe, 2013, Stilgoe et al., 2013)* has been developed to highlight the wider social and ethical implications of research projects. In a similar vein, given the high number and diversity of approaches to accountability, sustainability, liability and responsibility in project environments, we argue that a more integrated approach to the social and ethical implications of megaprojects is needed, and we propose the concept of 'Responsible Project Management' *(RPM)* to articulate some interrelated approaches. Responsible Innovation *(RI)* offers preconditions on how to deal with these issues aiming at improving overall performance of megaprojects addressing sustainability.

The research problem is how to embed responsible innovation, accountability and sustainability practices in the process of megaproject conceptualization and development in order to improve their performance. The starting point is with megaprojects as these are 'extreme' cases of complex projects, for which responsibility, accountability and sustainability are more prominent for society as a whole. However, the framework could be applied to other types of projects in developed countries *(e.g., research projects, nuclear plants, space projects, refineries, etc.)*, as well as in developing countries *(e.g., water and sewage systems, energy dams, underground lines, etc.)*.

The framework brings together the dimensions of responsible innovation *(Stilgoe et al., 2013)*, the instruments of accountability for megaprojects *(Flyvbjerg et al., 2013)*, and the principles of sustainability *(Silvius et al., 2013, Silvius et al., 2012)* as a starting point to fleshing out in practice the areas of concern when the conception of a project emerges and evolves towards an outcome *(e.g., new industrial facilities and infrastructure for transportation and water supply)*. This requires an inclusive approach and increasing participation of all stakeholders involved in the process *(i.e. members of society and their representatives, investors, project developers and integrators, government organisations, etc.)*. They are of social, economic, and political importance for the success and the legacy of developmental megaprojects and the avoidance of unintended consequences.

This paper explains the concept of RPM in four sections. In this first introductory section, we articulate the various aspects *(accountability, liability, sustainability, etc.)* in which the issue of responsibility is discussed in the literature of megaprojects. We propose that these various aspects can be articulated into an integrated framework through the concept of 'Responsible Innovation'. In Section 2, we present the four dimensions of RI *(Stilgoe et al. 2013)*, the four instruments for accountability in megaprojects *(Flyvbjerg et al., 2013)* and the six principles of sustainability *(Silvius et al., 2013, Silvius et al., 2012)*, which are the starting point for developing the integrated framework for RPM. In Section 3 we develop the framework for 'Responsible Project Management,' organizing the dimensions, instruments and principles in a more comprehensive way for better understanding and visualizing of the various aspects put into play. Section 4 draws some conclusions regarding the integrated framework to improve megaproject performance, and invites further research in order to address the limitations of the framework and to refine it.

2. In search of a framework for responsible project management

The sustainability challenges that we face every day have changed dramatically what we do and what we are expected to do in order to guarantee access to goods and services to the current and future generations. It has changed the perspective from just a few people in charge of sustaining any economic, social and environmental system to a more inclusive approach. This means that the present model of economic growth of countries may not be socially and environmentally sustainable in the long term.

This raises the problem of the need for a more holistic and coherent view of projects in terms of the degree of fitness with their environment and society at large. Projects *(especially the large scale, megaprojects)* can be seen as socio-technical systems, beyond the techno-economic paradigm which is the pervasive approach predominant in the development of megaprojects. Issues such as the public value of megaprojects tend to be undervalued and insufficiently addressed in the early stages of the front-end and planning of megaprojects, sometimes resulting in 'white elephants' that only raise suspicion before the public eye.

The main purpose of this section is to review critically three interrelated bodies of literature to explore sustainability as the main aim of any economic and social system and to obtain in-depth understanding as to why we need a Responsible Project Management concept and a framework for its operationalization.

The section explores three propositions in order to obtain a better understanding of the meaning of sustainability of project management and to address the agents and processes that influence accountability and responsibility therein. These propositions focus on:

- Responsibility regarding the activities and processes and their intended and unintended consequences when searching, defining and carrying out new projects (Who's responsible? Who benefits? Who decides? What are the risks? Who's in control? What if we are wrong? What are the alternatives? Etc.) (Stilgoe, 2013).
- The sustainability of the project per se. That means projects that guarantee to a certain extent the protection of the planet's natural resources and increasingly create wealth and welfare for more people (Silvius et al., 2012).
- Redrawing and rethinking some instruments of accountability of private and public sectors and increasingly society's participation in the development of major infrastructure and megaprojects (Flyvbjerg et al., 2013).

The concept of RPM is novel as is evidenced by it not being highlighted in the literature. The contributions of this paper are in two aspects: *(i)* to introduce the RPM concept in regard to megaprojects; and *(ii)* to provide a framework which might help improve the performance of project management.

2.1 Responsible Innovation Approach

The Responsible Innovation approach started to appear in academic and policy studies of science, technology, and society in the past 20 years. However, as it is addressed by Stilgoe et al. *(2013)*, responsible innovation is an idea that is both old and new and an important area of research and practice, which is framed in different time and place. Science, Technology, and Innovation *(STI)* have allowed society to have important achievements. In turn, society has also influenced their direction. However, the key question for scientists, technologists, innovators, firms, and policy makers is the extent to which STI can generate economic and public values that match the demands of society. This is an important concern in developed countries and increasingly in developing countries *(Murakami et al., 2013)*, since sustainability is a local-global process, which involves individual, organisational and societal responsibility.

RI is a recent and emerging powerful policy discourse in Europe and North America *(Owen et al., 2013a, Owen et al., 2013b)* and increasingly in cross-cultural perspectives from North-South governance of controversial areas of research, technologies and innovation *(Macnaghten et al., 2014)* and responsible global leaders in management *(Muff, 2013)*.

