Defining uncertainty in projects – a new perspective

Olga Perminova a,b,*, Magnus Gustafsson a,b, Kim Wikström a,b

a Åbo Akademi University, Laboratory of Industrial Management, Faculty of Technology, Biskopsgatan 8, FIN-20500 Åbo, Finland
b PBI – Research Institute for Project-Based Industry, Slottsgatan 10, FIN-20100 Åbo, Finland

Received 30 July 2007; accepted 2 August 2007

Abstract

The aim of this paper is to discuss the phenomenon of uncertainty in projects and attempt to integrate it as part of project management. Despite the fact that project risk management discipline has gained a lot of attention in the past decade from both academia and practitioners, there is still considerable potential for development in this field. Recent trends in project management stress the need to readdress the issue of uncertainty. Though one can come across the notion of uncertainty in traditional project risk and uncertainty management literature rather often, there is no common understanding between the scholars as to what this term means. Based on the review of the existing research, we present our own definition of uncertainty as a crucial element in managing projects. We argue that key elements in managing uncertainty are reflective learning and sensemaking as enablers of flexibility and rapidness in decision-making regarding the choice of alternative actions in response to the situation. This approach is suggested in order to facilitate and maximize the outcome of project risk management practices.

Keywords: Uncertainty; Risk; Project management; Reflective processes

1. Introduction and background

A variety of recent studies in the field confirms continuing changes in project management both as profession and research area [10,40]. This discipline is being applied in new industries, countries and spheres. Project management has become a core business process for many firms both on a strategic and operational level. In fact, any activity that is perceived as significant and necessary from the customer perspective could be termed a project, and each big project can be seen as a series of sub-projects [3]. Consequently, such developments change the way project management is perceived. The hypothesis stating that traditional general management will have been merged into or replaced by project management in the future gains more and more support of researchers in this field [4].

The study performed by Crawford et al. [10] during the period of 1994–2003 reveals that the relationship management, resource management, time management, cost management and risk management all displayed consistent significance. It confirms the fact that project management puts a lot of emphasis on assuring conformance to time, budget and scope constraints. Adding to that, traditional operations management literature suggests that projects are mostly considered as a pre-phase to production [20]. Taking in consideration these facts, the criticism suggesting that the management of projects is still too rigid and emphasizes the coordination-oriented project management seem to be fair. Project management needs to be regarded as an ongoing process rather than a planning tool, stressing on real performance instead of conformance to timing, scope, quality and budget.

Increased customer orientation is one of the most significant trends in project management. It leads to the fact that many companies concentrate their operations to the provi-
sion of high-value integrated solutions instead of stand-alone products and services [14,20]. It is argued that these innovative combinations of products and services constitute organization’s competitive advantage [11,17]. All projects are to a certain degree unique complex undertakings. However, there are few significant similarities. First of all, most projects have restrictions in time, costs and scope as well as certain demands for quality. Secondly, there is a high level of uncertainty with both positive and negative effects in any project. The traditional approach to project management still puts a lot of emphasis on assuring conformance to time, budget and scope constraints. Considerations, such as continuous improvement, customer-centric thinking, reflective learning are often left behind. This leads to the fact that project companies become less flexible, unable to accumulate knowledge and experience necessary for coping with uncertainty. Moreover, in project risk management literature, there is no common understanding as to what uncertainty is. The aim of this paper is to discuss and define the phenomenon of uncertainty inherited in projects and attempt to integrate it as part of project management.

2. Project risk management and management of uncertainty

There have been a number of distinctive approaches to project risk management since the discipline emerged in 1950s. The methodology of systematic project management and organization with special emphasis on effective planning, communication and evaluation to achieve desired outcomes is still dominant today [1,29,42]. As a result, the traditional view on project risk management (as well as project management in the whole), stresses the importance of planning as one of the major routines, supporting other activities such as risk identification, analysis, monitoring and control. Risk itself is traditionally described as an uncertain event [35,36], which gives some scholars ground to argue that project risk management should be referred to as project uncertainty management [7,18,21].

The new trend challenging traditional view on project risk and uncertainty management originally emerged from strategic management literature [30] and represents a critical insight into the role and influence of strategic planning on the performance of a project company [2,13]. The main assumption is that planning of project activities at an early stage is necessary, but not a sufficient criterion for project success. Taking into consideration that projects are complex endeavors with restrictions in time, costs, resources and precise specifications of the product to be delivered, planning seems to be a difficult task. However, there are constraints and unclear areas, that neither customer nor the project company is able to recognize at an early stage. The real difficulty project managers meet is making an optimal choice among the alternative actions, which requires knowledge about outcomes of preceding activities [2].

