

INNOVATION PROJECT MANAGEMENT: A RESEARCH AGENDA

SERGEY FILIPPOV; HERMAN MOOI

*DELFT UNIVERSITY OF TECHNOLOGY, DEPARTMENT OF INNOVATION SYSTEMS
RESEARCHER AT DELFT CENTRE FOR PROJECT MANAGEMENT (THE NETHERLANDS)*

Abstract

Originally developed in the mid-20th century, project management has become a distinctive way to manage business activities nowadays. Another important development is virtually universal recognition of the role of innovation and technology in the corporate change, growth and profitability. It is unsurprising that development of innovation is often run as a project. Yet, theoretically both project management and innovation studies have evolved over time as distinctively separate disciplines. In this paper we make an attempt to conceptualise the innovation project management and to specify the idiosyncratic nature of innovation projects as opposed to conventional projects. By doing so, we contribute to the nascent academic debate on the interplay between innovation and project management.

Key words: project management, innovation, technology

1. Introduction

This paper is concerned with three topics and the interplay between them, namely “Innovation”, “Research and Development (R&D)” and “Project Management”. The interest in these topics has exploded recently as they emerged both on the policy agenda and in the corporate strategies.

The contribution of technological innovation to national economic growth has been well established in the economic literature. In the last couple of decades, new technologies, new industries, and new business models have powered impressive gains in productivity and GDP growth. While originally there was a tendency to equate R&D and innovation, contemporary understanding of innovation is much broader than purely R&D. R&D is one component of innovation activities and knowledge creation among others. Innovation emerges as a pervasive and complex force, not only in the high-tech sectors in advanced economies, but also as a phenomenon existing in low-tech industry of developing, or catching-up economies. Still, the link between R&D and innovation is often at the core of the innovation studies.

Presently, we are witnessing “projectification” of the world as a growing number of specialists organise their work in projects rather than on on-going functional basis. The connection between R&D and project management has a long history. Most tools of project management have been developed from the management of R&D, often with military purposes (Lorell, 1995). The most vivid example of managing R&D projects in the public sector is the PRINCE2 method (UK OGC, 2005).

Due to the above mentioned difference between R&D and innovation, R&D projects should be distinguished from innovation projects too. Innovation is a non-linear process, not necessarily technology-led and may not necessarily result from formal R&D investments. Innovation is the exploration and exploitation of new ideas and recombination of existing knowledge in the pursuit of sustained competitive advantage. Besides, both innovation and R&D projects by their nature differ from conventional projects. Thus, there is a need to examine the Innovation Project Management (IPM) as a distinctive area of managing innovation in projects, using the tools and methods of the project management.

On the side of the innovation studies, while the complex nature of innovation and collaborative efforts is underscored, as such this research area does not explicitly address the specifics of managing innovation in projects. As Anbari (2005, p.101) rightly states “Innovation and project management, ... are addressed in the literature generally as separate issues”. However, recently this link between innovation and project management has triggered some academic research, as shown later in this paper. The idea of innovation projects has been pronounced in policy documents as well (e.g. European Commission, 2004, 2006). Yet, this area still offers

opportunities for further research, both in terms of conceptualisation and empirics. This is precisely the aim of this paper – to contribute to bridging the gap between two research areas – innovation studies and project management by finding connections in both streams of literature and by developing conceptual models and typologies.

The paper is structured as follows. Section 2 reviews the literature with the focus on the interfaces between PM and innovation, and develops conceptual understanding of this link. Section 3 provides in-depth analysis of the innovation project management. Finally, the paper provides managerial implications and outlines directions for further research.

2. Theoretical background

This section aims to review the relevant literature of both PM and innovation studies, and the interfaces between them. Further, it will elaborate on the definition of an innovation project and innovation project management.

2.1. Literature Review: Innovation & Management

In this paper we seek to establish bridges between two distinctive disciplines – project management and innovation management (innovation studies). Despite seemingly interrelated nature of both subjects, these two research domains have been developing relatively isolated from each other.

Innovation studies

Innovation studies are rooted in the seminal writing of Joseph Schumpeter in the 1920s-1930s (e.g. Schumpeter, 1934), whose ideas started to gain popularity in the 1960s, as the general interest among policymakers and scholars in technological change, R&D and innovation increased. The field formed as a distinctive academic discipline from the 1980s. Scholars like Richard Nelson, Chris Freeman, Bengt-Åke Lundvall, Keith Pavitt, Luc Soete, Giovanni Dosi, Jan Fagerberg, Bart Verspagen, Eric von Hippel and others have shaped and formed this discipline. The seminal publications in the area include, *inter alia*, Freeman (1982), Freeman and Soete (1997), Lundvall (1992), Nelson and Winter (1977, 1982), von Hippel (1988).

Regarding the definition of innovation – a general consensus has been achieved among innovation scholars who broadly understand this phenomenon as a transformation of knowledge into new products, processes and services.

An in-depth review of the innovation literature is beyond the scope of this paper (refer to Fagerberg (2004) for such analysis). Our intention is to outline main directions of research. In a recent paper, Fagerberg and Verspagen (2009) provide a comprehensive analysis of the cognitive and organisational characteristics of the emerging field of innovation studies and consider its prospects and challenges. The authors trace evolution and dynamics of the field. Reflecting the complex nature of innovation, the field of innovation studies unites various academic disciplines. For examples, Fagerberg and Verspagen (2009) define four main clusters of innovation scholars. They are “Management” (cluster 1), “Schumpeter Crowd” (cluster 2), “Geography and Policy” (cluster 3.1), “Periphery” (cluster 3.2) and “Industrial Economics” (cluster 4).

For the purposes of our analysis we shall have a closer look at the “Management” cluster, since it is here where the connection between innovation and Project Management can be found. In fact “Management” is the smallest cluster within the entire network of innovation scholars, consisting of only 22 scholars, mainly sociologists and management scholars, with a geographical bias towards the USA. This small number of scholars (22) is in sharp contrast with the biggest clusters – “Geography and Policy” (298 scholars) or “Schumpeter Crowd” (309).

In terms of publication preferences, apart from Research Policy, the favourite journal for innovation scholars, members of “Management” cluster see management journals as the most relevant publishing outlets, particularly Journal of Product Innovation Management, Management Science and Strategic Management Journal.

Fagerberg and Verspagen (2009, p. 229) see a strong link between innovation and management and provide a following description:

“Management is to some extent a cross-disciplinary field by default and firm-level innovation falls naturally within its portfolio. So between innovation studies and management there clearly is some common ground”.