The RI framework proposes that research and innovation processes must be responsive to societal challenges, in the face of unavoidable uncertainties, ambiguities and questions that research and innovation create *(Owen et al., 2013a)*. Stilgoe et al. *(2013, p 1570)* reframe responsibility aiming at opening up scientific governance, which constitutes the relevant foundations for responsible innovation and expands to 'responsible research and innovation.' Although the framework lacks conceptual weight, it appears in academic and policy literature and debates around nanotechnology and other emerging contested areas of science and technology *(e.g. geoengineering projects, GMOs, etc.) (Owen et al., 2013b, Parkhill et al., 2013, Stilgoe, 2013, Stilgoe et al., 2013)*. RI is seen as a platform for making sense of the move from the governance of risk to the governance of innovation itself as it is conceptualised by the European Commission. However, RI is and will be an evolving framework since different perspectives address different factors of responsibility, accountability, and sustainability regarding science, technology, and innovation, which affect economies and eventually societies in different ways.

von Schomberg *(2013, p 63)* defines Responsible Research and Innovation as 'A transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the *(ethical)* acceptability,

sustainability and societal desirability of the innovation process and its marketable products *(in order to allow a proper embedding of scientific and technological advances in our society).*' This definition is anchored to European policy products, processes, and values.

Responsible innovation *(Stilgoe et al., 2013, p 1570)* has similar elements to those proposed by von Schomberg *(2013)*. However, it emerged in the context of UK public debates about new areas of science, technology and innovation *(STI)* with high uncertainty *(e.g., geoengineering and biotechnology)*. Responsible innovation means taking care of the future through collective stewardship of science, technology and innovation in the present. These new areas of STI involve a set of convergence of different technologies and social arrangements, which require a more systemic and systematic way to look at the interactions of actors and factors influencing the decision making process for the creation, selection, adoption and diffusion of new science and technology and the innovations derived from them *(e.g., products, processes, or purposes of innovation)*. They also include conventional governance focuses of products, particularly of technological risk, tools of ethical governance and research integrity moving into questions of processes, especially when human volunteers and animals are involved in experimentation. Governance extends to questions of uncertainty, purposes, motivations, social and political institutions, trajectories, and direction of innovation.

Stilgoe et al. *(2013)* propose four dimensions of the RI framework *(i.e. anticipation, reflexivity, inclusion and responsiveness)*, which aim at responsible innovation by raising, discussing and responding to societal concerns and interests in research and innovation. These dimensions are helpful to the understanding of the importance and convergence of STI in a specific application and/or a complex system, which is the case of infrastructure megaprojects. These projects have high complexity observed at multiple levels: components, subsystems, systems, and array or systems of systems *(Shenhar and Dvir, 1996, Shenhar and Dvir, 2007)*. Accordingly, project managers as well as other stakeholders involved in the projects become very important agents to improve project performance under factors/dimensions supporting systems integration *(Davies and Mackenzie, 2014)* and eventually their sustainability *(Silvius and Schipper, 2012, Silvius et al., 2013, Silvius and van den Brink, 2013)*.

Anticipation involves systematic thinking aimed at increasing resilience, while revealing new opportunities for innovation and the shaping of agendas for socially-robust risk research and innovation. Improved anticipation in governance comes from several sources: political and environmental concerns about the pace of social and technical change; from scholarly critiques of the limitations of top-down risk-based models of governance, which entail the social, ethical, and political stakes associated with technological and scientific progress. The negative implications of new technologies and innovations embedded in megaprojects are often unforeseen and risk-based estimates of harm have failed to provide early warning. Then anticipation calls for stakeholders to ask specific questions about what if…? to consider contingency, what is known, what is likely, what is plausible and what is possible; any process of anticipation faces a tension between prediction, which tends to see particular futures, and participation, which looks for a diversity of futures *(Stilgoe et al., 2013, p 1570-1571)*. Moreover, anticipatory processes *(e.g. scenarios)* need to be well-timed in order to be constructive and meaningful *(Rogers-Hayden and Pidgeon, 2007, in Stilgoe et al., 2013, p 1571)*. However, anticipation faces institutional and cultural resistance *(Stilgoe et al., 2013, p 1571)*, for which reflexivity and inclusiveness might be helpful to bring new knowledge and values that might help to overcome the resistance.

Reflexivity involves recognising and systematically reflecting upon social and ethical issues of decision making, while otherwise carrying out normal routines and practices. However, reflexivity to create awareness of the broader context is not enough if individuals and organisations do not act consequently to their reflexions *(Fisher and Rip, 2013)*.

Reflexivity at the level of institutional practice, means holding a mirror up to one's own activities, commitments, and assumptions, being aware of the limits of knowledge and being mindful that a particular framing of an issue may not be universally held. Building actors' and institutions reflexivity means challenging and rethinking prevailing conceptions about the moral division of labour within science, technology and innovation; and challenges their assumptions of amorality and agnosticism. It asks scientists, technologists, and innovators to remove the boundary between their role responsibilities, and wider, moral responsibilities. Importantly, private and public institutions have a responsibility not only to reflect on their own values systems, but also help to build the reflective capacity within the practice of science, technology and innovation *(Stilgoe et al., 2013, p 1571)*.

Inclusion is a process of moving beyond engagement with the stakeholders to include members of the public. It uses multi-stakeholder partnerships, forums, the inclusion of lay members on the scientific advisory committees, and other mechanisms to diversify the inputs to, and delivery of governance *(Stilgoe et al., 2013)*. However, inclusion leads to power issues among stakeholders, since their differences in expectations that underpin the dialogue might favour powerful parties. This dimension is very important when the definition of a megaproject is taking place and participatory approaches and activities are required to justify and mediate the relationships among the participants, to create diversity, which encourages the analysis of the risk of the projects; and to restrict the influence of powerful stakeholders, such as politicians and/or business associations in the tendering process. Public engagement might constitute not just a new governance paradigm *(ibid.)*, it might be a process of ongoing experimentation to confer legitimacy on the process of inclusion *(Lövrand et al., 2011, in Stilgoe et al., 2013, p 1576)* as well as legitimation of a megaproject and its implications and consequences for society in general. Therefore, inclusion processes might help to visualise and assess risks, to create a democratic participation to counterbalance power at different levels of influence on the projects *(i.e. government agencies, industrial and business interests, scientific and technical experts, and societal representatives) (Flyvbjerg et al., 2013)*.

Multi-stakeholders' inclusion is also an ongoing process in the execution of a megaproject when deliverables are presented and assessed to avoid overruns in time and cost; and to avoid unintended consequences for society *(i.e. financial breakdowns, vulnerability to natural disasters, changes in technology, environmental degradation, tax increases, etc.)*, which emerge in the process of project implementation and its legacy.