In support of the latter “strategic” trend, it must be said that projects are unique only to a certain extent. Project managers are often expecting a number of risks to occur, which will be similar from project to project. According to Davies et al. [12], project managers can employ experiences gained through the course of one project to the next one in the form of standardized successful processes and procedures. In our opinion, repetitiveness of these procedures not only from one undertaking to another one, but also at different stages of the project is the core element in success of project risk management practices. At the same time, these measures aimed at accumulating knowledge facilitate management of uncertainty by providing basis for reflective processes which in turn help to reduce uncertainty by transferring it into known risks and opportunities. The main danger in this respect is that the acquired knowledge will be lost after the project has finished. By standardizing and modularizing processes and procedures, making the gained experiences easily accessible within project team there is a greater preparedness to be more flexible in accordance to the various situations occurring. Adding to that the fact that the project and its environment are in continuous process of change, there is obvious importance of reflecting in order to foresee potential dangers and opportunities to the possible extent [38]. Thus, projects are better described as journeys of exploration in given direction, rather than strict plan-following endeavors. Projects are very complex and uncertain, which emphasizes the need for greater flexibility and reflection as a new way of generating knowledge and functioning [42].

3. Distinguishing risk from uncertainty

Project risks originate from the uncertainty that is present to a different extent in all projects. For example, the recent edition of PMBOK [36, p. 238], which presents a traditional view on project risk management, defines project risk as “an uncertain event or condition that, if occurs, has a positive or a negative effect on at least one project objective, such as time, cost, scope, or quality”. Causes or conditions of risk, according to the same source, arise from the project’s or organization’s environment, such as on-going multiple projects, poor management practices, dependency on external participants, etc. PMBOK describes risk through the notion of uncertainty, however it does not specify what “uncertainty” is. Uncertainty is not a self-explanatory term, and we consider it of importance to distinguish it from the term “risk”. According to the description of risk presented above, one can make a conclusion that risk is uncertainty. However, these two phenomena are not synonymous; they are better described as cause and consequences. Making a distinction between uncertainty and risk is necessary in order to be able to explain the influence of these on project performance. From managerial perspective, defining uncertainty is an important element of performance-oriented project risk management.

A significant amount of work has been done to conceptualize and measure uncertainty [8,9,23,24,27]. The domi-
nant theme in organization theory has been internal uncertainty reduction strategies. Most research in this field has focused on identifying and prescribing ways managers can either reduce or absorb the negative consequences of environmental uncertainty, which has been recognized as an important variable in the explanation of organizational stability and performance. Adepts of organization theory often depict uncertainty as “emanating from some set of objective (but largely unmeasured) environmental characteristics” [22, p. 778]. Some authors regard uncertainty as negative for the firm because it withdraws organizational equilibrium, and thus managers attempt to eliminate it [26]. Others came to the conclusion that managers can not control it [15], and they ignore it [28]. However, firms do not necessarily get negative impact from uncertainty and risks; they can create opportunities out of it. An important insight into understanding uncertainty in this respect is provided by Karl Weick, whose research showed examples of organizations “proactive toward their environments rather than reactive to them” Karl Weick [41, p. 271]. Furthermore, he argues that understanding and sensemaking affect strategic decisions, and consequently, performance of the firm.

In the similar vein, project risk management scholars describe uncertainty from the point of view of not only negative impact on the project outcomes and danger of not meeting project’s objectives, but also as changes that might bring new opportunities into the project [6]. Thus, risks are understood as one of the implications of uncertainty, in contrast to traditional risk management approach, assuming risk is uncertainty. Such interpretation has given ground to a new trend in project risk management science referred to as project uncertainty management [7,18,21]. However, this approach can not be considered as “strategic” as the one we discussed in the previous chapter. For the most part, project uncertainty is described by project uncertainty management school as probability that the objective function will not reach its planned target value, or as an unknown probability of occurrence of an event [21, p. 89,101]. From this perspective, uncertainty is closely related to project performance measures: time, budget, scope and quality. This approach has certain similarity with traditional project management in sharing the view that the planning procedures are crucial for the project success. However, project planning and documentation is seen not only as an administration and statutory requirements, but as means of information collection, integration, evaluation and proactive decision-making.

Describing uncertainty in terms of probability is not new to project uncertainty management scholars. The classic distinction between risk and uncertainty comes from economics, particularly from the seminal work of Frank Knight Risk, Uncertainty and Profit [23]. Knight states that risks are events subject to known or knowable probability, whereas uncertainty refers to events for which it is impossible to specify numerical probabilities. Some scholars argue that this definition is not valid [16,25]. Knight’s thoughts are somewhat similar to the distinction that is used in decision theory, which denotes by uncertainty “a condition of the environment of the decision maker such that he finds it impossible to assign any probabilities whatever to possible outcomes of an event” [19, p. 206]. In other words, uncertainty is referred to all situations where a single action may lead to alternate consequences. Hence risk is assumed as a condition in the environment in which the decision-maker presumes him- or herself able to give probabilities to outcomes of events, each probability being greater than zero. For the purpose of our study, another description derived from the same work by Knight [23] is of relevance. According to it “the word “risk” is ordinarily used in a loose way to refer to any sort of uncertainty viewed from the standpoint of the unfavorable contingency, and the term “uncertainty” similarly with reference to the favorable outcome; we speak of the risk of a loss, the uncertainty of the gain...” Knight’s explanation of profit as a reward for bearing uncertainty stresses the understanding of uncertainty not only as risk or danger, but also as opportunity. However, this view seems to be limited as well.