Project management

The project management as a human activity has a long history; e.g. construction of Egyptian pyramids in 2000 BC may be regarded as a project activity. However, the start for the modern Project Management era, as a distinctive research area, was in the 1950s.

Maylor (2005) determines three major stages of the PM historical development. Before the 1950s, the PM as such was not recognised. In the 1950s, tools and techniques were developed to support the management of complex projects. The dominant thinking was based on “one best way” approach, based on numerical methods. The third stage, from the 1990s onwards is characterised by the changing environment in which projects take place. It is more and more realised that a project management approach should be contingent upon its context. It is also noted that a shift is observed over time in development of project management – from focus on sole project management to the broader management of projects and strategic project management (Fangel, 1993; Morris, 1994; Bryde, 2003).

Reflecting these changes in the managerial practices, the body of academic literature on PM has evolved and burgeoned. International Journal of Project Management and Project Management Journals became the flagship publication outlets for PM scholars and practitioners. A large number of (managerial) handbooks outlining the methods and techniques of PM have been published, e.g. Andersen et al (2004), Bruijn et al (2004) Kerzner (2005), Maylor (2005), Meredith and Mantel (2006), Müller (2009), Roberts (2007), Turner (1999), Turner and Turner (2008).

Despite a growing number of publications, there is no unified theoretical basis and there is no unified theory of project management, due to its multidisciplinary nature (Smyth and Morris, 2007). Project management has a more applied nature than other management disciplines. Although the PM has formed as a distinct research field, there is no universal, generally accepted definition of a project and project management. Turner (1999) develops a generic definition of a project:

A project is an endeavour in which human, financial and material resources are organised in a novel way to undertake a unique scope of work, of given specification, which constraints of cost and time, so as to achieve beneficial change defined by quantitative and qualitative objectives.

There have been several attempts to provide an overview of the state-of-the-art research in PM and outline its trends and future directions (e.g., PMI, 2004; Betts and Lansley, 1995; Themistocleous and Wearne, 2003; Crawford et al, 2006; Kloppenberg and Opfer, 2002). In a recent article, Kwak and Anbari (2009) review relevant academic journals and identify eight allied disciplines, in which PM is being applied and developed. These disciplines include such areas as Operation Management, Organisational Behaviour, Information Technology, Engineering and Construction, Strategy/Integration, Project Finance and Accounting, and Quality and Management. Notably, one of these eight allied disciplines is “Technology Application / Innovation / New Product Development / Research and Development”. The authors found that only 11% of journal publications on the subject of project management fell under the “Innovation” heading. Yet, importantly, this area showed sustained upward interest, and hence the number of publications, since the 1960s. Overall, Kwak and Anbari (2009) conclude that the mainstream PM research proceeds largely in the “Strategy / Integration / Portfolio Management / Value of PM / Marketing” direction (30% of all publications examined by the authors).

Innovation projects

As this brief literature review reveals, the interfaces between innovation studies and (project) management do exist. Yet, it can be seen that the development of both research streams has proceeded in a relative isolation from each other, and the connection between two domains is quite often implicit. Keegan and Turner (2002, p. 368) state,

With some notable exceptions, however, the traditional innovation literature largely ignores project management and the intricacies of managing innovation in project-based firms. In addition, the project management literature, considerably expanded in recent decades, largely ignores innovations.

Nonetheless, recently the link between innovation and projects has come under scrutiny as the scholars and practitioners started witnessing a certain degree of convergence between these two research areas. For instance, the relevance of the interplay between projects and their management, and innovation was accentuated at the eight IRNOP research conference in Brighton in September 2007. IRNOP stands for the International Research Network on

Organising by Projects – a global community of researchers in project management. The theme of the conference was “Projects in Innovation, Innovation in Projects”.

As Brady and Söderlund (2008, p. 466) report on the essence of this debate:

There are several important links between projects and innovations. Just think of the origin of the two terms. Today we use the word project in a number of different settings – to signify a group or an organisation, to demarcate a particularly complex transaction, to refer to a visionary plan or idea. Originally, however, the term draws on the Latin word *projicere* of which the meaning might be derived to throw something forward. Innovation is often used to signify something new, either a new product, service or other output, and/or a new process and method. The word is also traceable to Latin and the word *innovo* which could be translated as to renew. In many ways the two fields of research have been kept apart leading to a neglect in the project management area to acknowledge and embrace the unique processes of projects – to cope with uncertainty instead of eliminating it by the use of advanced planning techniques. In the innovation arena, project management has often been looked upon as a simple implementation endeavour with little problems. However, research has time and time again pointed out the difficulties of moving from invention to innovation, of moving from ideas to value creating products – a process where project management potentially would have a very important role.

Kavanagh and Naughton (2009) directly address the links between innovation and project management by comparing PM score and innovation indices for a group of nations. Using as variables the PM certifications by Project Management Institute (based in the US) and the International Project Management Association (based in Zurich) and the innovation index from the European Innovation Scorecard, the authors find an inverted U-shape curve. This finding entails that increasing levels of project management are positively correlated with increasing level of innovations, effectively supporting an existence of a link between innovation and PM. However, after a certain threshold, very high levels of PM become negatively correlated with innovation. As an explanation of this phenomenon, Kavanagh and Naughton (2009) suggest that formal methods of PM can facilitate exploitation of existing knowledge, but hinder the exploration of new one.

While this study was done on a macro-level, most studies have examined the link between innovation and PM on a micro-level, i.e. interplay between innovation and project management within particular economic agents.

Davies and Hobday (2005) draw on a multi-year study of the business of projects in order to describe the process of project capabilities development and the connection between the innovative capability of the firm and the way it generates and organises projects. Shenhar and Dvir (2007) outlined a contingency theory of project management, underscoring novelty, technological uncertainty, complexity and pace.

Richtnér and Södergerm (2008) have examined what enables innovation projects to create innovation whilst being part in a system of innovation. The authors argue that complexity of innovation projects (stemming from being knowledge intensive, having multiple stakeholders, etc) compels to use supporting resources to make such projects “resilient”. To support the conceptual model, projects in Evidence Based Medicine are studied.

Ernst and Lichtenthaler (2009) address the subject of innovation portfolio management. Innovation portfolio management tackles the issue of “managing the right innovation projects”, i.e. optimisation of innovation portfolios with regard to the management of the right innovation projects.

Amaro dos Santos et al (2008) claim that successful innovation process requires effective controlling and alignment with project management. The authors design an integrated indicator – the Value Index in order to support an aligned controlling in the innovation process.