Responsiveness is the coupling of reflection and deliberation to action that has a material influence on the direction and trajectory of innovation itself *(Owen et al., 2013b, p 29)*. It requires a capacity to change shape or direction in response to stakeholder and public values and changing circumstances *(Stilgoe et al., 2013, p 1572)*. In a much broader sense, responsible innovation calls for institutionalised responsiveness for the coupling of anticipation, reflexivity and deliberation to action. Then, agents can resolve conflicts and move beyond their traditional roles. For instance, where companies highlight benefits and NGOs risks, co-responsibility implies that agents have to become mutually responsive. It means firms have to go beyond the short-term benefits and NGOs have to reflect on the constructive role of new technologies and innovations. In other words, responsiveness implies responding to changes as they arise. It requires sufficient discussion between stakeholders on the possible positive and negative consequences of STI and/or projects. Moreover, these consequences need to be visibly responsive to the society as a whole *(Owen et al., 2013b, p 44, 70, 210, 235)*.

2.2 Sustainability in Project Management

Sustainability in project management has become a very important idea among practitioners and academics from different perspectives *(i.e. normative, logical or moral point of view)*. However, it is still an emerging field of study in project management, which requires empirical evidence on how sustainability is implemented in practice *(Silvius et al., 2013)*.

Sustainability is not just relevant to projects and project management; it is increasingly necessary to support society's development and this implies the full deployment of a project, from its conception to its disposal. Since project management standards fail to address sustainability, *(Silvius et al., 2013, p 14)* propose to include it. From this perspective, the project management profession should change from 'doing things right' to 'doing the right things' *(Silvius and van den Brink, 2013)*. Moreover, 'in order to change the ways we DO things, we need to change the way we VIEW things' *(Nelmara Arbex, Global Reporting Initiative Director in Planko and Silvius, 2012, p 19)*.

(Silvius et al., 2013, p 11) reported that in 56 case studies an overall level of sustainability consideration in the Actual Situation *(that is, giving consideration to sustainability of the project)* was 25.9%. For the Desired Situation *(having an ambition about sustainability of the project)*, the score is 10% higher *(35%)*. The results show that sustainability is most of all considered on the level of business resources, accordingly with a traditional project management view and not at the level of the product or service, which would correspond to a broader socially responsible approach for project management. The authors conclude that sustainability is an emerging trend moving from reputational strategy towards business orientation. It would be argued that sustainability must be a way of working, doing, and living in a way firms and any other organisations improve the welfare of the society and prevent the exhaustion of natural resources.

'Sustainability in projects and project management is the development, delivery and management of project-organised change in policies, processes, resources, assets or organizations with considerations of the six principles of sustainability, in the project, its results and its effects' *(Silvius and Schipper, 2012, p 40)*. This includes the internal, which focuses on the delivery and management processes of the project, the project resources, approach and team; and the external scope, which focuses on the deliverables and benefits of the project, in other words, the project results and their effects. Also, sustainability is about both short term and long term orientation, another principle of sustainability, which links these two scopes together. Although one could argue that the responsibility of the project manager is restricted to the internal scope, the project delivery and management processes, considering sustainability in project management inevitably includes sustainability aspects of the project deliverables and their effects. This

Main Dimensions to achieve Sustainability	Contexts	Variables
Economic	Economics	Returns on investment Direct financial benefits Net present value Strategic value Risk analysis
	Business and organisational model	Flexibility Optionality in the project Business model Organisational arrangements
Environmental	Transport	Local procurement Supplier selection Digital communication Travelling Transport
	Energy	Energy production and use Emission/CO2
	Water	Water supply and usage Recycling
	Waste	Production Recycling and disposal
	Ecosystem	Land use Affected landscape Use and erosion of resources Biodiversity Pollution sources Noise Community and social impacts
	Use of materials and resources	Reusability Incorporated energy Sustainability of suppliers
Social	Labour practices	Fair employment Labour/management relations Fair wages and salaries Health and safety Training and education Organisational and systems learning
	Human rights	Non-discrimination Diversity and equal opportunities Freedom association Opposing child labour, forced and compulsory labour
	Society and customers	Community support and development Public policy/compliance Customer health and safety Product and services labelling Market communication and advertising Customer privacy
	Ethical behaviour	Investment and procurement practices Anti-bribery and corruption measures Anti-competitor behaviour

TABLE 1. *Context and Variables for the main Dimensions to achieve Sustainability for Project and Project Management*

Source: Authors' modification of (Silvius, 2010, cited by Silvius and Schipper, 2012, p 41).

external scope may not be the primary and direct responsibility of the project manager, but project managers are the best positioned to bring sustainability aspects to project management, which goes beyond corporate social responsibility narrowly defined *(Russell, 2008, cited in Schipper and Silvius, 2013).* Therefore, the project manager has an influence not just on the project process, but also on project deliverables *(Schipper and Silvius, 2013)* .

The proposed principles of sustainability *(Schipper and Silvius, 2013, Silvius et al., 2010, Silvius et al., 2013, Silvius et al., 2012, Silvius and van den Brink, 2013)* act as a guidance to address sustainability in project and project management. They are based on reflections of multiple propositions *(Gareis et al., 2011, Gilbert et al., 1996, Martens, 2006, Robinson, 2004, Willard, 2005)* including the ISO 26000. These principles are:

- Sustainability to balance and harmonise social, environmental and economic interests. It requires a proactive approach and is not just about compensating harmful unintended consequences, but about creating good effects.
- Sustainability addresses both short-term and long-term consequences of firms, organisations, and government and stakeholders' actions. It is, therefore, not only focused on short-term gains. This is a very important principle for publically financed projects, for which firms in many cases have overemphasised the short-term performance and thereby lost sight of the possible negative social impacts or environmental degradation, which may occur over the long-term.
- Sustainability focusing on local and global orientation for which international stakeholders' behaviours (i.e. government agencies, competitors, suppliers or potential customers) and their institutions must coordinate efforts across several levels, ranging from the global to the regional and the local.
- Sustainability based on consuming income, ensuring the natural capital remains intact and the environment is not degraded. Therefore, the extraction of renewable resources should not exceed the rate at which they are renewed. Whereas this principle is clear for financial managers, from a social or environmental perspective, however, the impact may not be visible in the short-term, causing degradation of resources in the future. Therefore, for firms to be sustainable, managers have to manage not only economic capital, but also social and environmental capital.
- Sustainability, with its focus on transparency and accountability means that organisations are open about their policies, decisions and actions, including the environmental and social effects of their activities. This implies that they provide timely, clear and relevant information to their stakeholders so that the latter can evaluate the former's actions and can address issues of concern. The principle of accountability is logically connected to this and implies that an organisation is responsible for its policies, decisions and actions and the effect of these on environment and society – and which it accepts.
- Sustainability is also about personal values and ethics. Sustainable development is inevitably a normative concept, reflecting values and ethical considerations of a society. Accordingly, a change in behaviour is required on the part of professionals, business, and consumers so that they are congruent with this normative stance.

These principles represent consideration and dilemmas from different perspectives on the project. However, in order to integrate these principles into the project and project management, they have to be specific to the project under consideration for which specific context and variables have to be analysed *(e.g., see* **Table 1***)*.

These principles eventually have direct effects on the societal and organisational context of the project, the increasing responsibility of stakeholders in the short and long term as well as in both local and global environments. Therefore, they will influence the content of the project, which will influence objectives, results and success factors, when environmental and social concerns are included. These principles will also affect the business case in order to expand non-financial factors *(e.g. societal perceptions of the project, ethical behaviour on the selection of suppliers, etc.) (Schipper and Silvius, 2013, Schipper et al., 2012)* to refine and define the success of the project in a wider and more sensitive way to benefit not just firms and government organisations, but the welfare of future generations.

2.3 Accountability in megaprojects

Accountability in megaprojects comes up from Flyvbjerg et al.'s *(2013)* discussion of the five most important factors that explain the megaproject paradox: a) cost overrun, b) inaccuracy in the demand forecasts, c) environmental impacts and risks, d) regional and economic growth effects, and e) optimistic risk analysis.

Cost overrun in major transport infrastructure projects is widespread – often by 50-100%. A main cause of overruns is a lack of realism in initial cost estimates because many factors influencing the cost are ignored *(e.g. geological risk, environmental risk)*, or underestimated *(e.g., duration of activities, changes in specifications, changes in exchange rate, etc.)*. Many projects also involve important technological innovations with high risk *(e.g., delays in technological development, uncertainty of the outputs and unexpected consequences)*, which is translated into cost increases.

Also in the transport sector, **demand forecasts** *(e.g., covering traffic volumes, spatial traffic distribution and transport modes, etc.)* are the basis for socio-economic and environmental appraisal but are usually wrong by 20-70%. Therefore, the financial viability, which relies heavily on these forecasts, is often poor. If the actual viability had been known for a given project, the decision might have been: a) not to implement the project, b) to implement it in a different way, or c) to develop an alternative project. Clearly, demand uncertainty is invariably high. However, the lack of further use of tools to understand the sources of uncertainty and the risk of the project *(except the economic risk assessment)* leads to an inefficient use of resources.

The extent and magnitude of the actual **environmental impacts** of projects are often very different from forecast impacts. The Environmental Impact Assessment *(EIA)*, which is the main methodology used to predict environmental effects of megaprojects, is rarely used to trigger learning. The reason for lack of learning is that in most cases, post-auditing of projects is neglected. Furthermore, although many environmental studies have been done, there are important deficiencies of these assessments such as a) a lack of accuracy in impact predictions, b) the narrow scope of the impacts in their time horizon; and c) an inadequate organisation, scheduling and institutional integration of the EIA process in the overall decision making process.

The **regional, national and sometimes international development and growth** claimed by promoters of projects typically does not materialise, or they are so diffuse that researchers cannot detect and measure them. Studies of the effects of economic growth of firms affected by the megaprojects are marginal. The main reason why is this so, the transport cost is relatively small component of the final price of goods and servic-

es *(1-7%)* that firms produce *(ibid., p 71)*. However, the combination of the investment in both infrastructure and social capital in proactive regional development has proved to attract new business and leisure activities.

The **appraisal optimism of risk analysis** refers to the actual project viability, which does not correspond with forecast viability, especially market forecasts, which are in most cases brazenly over-optimistic *(ibid., p 136)*.

(Flyvbjerg et al., 2013) conclude that rent seeking behaviour and the appraisal optimism are not in the interest of those whose money is put in risk, i.e. taxpayers or private investors. Nor are they in the interest of those concerned with environment, safety, democracy and the social interest. For those stakeholders, *(Flyvbjerg et al., 2013)* propose four instruments to improve accountability in megaproject decision making.

1. **Transparency** is the main instrument to enforcing accountability. Transparency refers to a higher degree of openness and of public participation, which requires a high involvement of stakeholders, explicitly civil society. In other words, it demands inclusion of wider groups of stakeholders, and the engagement of the public that might be affected.

2. **Performance specifications** imply a goal-driven approach to megaproject decision making. This is the opposite of the conventional technical-solution approach. Performance specifications force stakeholders to focus on the end rather than the means. This requires a constructive, reflexive and responsive dialogue with different stakeholders, which play an active role regarding environmental, safety, economic, and social interests to construct credibility for the project and their supporters. This instrument is clearly related to anticipation and reflexivity dimensions of responsible innovation, which aim at recognising and systematically reflecting upon social and ethical issues of decision making. These processes might eventually contribute to balancing and harmonising the interest of the economic, social and environmental stakeholders.

3. The **regulatory regime** refers to the set of political, economic, and financial rules regulating the construction and operations of a specific megaproject, which influence the cost and risk of the project. It has to be set up front when the project is conceptualised and implemented – meaning that the regulatory regime is central to any feasibility study and appraisal. This instrument is becoming increasingly important since most megaprojects are funded by private and public investment. Furthermore, the political nature of projects requires a regulatory regime which identifies all risks before the decision regarding the project is made and supports and anticipates possible responses to stakeholders' demands.

4. **Risk capital**, in economic terms, is the most important issue from an accountability point of view. It leads to the decision on whether to proceed with a project. Governments are not sufficiently effective in enforcing accountability on decisions made on mega infrastructures. A more effective way of achieving accountability is to authorise a project – assuming the project satisfies agreed public interest objectives – but without a sovereign guarantee. Hence at least part of the capital is genuine risk capital. In other words, only if this capital is mobilised will the project be undertaken. Thus, tax payers bear limited risk and investors will share the costs of wrong decisions. This inevitably necessitates a high degree of involvement by investors during the design, construction and operation phases of the project. As a consequence, better cost control can be expected and better control against construction delays.