Cozijnen et al (2000) investigate determinants of success or failure of innovation projects in the context of Dutch companies. The authors argue that the implementation phase is the essence of every innovation process and the most failures can be expected to happen during this phase. Many innovation projects fail because the implementation phase is not managed correctly. Cozijnen et al (2000) point to the lack of empirical research on this issue; and investigate this subject in the Dutch context.

Departing from the argument that project-based, service-oriented forms of enterprise are not adequately addressed in the innovation literature, Gann and Salter (2000) explore the ways in which these firms manage innovation in construction projects. Based on the case studies,

authors examine links between operations at the project level, portfolios of projects, and central routine activities.

Gales et al (1992) study the information processing and performance in innovation projects. Among several findings of this study is support to the hypothesis stating that the importance of rich information increases for projects as they progress from idea generation through commercialisation. It implies that as a project proceeds, each subsequent phase necessitates more and richer information. This finding is in contrast to the wide-spread belief that the uncertainty will decline as the project proceeds. The effect of uncertainty on the performance of innovation projects was also studied by Rice et al (2002) who used twelve case studies in large US companies.

Keegan and Turner (2002) analysed the management of innovation in project-based firms along three dimensions – context supportive for innovation, slack resources and perception of innovation as being useful or not. The authors observe that the interplay between innovation and projects is dominated by the ideas on how to correctly manage projects, rather than how to effectively manage innovation. In other words, the attitude towards managing innovation projects remains mechanical in nature as traditional project management approaches are applied to innovation projects. Keegan and Turner (2002) argue in favour of the evolution of the traditional project management towards more informal, organic management of innovation, with a higher tolerance for slack resources and greater levels of redundancy in order to create time, space and creativity for innovation.

2.2. Definition of Innovation Projects

Our literature survey presented in the previous section has shown that recent publications tend to emphasise the relevancy and significance of research on the interplay between innovation and project management. While this connection is intuitively understood, the literature remains inconclusive about the definition of “an innovation project”, or its conceptual basis. Quite often “an innovation project” is equated with new product development, or even left without any definition.

One of the few, Anbari (2005, p.104) explicitly provides a definition for the management of an innovation project, which can be viewed as “...*the management of a system that transforms inputs into outputs and has a feedback mechanism to ensure that the project output is consistent with its objectives*”. In our view, this definition is a highly generic one, since it can be applied to virtually all categories of projects and it does not underscore the specific nature of innovation.

Finding a comprehensive definition is a challenging task. To start with, the borders between a project activity and a process/programme may be very fuzzy. Activities of non-project nature might be called “projects” (in order to present this work in an attractive way), adding to ambiguity. Further, while there is a generic definition of innovation (presented in the previous section), a precise definition is difficult to formulate. Broadly speaking, the term may refer to a new way of doing something; to incremental and emergent or radical and revolutionary changes in thinking, products, processes, or organisations. The borderline between a minor change or improvement, and an innovation is sometimes elusive.

Project management is the engine for implementing new ideas, and all projects may involve a certain degree of innovation and creative effort, depending on the definition of innovation (product innovation, process innovation, organisational innovation, user innovation, etc). Organisational innovation may emerge as an enabling force contributing to a success of a project, but the project itself might not be innovation one *per se*.

We depart from the view of the product innovation, i.e. innovation materialises as a result of invention. In this way, this understanding follows the conceptual distinction between invention and innovation. As Fagerberg (2004: 4) argues, “*An important distinction is normally made between invention and innovation. Invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out into practice*”. Then, a project is understood as a vehicle of the transition from invention to innovation.

The Community Innovation Survey (CIS) of the European Union defines a product innovation as “*the market introduction of a new or significantly improved good or service with respect to its capabilities, user friendliness, components or sub-systems*”. Likewise, a process innovation is defined as “*the implementation of a new or significantly improved production process, distribution method, or support activity for your goods or services*”. Both product (new or improved) and process innovations must be new to a specific enterprise, but they do not need to be new to the market.

We follow these definitions, and under an “innovation project” we understand a project dealing with product and service innovation, involving various aspects of innovation and innovativeness. Therefore, an innovation project revolves around certain criteria (and should include at least one of them):

- aimed at development of an innovative (new) product or service (product or service innovation);
- employ innovative methods and approaches (process innovation);
- lead to improvement of innovative and learning capabilities of the project executor (organisational innovation);
- be realised in a close interaction with the project owner (user innovation).

Several characteristics can be taken into account when comparing innovation and conventional (i.e. those without explicit “innovation” content) projects.

Firstly, the projects differ in objectives. Conventional projects tend to have clearly defined goals and targets. On the opposite, innovation projects might not necessarily have this detailisation. Innovation is often elusive and cannot be described before it is actually achieved. Many innovation projects relate to intangible assets and the commercial success of an innovation project can be highly uncertain. In fact, innovation is often a result of trial-and-error.

Risk-taking is low in regular projects since the objectives are clearly defined and processes are established. In innovation projects, objectives are loosely defined and ambiguous, and processes are more experimental and exploratory, hence the risk-taking is high. Expenses for innovative and research activities are characterised as long-term, with increased insecurity regarding to the eventual amount of generated earnings. In other words, it is difficult to gauge ex ante the net present value of innovation projects (Keegan and Turner, 2002).

To reflect the complex nature of innovation, the innovation project team is made up of people with diverse background.

The major issue regarding innovation project management is that due to its origins in the engineering field, traditional project management is shaped by the precision, accuracy and optimal use of resources. However, innovation by its definition is a creative process coupled with uncertainty and a need for slack resources. As Keegan and Turner (2002, p.385) argue, “A revision of traditional project management guidelines may be necessary given the potential of conventional approaches to managing (innovation) projects to stifle innovation”. We further elaborate on this issue in the following section.

3. Innovation Project Management

3.1. Positioning Innovation Project Management

By its definition, a project is a temporary endeavour, or a temporary organisation (Turner and Müller, 2003), with a specific purpose. This temporary nature of projects is in contrast to functional organisation in companies or public institutions where certain functions are run as continuous processes on a daily basis. We present this distinction graphically (Figure 1).