(Flyvbjerg et al., 2013) propose two alternative models to improve accountability in megaprojects decision making: one based on the state-owned enterprise *(SOE)* approach to project development, and the other on the build-operate-transfer *(BOT)* approach. Both alternatives require careful consideration of the four instruments; moreover, they are very useful in supporting some of the sustainability principles. For instance, it is clear that the issue of sustainability is important for firms and organisations since infrastructure megaprojects are always subject to public scrutiny. For firms, the short term is crucially important *(especially on cash flows and profitability)* as it often determines long term survival. In the case of government organisations, since mega infrastructures are assessed by society in terms of perceived costs and benefits, short term success or failure of the projects might affect and influence the political environment in the long term.

3. An Integrative Framework: Responsible Project Management

The idea of an integrated framework is to present and reflect on the four dimensions of responsible innovation proposed by *(Stilgoe et al., 2013) (i.e. anticipation, reflexivity, inclusion, and responsiveness)*, which are the preconditions for responsible project management achieving sustainable projects. These dimensions embed and extend the instruments of transparency, performance specifications, regulatory regime and risk capital in order to improve megaprojects accountability as proposed by *(Flyvbjerg*

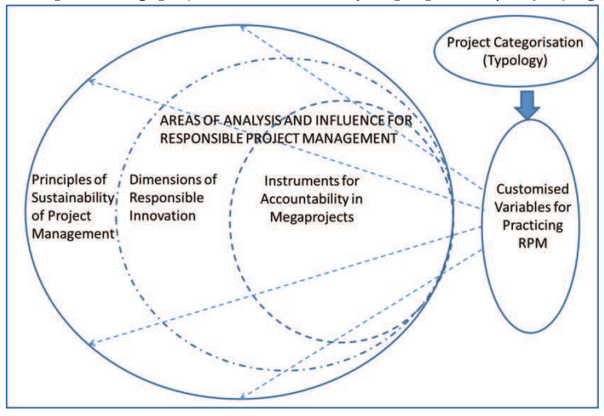

FIGURE 1. *An integrated framework for Responsible Project Management (RPM)*

Areas of analysis and influence to operationalise RPM (Preconditions)

Principles of Sustainability	Anticipation	Reflexivity	Inclusion	Responsiveness	Transparency	Performance specifications	Regulatory regime	Risk capital
Social, environmental and economic interest	(1) Explicit recognition of the complexities and uncertainties of the future	(2) Rethinking moral division of labour	(3) Building capacity for RPM through education	(4) Including and nurturing diversity in the decision making process	(5) Public scrutiny of the stakeholders and the public interests and commitments	(6) Public policy and public interest requirements	(7) Developing integrated regulatory regimes to satisfy the principles of sustainability of a larger group of stakeholders and the public	(8) Increasing ex post social, environmental and economic project assessment
Short- and long term orientation	(9) Investing in scenario building and vision assessment of projects and their alternatives	(10) Enlarging and/or redefining role responsibilities	(11) Setting up an iterative learning process	(12) Developing strategic policies and technology roadmaps	(13) Increasing involvement of civil society	(14) Understanding and designing projects capacity requirements and alternatives	(15) Working out the short and long term feasibility studies in order to move in the sustainable direction of the project	(16) Distributing the risk/benefits among public investors and public
Local and global orientation	(17) Participating in local, national and global fora	(18) Analysing the interconnectivity of the systems and their implication for stakeholders	(19) Highly coordinated effort across several stakeholders and public	(20) Flexibility to respond to project management needs at different levels	(21) Representative participation of stakeholders and the public	(22) Developing technological standards	(23) Developing institutions to enforce environmental and economic rules	(24) Willingness of stakeholders to negotiate and share
Consuming income, not capital	(25) Analysing systematically intended and unintended consequences	(26) Reconfiguration of the use of resources	(27) Implementing harmonious economic, social and environmental projects	(28) Explicit scrutiny of the tensions and governance mechanisms	(29) Rearrangements of public and private responsibilities to ensure sustainability	(30) Developing alternative specifications before appraising the project to fulfil the sustainability criteria	(31) Setting up the economic, environmental and social rules to achieve sustainability and to avoid political costs	(32) Ensuring economic, financial and social viability
Transparency and accountability	(33) Anticipatory discussions of possible and desirable futures	(34) Institutional reflexivity in the governance of the decision making process	(35) Broader stakeholders and public engagement	(36) Developing intellectual property regimes to attend public and stakeholders demands	(37) Availability of project documentation and independent peer review	(38) Set up clear and unequivocal performance criteria	(39) Engaging public, private and the public in the development and choice of the regulatory regime	(40) Ensuring the role of the government and private sector (e.g. SOE and BOT models)
Personal values and ethics	(41) Shaping desirable futures	(42) Challenging stakeholders and society value systems	(43) Clarification of purpose and motivation to develop specific project	(44) Embracing values and ethical considerations of stakeholders and society	(45) Developing a constructive role of stakeholders and the public to set up common goals	(46) Develop the value systems that guide the performance specifications	(47) Set up the regulatory regime involving the value systems of stakeholders and the public to improve performance	(48) Internalising values in the economic and environmental decision making

TABLE 2. *Areas of analysis and influence of the Framework for Responsible Project Management*

et al., 2013); which eventually aim at supporting the principles for sustainability in project management proposed by *(Silvius et al., 2012) (i.e. balancing and harmonizing social, environmental and economic interests; long and short term orientation; local and global orientation; consuming income, not capital; transparency and accountability; and personal values and ethics)*. Principles of sustainability on the top layer, dimensions of responsible innovation and instruments for accountability as preconditions for responsible project management are represented as nested circles or progressive layers in **Figure 1**. The nested circles and progressive layers give a sense *(but not a necessity of)* hierarchy. This means that the principles of sustainability, dimensions of responsible innovation and instruments for accountability in megaprojects may be seen 'blended' in a way that better suit the megaproject under consideration.

RPM goes beyond time cost and quality constraints, which are firm-customer centred. RPM is a process carried out by responsible and accountable firms, government agencies, society representatives and in general multiple stakeholders. Their systematic and systemic participation in the definition, selection and implementation of megaprojects by highlighting some of the 48 areas of analysis and influence of RPM *(see* **Table 2***)* is crucial in achieving sustainability. The ultimate aim is preventing and/or avoiding negative unintended consequences as a result of implementing a megaproject.

The RPM framework entails cross disciplinary views and activities, of multiple combinations of the various areas of analysis and influence of RPM throughout the preconditions *(i.e. dimensions of responsible innovation and instruments for accountability)*.

Table 3 shows an instance of the 'customised variables for operationalising and practicing RPM.' Each project can take different and specific combinations of variables depending on a) the type of project based on novelty *(derivative, platform, breakthrough)*; technology *(low, medium, high and super high)*; scope *(assembly, system, array or meta system)*, and expected legacy, that is, the degree of uncertainty and complexity of a project *(Shenhar and Dvir, 1996, Shenhar and Dvir, 2007)*; and their systems *(Davies and Hobday, 2005, Hobday, 1998) (e.g., research projects, industrial projects, infrastructure projects and or megaprojects)*; and b) the economic, environmental and social impacts of the project *(Flyvbjerg et al., 2013, Silvius et al., 2013, Silvius et al., 2012, Silvius and van den Brink, 2013, Stilgoe et al., 2013)*.

These areas of analysis and influence to operationalise RPM are the starting questions for each of the projects and the customised variables are left open as they are defined for each project in consideration such as research projects and mega projects, industrial, infrastructure and complex projects. Customised variables could be analysed and defined by using indicators as proposed by several authors depending on the stakeholders' views, interest and responsibilities of a specific project *(see examples in* **Table 1***)*. These indicators are included in **Table 3**, that is, the framework informs the analysis of the customised variables. Moreover, the elaboration of the customised variables, as indicated in the Framework would also be informed by a project categorisation and typology, which can highlight some aspects such as the extent of the geographical impact of the project - from local, to regional, to national, to international, to global.

3.1 Responsible Project Management as a cross disciplinary approach

Responsible project management is a cross disciplinary management process in which stakeholders either feel responsible, or can be made responsible for a project *(i.e. the product and/or the service)* and its consequences on a sustainable basis. RPM refers to whatever invites, accommodates, stimulates, enhances, fosters, implies, or incentivises responsible action from stakeholders who have participated in the conception and definition of a megaproject as well as its design, execution/implementation, control during its life cycle *(including maintenance)* and eventually its disposal. It implies that those who initiated it and were involved in its functioning be accommodated as ethical and responsible agents. They have to be capable of:

- obtaining as much as possible the relevant knowledge on the consequences of the inputs and outcomes of their activities; and on the range of options to commission a megaproject;
- evaluating options effectively in terms of relevant values (e.g. wellbeing, equality, justice, privacy, safety, security, sustainability, democracy, and efficiency). In other words, RPM is a capability procedure for ethical stakeholders and agents involved in the conception, development and disposal of megaprojects.

RPM as a tool might be a process to improve the performance of firms and organisations and/or to prevent the collapse of firms and governments by avoiding unintended consequences for societies and their ecosystems *(Flyvbjerg et al., 2013, van der Hoven, 2013, Silvius et al., 2013)*.

The RPM framework helps to address project sustainability at three different levels: a) the macro-level, which focusses on the socio political and economic environment of the project, i.e. the context in which the project is conceptualised and defined; b) the meso level, which articulates the institutional processes which affect the macro level, and supports the firms and organisations activities to conceptualise and implement the project, and c) the micro or individual level by connecting responsibility when no one actor/stakeholder/public is in control, but many are tasked with specific project activities *(Flyvbjerg et al., 2013, Macnaghten et al., 2014, Stilgoe et al., 2013)*.

3.2 Limitations of the concept and framework of Responsible Project Management

The main constraint on RPM is the limited reflexion of the implications and consequences of past projects in the use of resources to avoid further degradation of the environment and society. The main problem is the lack of systemic and systematic assessment of the costs and benefits of existing projects. Most of the existing assessments address the consequences of disasters such us Bhopal gas leakage in 1984, Chernobyl explosion in 1986, and Fukushima explosion in 2011. Moreover, the debate on climate change and environmental sustainability is a hot spot because of the contested analysis of the outputs of some of the consequences of the extraction and exploitation of resources versus the rate at which they are renewed. Whereas economic considerations are usually clear, from a social and/or environmental perspective, considerable progress still needs to be made.

RPM requires a proactive approach as to how organisations influence each other. Recognising the complexities and uncertainties of projects, which could be improved by anticipatory discussions carried out by including and engaging a broader audience than just traditional stakeholders to visualise short and long term futures at different levels, that is, economic, social and environmental ranging from the global to the regional and the local. Moreover, they would help to shape, coordinate and organise efforts towards them and eventually creating benefits instead of compensating unintended consequences, which may not occur before the long-term.

RPM is logically connected to this and implies that an organisation is responsible for its policies, decisions and actions and the effect of these on environment and society. Responsible project management is, therefore, inevitably a normative concept and process, which reflects on values and ethical considerations of organisations, their individuals and of society. It needs to have implicit or explicit set of values that professionals, business leaders, government representatives and citizens can influence and which lead to collective behaviour for conceptualisation and implementation of new projects new projects.

RPM also implies a system of learning and knowledge, which underlies the evolution of complex systems, regardless of the nature and composition of the projects and their systems *(Laszlo 1991)*. These learning systems might be the foundation for responsible leaders/stakeholders decision making process aimed at improving performance and commitment to society and environmental sustainability.

4. Conclusions And Policy Implications

By linking the idea of RPM to the accountability and sustainability of megaprojects, we aim at broadening and amplifying the scope and scale of the traditional project management approach when conceptualising, designing, planning, implementing and assessing megaprojects. The integrated framework presented in **Figure 1** reflects on the four dimensions of responsible innovation *(i.e. anticipation, reflexivity, inclusion, and responsiveness)*, which are the preconditions for responsible project management for the achievement of sustainable projects. These dimensions embed and extend the instruments of transparency, performance specifications, regulatory regime and risk capital in order to improve the accountability of megaprojects, which eventually aim at supporting the principles of sustainability in project management *(that is, balancing and harmonizing social, environmental and economic interests; long and short term orientation; local and global orientation; consuming income, not capital; transparency and accountability; and personal values and ethics)*.