<i>Project management</i>	<u>Innovation project management – development of a unique and novel product or service</u>
Creation of a product or service which is new to its owner, and may not be necessarily commercialised on the market	<i>Innovation, unique and novel for everyone</i>
<i>Innovation, unique and novel for yourself</i>	Corporate R&D laboratories / public research institutes
Functional activity in an organisation, with minor improvements	
<i>Functional organisation / processes</i>	

Figure 1 Positioning of innovation project management

The vertical axis in the Figure 1, presents two extremes – project management versus functional organisation of activities. The horizontal axis plots an “intensity” of innovation. The right hand-side of this axis portrays innovation as bringing a new idea to market as a valuable product or service. A creative idea is transformed from invention to innovation through commercialisation on the particular market. The left hand-side presents a “weaker innovation”, i.e. a development of a product or service new and novel to this specific economic agent. A similar or the same product or service may already exist on the market but still it is entirely new to the one who develops it. In this sense, it is “imitation”, rather than “innovation”.

These two axes form four quadrants. In the upper-left quadrant, we find projects of “low innovation intensity” nature. While they involve a temporary creative effort aimed at development of a specific product or service, they are not strictly speaking innovative as such. Typical examples of project-based industries include construction, motion picture, consultancy, etc. Obviously, each project is unique *per se*, still, they all are aimed at offering a standardised service. Further, a product or service created will not necessarily be commercialised on a market; rather it may be for internal use. Examples include writing a doctoral thesis, planning of own holidays, moving houses, or even cooking a specific dish.

In the contrast, many activities and industries are organised in a functional way (lower-left quadrant). In fact, this is a traditional way of organising and managing day-to-day business activities in most firms/organisation with low innovation potential. Slight improvements in the product / service may be novel for a company, but not new to the relevant market. For instance, an organisation may offer maintenance services for motor vehicles. This activity is performed in a routinely manner, however, this company may offer minor design improvements, already existing on the market.

The lower-right quadrant represents innovation as a continuous functional process, i.e. development of new products or services in specialised departments in companies, or in specialised public research institutes. This scenario reflects “routinisation” of research in general and of product development processes in particular. Research or product development is assigned to particular departments / programmes that follow standard procedures and processes with the same employees. Moreover, the formal definition of R&D given by OECD, implies a certain degree of systematisation and continuity. R&D comprises creative work *“undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications”* (OECD, 2002, p.30). R&D includes basic and applied research along with development.

Last but not least is the upper-right quadrant, the innovation project management, meaning creation of a new product or service using the project management tools and methods. This product or service is new to the market and it is expected to be commercialised on the market.

It should be noted that despite the visibly clear distinction between the four categories, in reality the borders are fuzzy. For example, in multinational companies, innovative products might be developed within existing R&D departments, but in a manner of project management. Even a couple of project management teams within the same R&D department may compete for development of a specific product. Therefore, Figure 1 represents a frame of reference, aiming to position the Innovation Project Management, rather than a strict classification.

Traditional industries that once organised their activities in a functional way are evolving towards project-based forms of organisation. Likewise, emerging industries (ICT, biotechnology) are increasingly adopting project-based forms. New forms of organisation (such as projects) are used in order to cope with increasing complexity of production, communication and technology (Rycroft and Kash, 1999).

3.2. Argument for managing innovation in projects

The origins of project management in the manufacturing and construction industries determine an engineering perspective, viewing a project as a task-focused entity, proceeding in a linear or similar way from the point of initiation to implementation. This view prevailed until comparatively recently. This view is seemingly in stark contrast with the nature of innovation. It is increasingly being acknowledged that the innovation is a complex non-linear process. The earliest view on innovation process as a pipeline model (whereby a given input is transformed to a specific output) has been largely abandoned.

Presently, however, project management is increasingly recognised as a key generic skill for business management (Fangel, 1993), rather than a planning-oriented technique or an application of engineering sciences and optimisation theory, in which project management has its roots (Söderlund, 2004). The “management by projects” has emerged as general mode of organising for all forms of enterprise (Turner 2003).

This new conceptualisation of project management enables to embrace the non-linear nature of innovation. Even a creative and non-linear nature of innovation is often characterised as an organisational or management process, rather than spontaneous improvisation. Davila et al. (2006) state, *“Innovation, like many business functions, is a management process that requires specific tools, rules, and discipline”*. Hence, a project, with its defined objective, scope, budget and limitations, can be an appropriate setting of innovation.

The non-linear view on innovation stems from seminal works of Joseph Schumpeter, the forefather of innovation studies. Innovation is understood as a recombination of existing knowledge, or *neue Kombinationen* as put by Schumpeter (1934). This reasoning provides another justification for managing innovation in projects. Project team is made up of specialists of various backgrounds, and it is expected that the separate knowledge residing in individual specialists will be cross-fertilised when working in a project team.

3.3. Innovation project management versus functional management of innovation

In the previous section we have established the applicability of project management for managing innovation, and outlined its benefits. Notwithstanding the advantages of project management, it would be unreasonable to expect all innovation to be carried out through projects. In fact, many ideas are generated by employees in a company on a regular basis, not only within project teams. Thus, there is certainly a room for functional, on-going organisation of innovation process. Even more so, in certain situations project management can be detrimental to innovation. Aggeri and Segrestin (2007) show that the recent project development methods in automotive industry can induce negative effects on collective learning processes and these effects have managerial implications for innovative developments.

In order to determine conditions under which each of the modes of managing innovation is applicable, we examine main characteristics of both functional organisation of innovation and innovation project management (Table 1).

Table 1 Comparative analysis of functional organisation of innovation and IPM

	Functional organisation of innovation	Innovation project management
Main characteristics	Management of innovation in functional departments on an-going basis	Management of innovation in temporary, specifically established project teams
Objectives	Broad	Narrow and specified
Stakeholders	Limited number	A broad composition
Time limits	Continuous activity, time limits often not explicitly specified	Limited time

Source: authors

We reflect on the characteristics of functional organisation of innovation process and innovation project management. This conceptual examination does not aim to provide an all-inclusive answer to practitioners. Rather, this is an attempt to raise the awareness and to outline an avenue for further research.

The main difference between the functional organisation of innovation and innovation project management is the objective – in the former it is broader and more inclusive, and in the latter it is more narrow and specified. Achievement of this specific objective implies the end of an innovation project; on the other hand, innovation is a continuous activity in the functional organisation. As any project, an innovation project involves a large number of stakeholders, whose expectations should be carefully managed. In a functional organisation, as a rule, the number of stakeholders is limited to the direct organisational hierarchy.

Despite seemingly clear-cut division, there may be points of mutual interdependence. Innovation projects may be combined with the functional organisation of innovation process. Innovation projects may grow out of innovation programmes.