This paper has developed an approach to attract the attention of project management practitioners, academics, policy makers and members of the society, which are eventually the main participants in the development of the projects and/or those who benefit from or suffer from mega projects. Since these megaprojects are becoming increasingly highly public and intensely politicised endeavours, which have generated stronger involvement of multiple stakeholder groups, they deserve special attention for the future of the project management profession and practice in the decision making process.

The implementation of this framework requires further analyses of cases and their variables in order to refine and expand the RPM framework and/or to propose new/different instruments and dimensions to improve the performance of megaprojects, which may benefit society as a whole.

references

BARLOW, J. *(2000)* Innovation and Learning in Complex Offshore Construction Projects. Research Policy, 29, 973-989.

BREDILLET, C. N. *(2005)* Reconciling uncertainty and responsibility in the management of projects. Project management Journal, September, 3.

BRUZELIUS, N., FLYVBJERG, B. & ROTHENGATTER, W. *(1998)* 'Big Decisions, Big Risks: Improving Accountability in Mega Projects. International Review of Administrative Sciences, 64, 423-440.

CHAREST, P. *(1995)* Aboriginal Alternatives to Megaprojects and their Environmental and Social Impacts. Impact Assessment, 13, 371-386.

DAVIES, A., GANN, D. & DOUGLAS, T. *(2009)* Innovation in Megaprojects: Systems Integration at London Heathrow Terminal 5. California Management Review, 51, 101-125.

DAVIES, A. & HOBDAY, M. *(2005)* The business of projects. Managing innovation in complex products and systems, Cambridge, Cambridge University Press.

DAVIES, A. & MACKENZIE, I. *(2014)* Project complexity and systems integration: Constructing the London 2012 Olympics and Paralympics Games. International Journal of Project Management, 32, 773-790.

DE SCHEPPER, S., DOOMS, M. & HAEZENDONCK, E. *(2014)* Stakeholders dynamics and responsibilities in PublicPrivate Partnerships: A mixed experience. International Journal of Project Management, 1210-1222.

DENG, Y. & POON, S. W. *(2013)* Meeting sustainability challenges of mega-events flagships. Engineering Construction and Architectural Management, 20, 46-62.

EDUM-FOTWE, F. T. & PRICE, A. D. F. *(2009)* A social ontology for aqppraissing sustainability of construction projects and development. International Journal of Project Management, 27, 313-322.

FISHER, E. & RIP, A. *(2013)* Responsible innovation: Multi-level dynamics and soft intervention practices. IN OWEN, R., BESSANT, J. & HEINTZ, M. *(Eds.)* Responsible innovation: Managing the responsible emergence of science and innovation in society. Chichester, West Sussex. UK, John Wiley & Sons, Ltd.

FLYVBJERG, B., BRUZELIUS, N. & ROTHENGATTER, W. *(2013)* Megaprojects and risk. An anatomy of ambition, Cambridge.

GAAFAR, H. K. & PERRY, J. G. *(1998)* Limitation of design liability for contractors International Journal of Project Management, 17, 301-308.

GAREIS, R., HUEUMANN, M. & MARTINUZZI, A. *(2011)* What project management learn from considering sustainable principles? Project Perspective, XXXIII, 60-65.

GELLERT, P. K. & LYNCH, B. D. *(2003)* Mega-Projects as Displacements. International Social Science Journal,, 55, 15-25.

GIL, N., MIOZZO, M. & MASSINI, S. *(2012)* The Innovation Potential of New Infrastructure Development: An Empirical Study of Heathrow Airport's T5 Project. Research Policy, 41, 452-466.

GILBERT, R., STEVENSON, D., GIRARDET, H. & STERN, R. *(1996)* Making cities work: The role of local authorities in the urban environment, Earthscan Publications Ltd.

HOBDAY, M. *(1998)* Product complexity, innovation and industrial organisation. Research Policy, 26, 689-710.

KLAKEGG, O. J. *(2009)* Pursuing relevance and sustainability. Improvement strategies for major public projects. International Journal of Managing Projects in Business, 2, 499-518.

LASZLO, E. *(1991)* Responsible *(project)* management in an unstable world. International Journal of Project Management, 9, 68-70.

LÖVRAND, E., PIELKE, R. & BECK, S. *(2011)* A democracy paradox in studies of science and innovation. Science, Technology and Human Values, 36, 474-496.

MACNAGHTEN, P., OWEN, R., STILGOE, J., WYNNE, B., AZEVEDO, A., DE CAMPOS, A., CHILVERS, J., DAGNINO, R., G. DI GIULIO, G., FROW, E., GARVEY, B., GROVES, C., HARTLEY, S., KNOBEL, M., KOBAYASHI, E., LEHTONEN, M., LEZAUN, J., MELLO, L., MONTEIRO, M., PAMPLONA DA COSTA, J., RIGOLIN, C., RONDANI, B., STAYKOVA, M., TADDEI, R., TILL, C., TYFIELD, D., WILFORD, S. & VELHO, L. *(2014)* Responsible innovation across borders: tensions, paradoxes and possibilities. Journal of Responsible Innovation, 1, 191-199.

MARTENS, M. *(2006)* Sustainability, science or fiction. Sustainability: Science, Practice & Policy, 2, 36-41.

MOLLE, F. & FLOCH, P. *(2008)* Megaprojects and Social and Environmental Changes: The Case of the Thai "Water Grid". Ambio: A Journal of the Human Environment, 37, 199-204.

MUELLER, R., PEMSEL, S. & SHAO, J. *(2014)* Organizational enablers for governance and governmentality of projects: A literature review. International Journal of Project Management, 32, 1309-1320.

MUFF, K. *(2013)* Developing globally responsible leaders in business schools. The Journal of Management Development, 32, 487-507.

MURAKAMI, Y., KOBAYASHI, T., OMORI, T., OKUYAMA, H., YOSHIZAWA, G., FUKUSHIMA, K. & HAMADA, S. *(2013)* Expanding the range of participants and a new role for experts. Interactions between Science, Technology and Society. Report in R&D Focus Area: Science Technology and Humanity. Tokyo, Research Institute of Science and Technology for Society *(RISTEX)*. Japan Science and Technology Agency *(JST)*.

OWEN, R., BESSANT, J. & HEINTZ, M. *(2013a)* Responsible innovation. Managing the responsible emergence of science and innovation in society, Chichester, West Sussex. UK, John Wiley & Sons, Ltd.

OWEN, R., STILGOE, J., MACNAGHTEN, P., GORMAN, M., FISHER, E. & GUSTON, D. *(2013b)* A framework for responsible innovation. IN OWEN, R., BESSANT, J. & HEINTZ, M. *(Eds.)* Respponsible innovation. Managing the responsible emergence of science and innovation in society. First ed. Chichester, West Sussex. UK, John Wiley & Sons, Ltd.

PARKHILL, K., PIDGEON, N., CORNER, A. & VAQUGHAN, N. *(2013)* Deliberation and responsible innovation: A geoingineering case study. IN OWEN, R., BESSANT, J. & HEINTZ, M. *(Eds.)* Responsible Innovation. Managing the responsible emergence of science and Innovation in society. First ed. United Kingdom, John Wiley & Sons, LTD.

PLANKO, J. & SILVIUS, G. *(2012)* Sustainability on business. IN SILVIUS, G., SCHIPPER, R., PLANKO, J., VAN DEN BRINK, J. & KÖLHER, A. *(Eds.)* Sustainability in Project Management. Farnham, Surrey. england, Gower Publishing.

PMBOK *(2013)* A Guide to the Project Management Body of Knowledge, Newton Square, PA.

ROBINSON, J. *(2004)* Squaring the circle? Some thoughts on the idea of sustainable development. Ecological economics, 48, 369-384.

ROGERS-HAYDEN, T. & PIDGEON, N. *(2007)* Moving engagement "upstream"? Nanotechnologies and the Royal Society and Royal Academy of Engineering's inquiry. Public Understanding of Sience, 76, 1222-1239.

ROMZEK, B. S. & DUBNICK, M. J. *(1987)* Accountability in the Public Sector: Lessons from the Challenger Tragedy. Public Administration Review, 47, 227-238.

ROTHENGATTER, W. *(2008)* Innovations in the Planning of Mega-Projects. IN PRIEMUS, H., FLYVBJERG, B. & VAN WEE, B. *(Eds.)* Decision-Making on Mega-Projects: Cost-Benefit Analysis Planning and Innovation. Cheltenham, UK and Northampton, MA, Edward Elgar Publishing.

RUSSELL, J. *(2008)* Corporate Social Responsibility: What it means for the project manager. PMI Europe Congress. Zurich.

SCHIPPER, R. & SILVIUS, G. *(2013)* Taking resposibility. Project. The voice of Project Management, 257, 24-27.

SCHIPPER, R., SILVIUS, G. & VAN DER BRINK, J. *(2012)* Reflection and conclusion. IN MANAGEMENT, A. I. P. *(Ed.)* Sustainability in project management. Farnham, Surrey, England, Gower Publishing.

SCUDDER, T. *(1973)* The Human Ecology of Big Projects: River Basin Development and Resettlement. Annual Review of Anthropology, 2, 45-55.

SHENHAR, A. J. & DVIR, D. *(1996)* Towards a typological theory of project management. Research Policy, 25, 607-632.

SHENHAR, A. J. & DVIR, D. *(2007)* Reinventing project management:the diamond approach to successful growth and innovation, Boston, MA, Harvard Business School Press.

SILVIUS, G. *(2010)* Workshop Report Group 2. IN KNOEPFEL, H. *(Ed.)* Survival and Sustainbility as Challenges for Projects. Zurich, International Project Management Association.

SILVIUS, G. & SCHIPPER, R. *(2012)* Sustainability and projects. IN SILVIUS, G., SCHIPPER, R., PLANKO, J., VAN DEN BRINK, J. & KÖHLER, A. *(Eds.)* Sustainability in project management. Farnham, Surrey. England, Gower Publishing.

SILVIUS, G., SCHIPPER, R. & KÖHLER, A. *(2010)* Introduction. IN SILVIUS, G., SCHIPPER, R., PLANKO, J., VAN DER BRINK, J. & KÖHLER, A. *(Eds.)* Sustainability in project management. Farnham, England, Gower Publishing Limited.

SILVIUS, G., SCHIPPER, R. & NEDESKI, S. *(2013)* Sustainability in project management: Reality bites. PM World Journal. Second Edition ed.

SILVIUS, G., SCHIPPER, R., PLANKO, J., VAN DEN BRINK, J. & KÖHLER, A. *(2012)* Sustainability in Project Management, Farnham, Surrey. England, Gower Publishing Limited.

SILVIUS, G. & VAN DEN BRINK, J. *(2013)* Taking responsibility: the integration of sustainability and project management. Association for Project Management.

STILGOE, J. *(2013)* Forward: Why responsible innovation? IN OWEN, R., BESSANT, J. & HEINTZ, M. *(Eds.)* Responsible innovation. Managing the responsible emergence of science and innovation in society. Chichester, United Kingdom, Wiley.

STILGOE, J., OWEN, R. & MACNAGHTEN, P. *(2013)* Developing a framework for responsible innovation. Research Policy, 42, 1568-1580.

VAN DER HOVEN, J. *(2013)* Value sensitive design and responsible innovation. IN OWEN, R., BESSANT, J. & HEINTZ, M. *(Eds.)* Responsible innovation. Managing the responsible emergence of science and innovation in society. First ed. Chichester, West Sussex. UK, John Wiley and Sons, Ltd.

VON SCHOMBERG, R. *(2013)* A vision of responsible research and innovation. IN OWEN, R., BESSANT, J. & HEINTZ, M. *(Eds.)* Responsible innovation. Managing the responsible emergence of science and innovation. First ed. Chichester, West Sussex. UK, John Wiley & Sons, Ltd.

WILLARD, B. *(2005)* The next sustainability wave: Building Boardroom Buy-in, Gabriola Island, New Society Publisher.

ZHANG, X., WU, Y. & SKITMORE, M. *(2014)* A prototype system dynamic for assessing the sustainability of construction projects International Journal of Project Management, 32, 66-76.

ZWIKAEL, O. & SMYRK, J. *(2015)* Project governance: Balancing control and trust in dealing with risk. International Journal of Project Management, 33, 852-862.

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