3.4. Classification of innovation projects

Several typologies and classification of projects have been developed, e.g. Turner and Cochrane (1993), Dvir et al (1998), Turner (1999), Wheelwright et al (1992). For the purposes of our analysis we aim to determine the position of innovation projects and to specify their particular categories (Figure 2).

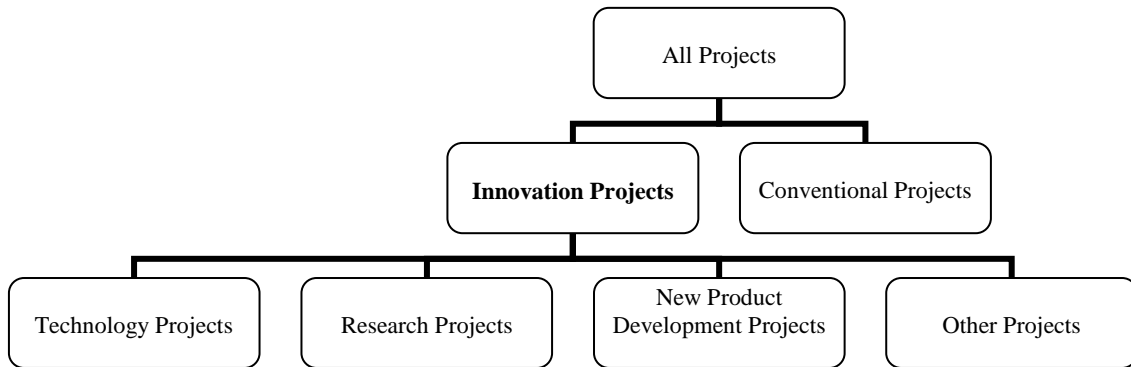


Figure 2 Classification of projects

Firstly, all projects can be potentially split into innovation and conventional projects. Conventional projects would include such commonly executed ones as infrastructural and constructions ones, as well as operational projects.

A number of project categories can be discerned under the umbrella of innovation projects, such as technology projects, research projects, new product development projects, etc (although this is not an all-inclusive list).

There is a distinctive research stream whereby innovation is understood as development of new products (i.e. product innovation), and hence New Product Development (NPD) projects can be identified within innovation project category. Since the 1980s, NPD projects have received an extensive treatment in the academic literature (Cooper, 1980; Hart, 1993; Larson and Gobeli, 1988; Souder, 1988). In his comprehensive book, Webb (2000) provides a complete guide to managing projects involving the development of new products. This practice-oriented handbook aims to give an insight into the myriad of processes involved in this industrial activity. Besides, recently a growing body of literature has analysed the industry-specific aspects of NPD projects (e.g. Kosaroglu and Hunt (2009) – NPD projects in telecommunications industry).

Technology projects are becoming important since much R&D activity is presently R&D conducted in projects, especially in such industries as aerospace, defence, etc. R&D projects are becoming a prevailing way of conducting R&D both in private and public sectors (Bart, 1993, Pinto and Slevin, 1989). For example, the US Federal R&D Project Summaries (www.osti.gov/fedrnd/index) contains information on over 800,000 R&D projects initiated by a number of federal agencies. One of the new participants of this programme in 2009 is the Department of Defence. The Defence Advanced Research Projects Agency (DARPA) is an agency of the United States Department of Defence responsible for the development of new technology for use by the military. DARPA focuses on short-term (two to four-year) projects run by small, purpose-built teams. The most significant achievement of DARPA was the ARPANET project, the predecessor of the Internet. Success of DARPA is explained by a number of factors; one of them is project-based assignments organised around a challenge model (Bonvillian, 2006).

By research projects we understand projects involving various research activities, such as social research, not necessarily technical or technological. The most known examples in Europe include the research projects initiated and funded by the European Commission (EC) within its Framework Programmes. The EC funds both individual and collaborative projects. The former are projects carried out by individual national or transnational research teams, while the latter are carried out by consortia with participants from different countries, aiming at developing new knowledge, new technology, products, demonstration activities or common resources for research. The size, scope and internal organisation of projects can vary from field to field and from topic to topic. Projects can range from small or medium-scale focused research actions to large-scale integrating projects for achieving a defined objective (European Commission, 2009). Similar (public) organisations, funding academic research, exist in most developed countries. For example, in the Netherlands, the Royal Agency for Science – KNAW and the Dutch Organisation for Scientific Research – NWO offer funding for academic and scientific research shaped in the form of a project.

3.5. Classification of innovation projects

Innovation is a complex phenomenon. For the purposes of analysis we intend to split innovation into several groups depending on its “intensity”. Extant body of literature has attempted to

classify innovation. For example, Henderson and Clark (1990) determine four types of innovation – incremental, modular, architectural and radical. Incremental innovations can be achieved by integration of supplementary technologies or by substitution or transfer of similar resources. Modular innovations stem from supplementary or even unrelated technologies, which add complementary or completely new functionalities. Architectural innovations are achieved by reconfiguring supplementary or similar technologies to build new product platforms. Finally, radical innovations emerge from the reconfiguration of unrelated technologies.

For the sake of clarity in our analysis we shall focus on two opposite categories – incremental and radical innovation. Furthermore, imitation is also included, defined as creative efforts for development of a product or service, new to the specific economic agent, but existent elsewhere on the market. In our scale of “intensity” of innovation, imitation is positioned before the incremental innovation; in other words, imitation has the lowest innovative intensity.

It should be noted that there are difficulties in anticipating the degree or “intensity” of innovation. According to Henderson and Clark (1990), radical innovation is defined in an ex-post evaluation. In fact, many radical innovations may not be visible from the outset, and not planned in the targets of respective innovation projects.

Table 2 Description of types of innovation projects

		“Intensity” of innovation		
		<i>Imitation</i>	<i>Incremental innovation</i>	<i>Radical innovation</i>
		A temporary endeavour undertaken to create a product or service, new to the customer / owner, but already existing somewhere on the market	A temporary endeavour undertaken to create a product or service, as a substantial improvement of products or services already existing on the market	A temporary endeavour undertaken to create a unique product or service, absolutely unique on the market
Project goals and objectives		Clearly defined	Clearly defined	More vague and broader
Uncertainties		Lower level	Medium level	Higher level
Industrial sectors	High-tech	Reverse engineering of an advanced technological product	Improvements in existing high-tech products	Breakthrough R&D in advanced high-tech
	Low-tech	Imitation in low-tech sectors, low value added, minimum learning and innovative potential	Slight improvement in low-tech products	Radical change in low-tech products

Source: authors

Regarding uncertainties, it is expected that the radical innovation is associated with a higher degree of technical, market and organisational uncertainty. This is in contrast with imitation, where a lower degree of uncertainty is expected. Referring to the industrial sectors, Shenhar and Dvir (1996) argue that engineering projects in each sector correspond to a certain degree of technological uncertainty. Four levels are identified: low technological uncertainty for low-tech projects, medium technological uncertainty for medium-tech projects, high technological uncertainty for high-tech projects and super high technological uncertainty for super high-tech projects.

As for such characteristics as project budget or quadruple constraints (time-cost-quality-scope), the evidence is inconclusive and it is not possible to generalise these characteristics for a specific group of projects. In other words, an imitation project might have a bigger budget than a radical innovation project, or vice versa.

Innovation projects are executed in various industrial sectors, ranging from low- to high-tech. At the bottom are imitative projects in low-tech sectors. They involve minimum learning and innovative potential, and generate low value. Incremental innovation projects in low-tech sectors aim at slight improvements in low-tech products (e.g. in carpentry, wood-working). Finally, there may exist radical innovation projects in low-tech sectors, such as agriculture, food processing, etc. Regarding the high-tech sectors, the imitation projects involve reverse engineering of

advanced technological products. More broadly, that was a key element of industrialisation strategy of many South-East Asian economies. Such imitative efforts in high-tech sectors may be organised in projects and conducted by both companies and public authorities (especially, if the national intellectual property rights regime allows to do so). Concerning the incremental innovation in high-tech, projects may be executed to add new functionalities to existing high-tech products.

Finally, the most advanced innovative product would be the one involving breakthrough innovation in high-tech industry. An example would be the Blu-Ray, a technology making possible to store large amounts of data on an optical disk, crucial for digital video. Initially, Sony started two projects applying the new diodes: UDO (Ultra Density Optical), and DVR Blue (together with Pioneer), a format of rewritable discs that would eventually become Blu-ray Disc. On February 19, 2002, the project was officially announced as Blu-ray, and Blu-ray Disc Founders was founded by the nine initial members (Sony, 2002). The project involved a high degree of complexity and uncertainty, including the "format war" with HD DVD standard. It has become a global standard for high-definition video storage.

3.6. Challenges of empirical studies

Scarcity and unreliability, or even lack of data poses a big challenge in research in both innovation and project management.

A macro-level research on PM is obstructed by the lack of data on the number of projects, carried out by firms and public institutions, and their characteristics. Problems stem from the definition of a project and the non-disclosure policy of most companies. In such circumstances, PM research has tended to rely on case-studies or on small-scale tailor-made surveys. There is a widely acknowledged lack of large-scale empirical research in PM (Kloppenborg and Opfer, 2002; Söderlund, 2004).

It is claimed that the Independent Project Analysis (IPA) is the market leader in quantitative analysis of project management systems, i.e. in project evaluation and project system benchmarking (IPA, 2007). All IPA analyses and research are based on proprietary databases. As of mid-2009, IPA's databases contain more than 11,000 projects of all sizes (\$20,000 to \$25 billion) executed across the world. Each year, approximately 1,000 projects are added with representation from the many different industries served by IPA. Each project in our databases is characterized by over 2,000 project attributes, including technology, project scope, project type, project costs, year of authorisation, and geographical location (IPA 2009). All information contained in the IPA databases is carefully protected and kept as confidential proprietary data (IPA, 2009). Due to the issues of confidentiality, access for academic researchers is restricted.

In the innovation field, academic community has been increasingly using several sources of data, such as granted patents, tailor-made surveys, as well as other data provided by national statistical offices. European research on innovation uses several instruments to obtain data on innovation indicators and to assess national innovation performance. The two main instruments are the Community Innovation Survey (CIS) and the European Innovation Scorecard (EIS). These two sources of data are interlinked to some extent, since the EIS mostly uses the data collected by Eurostat in CIS.

As of 2009, five successful CIS surveys have been carried out: CIS1 (1992), CIS2 (1996), CIS3 (2001), CIS4 (2004) and CIS 2006. CIS 2008 is currently in the field, while planning is underway for CIS 2010. Each new round was characterised by an improved questionnaire, in line with the evolution of understanding of the phenomenon of innovation. The more recent surveys embraced understanding of innovation in a broader sense, and for example, paid more attention to service innovations. Further, it is expected that the future surveys will also include management techniques, organisational change, environmental benefits, design and marketing issues.

For the past and present CIS questionnaire, distinction between functional and project management of innovation has not been a priority. The questionnaire refers to them jointly as "innovation activities". Even when the term "project" is used, the question relates to the overall innovation process in the enterprise, not to a specific project. Regarding formal R&D, the question "did your enterprise perform R&D" offers two choices: continuously (an enterprise has permanent R&D staff in-house) and occasionally (as needed only). Yet, the latter choice does not mean the R&D was organised in a project.

We argue that, taken into consideration the growing relevance of innovation projects, a clearer and explicit wording should be used in CIS questionnaire for determining whether innovation is organised and carried out in projects or functionally.

4. Conclusions

Innovation studies and project management as distinctive disciplines have been developing in a relative isolation from each other. The analysis in innovation studies domain has rarely explored the mechanisms and patterns of innovation in projects in contrast to traditional (functional or hierarchical) organisation. However, since innovation management in companies is increasingly organised in projects, it is of utmost importance to directly address the interplay between innovation management and project management.

In this paper, based on the relevant literature and insights from practice, we conceptually examined the relationships between these two research areas aiming at bridging the gap between them.

The presented conceptual and analytical elaboration serves as a frame of reference. The research on innovation project management should be enriched with relevant empirical evidence. However, scholars are confronted with unreliability or even lack of secondary data. One of our suggestions is to explicitly introduce the innovation projects and innovation project management in the Community Innovation Survey questionnaire. Another suggestion is creation of a specialised database of innovation project open for academic research needs.

Reliable data should enable to conduct studies on the effectiveness of project management for managing innovation. It is widely acknowledged within the discipline of innovation studies that there is a high percentage of failure of innovation initiatives, in other words, failure is inevitable when managing innovation. Likewise, a high percentage of failure is recorded for projects; projects are cancelled midstream, come over budget and/or too late (Anbari and Kwak, 2004). As Matta and Ashkenas (2003) put it, *"Big projects fail at an astonishing rate"*. Hence, innovation project management faces a double challenge caused by the complex natures of both innovation and projects. Cooper et al. (2004) point out that the huge amounts involved coupled with the high risks of failure make new product development (a category within innovation projects umbrella) one of the riskiest endeavours of the modern corporation. They estimate that only one in ten product concepts succeeds commercially. Hence, a fundamental research question is how to avoid such risks and failure when managing innovation project.

This research question is of utmost significance and practical relevance in the current circumstances of the global economic crisis when both private and public sectors are facing with truncated budget for research activities. Innovation is perceived as a luxury, not as a necessity. Therefore, it is of high priority to manage innovation effectively and efficiently with constrained budgets.

The paper outlined the differences between the functional organisation of innovation process and management of innovation in projects. The question, though, is still open. More academic and managerial research is needed to establish precisely under which conditions each of these two modes effective.

We advocate for further research on innovation projects and innovation project management. Combination of managerial approaches of the project management and the theoretical insights from the innovation studies will remain s a promising research avenue.

References

- [1] Aggeri, F. and Segrestin, B. Innovation and project development: an impossible equation? Lessons from an innovative automobile project development, *R&D Management*, 2007, 37(1): 37-47
- [2] Amaro Dos Santos, J., Ohlhausen, P. and Bucher, M. Aligning innovation and project management by the value index, *International Journal of Technology Intelligence and Planning*, 2008, 4(4): 413-430
- [3] Anbari, F.R. Innovation, project management, and six sigma, In Rahim, M.A and Golembiewski, R.T. (eds.). *Current topics in Management*, 2005, Vol.10, New Brunswick, NJ: Transaction Publishers, P. 101-116
- [4] Anbari, F.T. and Kwak, Y.H. Success factors in managing Six Sigma projects. Proceedings of PMI Research Conference, London, UK. Newtown Square, PA: Project Management Institute, 2004.
- [5] Andersen, E.S., Andersen, E., Grude, K.V. and Haug, T. *Goal Directed Project Management: Effective Techniques and Strategies*, 3rd revised edition, Kogan Page Ltd, 2004.
- [6] Bart, C.K. Controlling new product R&D projects, *R&D Management*, 1993, 23(3): 187-197
- [7] Beaume, R., Maniak, R. and Midler, C. Crossing innovation and product projects management: A comparative analysis in the automotive industry, *International Journal of Project Management*, 2009, 27(2): 166-174
- [8] Betts M. and Lansley, P. International journal of project management: a review of the first ten years, *International Journal of Project Management*, 1995, 12(4): 207-17
- [9] Bonvillian, W.B. "Power Play", *The American Interest*, vol. II, 2006
- [10] Brady, T. and Söderlund, J. (2008). Projects in innovation, innovation in projects: Selected papers from the IRNOP VIII conference, Guest Editorial, *International Journal of Project Management*, 2008, 26(5): 465-468
- [11] Bruijn, H., Ten Heuvelhof, E. and In 't Veld, R. *Process Management: Why Project Management Fails*, New York: Springer-Verlag, 2004
- [12] Bryde, D.J. Project management concepts, methods and applications, *International Journal of Operations & Production Management*, 2003, 23(7-8): 775-793
- [13] Cooper, R.G. Project NewProd: Factors in new product success, *European Journal of Marketing* 1980, 14(5/6): 277-291
- [14] Cooper, R.G., Edgett, S.J. and Kleinschmidt, E.J. Benchmarking best NPD practices, *Research Technology Management*, 2004, 47(1): 31
- [15] Cozijnsen, A.J., Vrakking, W.J. and van Ijzerloo, M. Success and failure of 50 innovation projects in Dutch companies, *European Journal of Innovation Management*, 2000, 3(3): 150-159
- [16] Crawford, L., Pollack, J. and England, D. Uncovering the trends in project management: journal emphasis over the last 10 years, *International Journal of Project Management*, 2006, 24(2): 175-84
- [17] Davies, A. and Hobday, M. *The Business of Projects: Managing Innovation in Complex Products and Systems*. Cambridge: Cambridge University Press, 2005
- [18] Davila, T., Epstein, M.J. and Shelton, R. *Making Innovation Work: How to Manage It, Measure It, and Profit from It*. Upper Saddle River: Wharton School Publishing, 2006
- [19] Dvir, D., Lipovetsky, S., Shenhar, A. and Tishler, A. In search of project classification: a non-universal approach to project success factors, *Research Policy*, 1998, 27(9): 915-935
- [20] Ernst, H. and Lichtenthaler, U. Innovation portfolio management: an understudied driver of innovation success? , *International Journal of Technology Intelligence and Planning*, 2009, 5(2): 111-117
- [21] European Commission. *Innovation Management in a knowledge-Driven Economy*, Brussels-Luxembourg: European Commission, Directorate-general for Enterprise, 2004
- [22] European Commission. Innovation tomorrow. Innovation policy and the regulatory framework: Making innovation an integral part of the broader structural agenda, *Innovation papers No 28*. Brussels, Luxembourg: European Commission, Directorate-General for Enterprise, 2006
- [23] European Commission. *Seventh Framework Programme (FP7): Funding Schemes*, available at http://cordis.europa.eu/fp7/what_en.html, 2009

- [24] Fagerberg, J. "Innovation: A Guide to the Literature", in Fagerberg, J., Mowery, D.C. and Nelson, R.R. (eds.). *The Oxford Handbook of Innovations*. Oxford: Oxford University Press, 2004
- [25] Fagerberg, J. and Verspagen, B. Innovation studies – The emerging structure of a new scientific field, *Research Policy*, 2009, 38(2): 218-233
- [26] Fangel, M. Comment: The broadening of project management, *International Journal of Project Management*, 1993, 11(2): 72
- [27] Freeman, C. *The Economics of Industrial Innovation*, London: Pinter, 1982
- [28] Freeman, C. and Soete, L. *The Economics of Industrial Innovation*, 3rd edition, London: Pinter, 1997
- [29] Gales, L., Porter, P. and Mansour-Cole, D. Innovation project technology, information processing and performance: a test of the Daft and Lengel conceptualization, *Journal of Engineering and Technology Management*, 1992, 9(3-4): 303-338
- [30] Gann, D.M. and Salter, A.J. Innovation in project-based, service-enhanced firms: the construction of complex products and systems, *Research Policy*, 2000, 29(7-8): 955-972
- [31] Hart, S. (1993). Dimensions of success in New Product Development: An exploratory investigation, *Journal of Marketing Management* 9(1): 23-41
- [32] Henderson, R.M. and Clark, K.B. (1990). Architectural innovation: the reconfiguration of existing product technologies and the failure of established firms, *Administrative Science Quarterly*, 1990, 35(1): 9-30
- [33] IPA [Independent Project Analysis]. About IPA, available at http://www.ipaglobal.com/inside%20pages/About_IPA/index.html, 2007
- [34] IPA [Independent Project Analysis]. IPA Database, available at <http://www.ipaglobal.com/Methodology/IPA-Database>, 2009
- [35] Kavanagh, D. and Naughton, E. Innovation & project management – exploring the links, *PM World Today*, 2009, vol. XI, issue IV, pp. 1-7
- [36] Keegan, A. and Turner, J.R. The management of innovation in project-based firms, *Long Range Planning*, 2002, 35(4): 367-388
- [37] Kerzner, H. *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, John Wiley and Sons Ltd, 2005
- [38] Kloppenborg, T. and Opfer, W.A. The current state of project management research: trends, interpretations and predictions, *Project Management Journal*, 2002, 33(2): 5-19
- [39] Kosaroglu, M. and Hunt, A.R. New product development projects and project manager skill sets in the telecommunications industry, *International Journal of Managing Projects in Business*, 2009, 2(2): 308-317
- [40] Kwak, Y.H. and Anbari, F.T. Analyzing project management research: Perspectives from top management journals, *International Journal of Project Management*, 2009, 27(5): 435-446
- [41] Larson, E.W. and Gobeli, D.H. Organizing for product development projects, *Journal of Product Innovation Management*, 1988, 5: 180-190
- [42] Lorell, M. *Bomber R&D since 1945: The Role of Experience*. RAND: RAND Monograph Report, 1995
- [43] Lundvall, B.-Å. (Ed.). *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter Publishers, 1992
- [44] Matta, N.F. and Ashkenas, R.N. Why good projects fail anyway, *Harvard Business Review*, 2003, 81(9): 109-114
- [45] Maylor, H. *Project Management*, 3rd revised media edition, Essex: Pearson Education Ltd, 2005
- [46] Meredith, J.R. and Mantel, S.J. *Project Management: A Managerial Approach*, 6th edition, John Wiley and Sons Ltd, 2006
- [47] Morris, P.W.G. *The Management of Projects*, London: Thomas Telford, 1994
- [48] Müller, R. *Project Governance*, Aldershot, UK: Gower Publishing, 2009
- [49] Nelson, R.R. and Winter, S.G. In search of a useful theory of innovation, *Research Policy*, 1977, 6(1): 36-76
- [50] Nelson, R.R. and Winter, S.G. *An Evolutionary Theory of Economic Change*, Cambridge, MA: Harvard University Press, 1982
- [51] OECD. *Proposed Standard Practice for Surveys on Research and Experimental Development (Frascati Manual)*. Paris: OECD, 2002
- [52] Pinto, J.K. and Slevin, D.P. Critical success factors in R&D projects, *Research Technology Management*, 1989, 32(1): 31-35

- [53] PMI. *The Guide to the Project Management Body of Knowledge*, 3rd edition, Newtown Square, PA: Project Management Institute, 2004
- [54] Rice, M.P., Leifer, R. and O'Connor, G.C. Commercializing discontinuous innovations: Bridging the gap from discontinuous innovation project to operations, *IEEE Transactions on Engineering Management*, 2002, 49(4): 330-340
- [55] Richtner, A. and Södergern, B. Innovation projects need resilience, *International Journal of Technology Intelligence and Planning*, 2008, 4(3): 257-275
- [56] Roberts, P. *Guide to Project Management: Achieving Lasting Benefit through Effective Change*, Profile Books Ltd, 2007
- [57] Rycroft, R.W. and Kash, D.E. *The Complexity Challenge: Technological Innovation for the 21st Century*, New York: Pinter, 1999
- [58] Schumpeter, J. *The Theory of Economic Development*, Cambridge, MA: Harvard University Press, 1934
- [59] Shenhar, A.J. and Dvir, D. Toward a typological theory of project management, *Research Policy*, 1996, 25: 607-632
- [60] Shenhar, A.J. and Dvir, D. *Reinventing Project Management: The Diamond Approach to Successful Growth and Innovation*, Harvard Business School Press, 2007
- [61] Smyth, H.J. and Morris, P.W.G. An epistemological evaluation of research into projects and their management: Methodological issues, *International Journal of Project Management*, 2007, 25(4): 423-436
- [62] Söderlund, J. Building theories of project management: past research, questions for the future, *International Journal of Project Management* 2004, 22(8): 655-667
- [63] Sony. Disclosure of Specifications for Large Capacity Optical Disc Recording Format Utilizing Blue-Violet Laser "Blu-ray Disc" Begins, Press Release on 20 May 2002, available at http://www.sony.net/SonyInfo/News/Press_Archive/200205/02-0520E/, 2002
- [64] Souder, W.E. Managing relations between R&D and marketing in npd-projects, *Journal of Product Innovation Management*, 1988, 5(1): 6-19
- [65] Themistocleous G. and Wearne, S.H. Project management topic coverage in journals, *International Journal of Project Management*, 2000, 31(2): 7-11
- [66] Turner, J.R. *Gower Handbook of Project Management*, 4th edition, Aldershot, UK: Gower Publishing, 1999
- [67] Turner, J.R. (ed.). Special Issue on the Fifth Biennial Conference of the International Research Network on Organizing by Projects IRNOP 5, *International Journal of Project Management*, 2003, 21(6): 385-386
- [68] Turner, J.R. and Cochrane, R.A. Goals-and-methods matrix: coping with projects will ill defined goals and/or methods of achieving them, *International Journal of Project Management*, 1993, 11(2): 93-102
- [69] Turner, J.R. and Müller, R. On the nature of the project as a temporary organization, *International Journal of Project Management*, 2003, 21(1): 1-8
- [70] Turner, J.R. and Turner, R. *The Handbook of Project-Based Management: Improving the Process for Achieving Strategic Objectives*, 3rd edition, McGraw-Hill Education, 2008
- [71] UK OGC [Office of Government Commerce]. *Managing Successful Projects with Prince2*, 5th Revised edition, Stationery Office Books, 2005
- [72] von Hippel, E. *The Sources of Innovation*, Oxford: Oxford University Press, 1988
- [73] Webb, A. *Project management for successful product innovation*, Aldershot, UK: Gower Publishing, 2000
- [74] Wheelwright, S. C. and Clark, K.B. Creating project plans to focus product development, *Harvard Business Review*, 1992, 70(2): 70-82