Keynes made a distinction between risk and uncertainty in the similar vein. “For him, uncertainty was a state in which individual actors find it impossible to attribute a reasonably definite probability to the expected outcome of their choice” (in [32, p. 31]). Keynes perceived uncertainty as inherent in economic life - like a rule of the game. If the rules are known, we are able to calculate possible outcomes and risks associated with that. If rules are not known, we are in the situation of uncertainty. Hence, uncertainty is the situation when it is not possible to calculate risk. Consequently, risk is seen as less threatening as compared to uncertainty.

According to the work of Keynes, one can say that risks as opposed to uncertainty were assumed calculable within the premises of probability theory, and thus, controllable. However, as noted by Nowotny et al. [32, p. 32], in modern science the word “risk” is increasingly used to denote in calculability and, as a result, uncontrollability. This statement emphasizes the tendency to mix these two concepts together, even though they are not the same. Risk as a fact or at least imaginable situation implies certain knowledge, and thus calculability and controllability, whereas uncertainty by definition implies that there is no certainty about the state of things.

Another principal definition of uncertainty comes from psychology: it is described as a state of mind characterized by a conscious lack of knowledge about the outcomes of an event. This description, in contrast with the Knight’s definition presented above, allows us to assume that the external environment is not the only source of uncertainty; the latter can take a form of mental reaction of a human to the external environment, and thus, is closer to the thoughts of Keynes. In this sense, uncertainty exists “in the mind of the person who doubts” [19, p. 206]. Similar thoughts have also been presented by several
authors distancing themselves from a deterministic and rationalistic view in favor of a more relativistic view.

Wittgenstein [44] discusses the concept of certainty and its relationship to uncertainty and note that uncertainty presupposes certainty. To be uncertain of a situation, to be in a state of doubt requires that one takes certain things for granted. Arguing that since we cannot be 100 percent certain we therefore have a constant state of uncertainty become meaningless as it can be countered with the question: how can we be certain that we are not completely certain? However, this does not mean that uncertainty would not exist. Uncertainty can rather be seen as a state of affairs that arises. Putnam [37] argues for adhering to the pragmatist principles fallibilism and anti-scepticism meaning that on the one hand all beliefs (facts) are fallible, but that questioning them requires a counter argument, i.e. another fact. Thus one could argue that whereas risk concerns itself with the calculation of probabilities based on certain facts, uncertainty concerns itself with epistemology, i.e. are we certain of the facts.

Table 1 summarizes the views on uncertainty and risk derived from different disciplines.

### 3.1. Conceptualizing uncertainty for project management discipline

The views on risk and uncertainty in different disciplines have their merits and drawbacks, however all of them have a standpoint assuming that there exists some sort of common truth, which is relevant for any situation and any party involved in it. We consider this presumption too deterministic. In our definition of uncertainty we have adapted a relativistic view as defined by Popper [34] and Putnam [37]. Various propensities impact on our decisions regarding how to meet and handle uncertainty. These propensities have been formed through individual experiences and beliefs. Consequently, uncertainty is regarded differently by different actors involved in project or even not recognized as such.

We define uncertainty as a context for risks as events having a negative impact on the project’s outcomes, or opportunities, as events that have beneficial impact on project performance. This definition stresses dual nature of uncertainty in potentially having both positive and negative influence on the project’s outcomes. Uncertainty can arise from sources both internal and external to the project. As an example of internal uncertainty we can take certain type of projects where risks at least partly originate from the system complexity – systematic uncertainty. In such projects structured approach for information creation or a structured product itself becomes a key factor in better project conformance [5]. From this perspective, risk management is seen as the creation of previously unknown information.

Both research and practice show that traditional project management tools are project planning, and project monitoring and control [31,36]. Let us consider an example. Many project companies in such industries as offshore oil and gas production and energy systems use cost estimations and schedules as an essential part of performance measurement. As a matter of fact, most of these documents are detailed actions plans, which are to be followed in order to achieve the goal of the project - that is deliver results according to customer’s expectations within fixed costs, time period and quality. The same logic applies to risk management procedures; risk identification and analysis, risk response plan, monitoring and control are considered before the project starts. Planning of risk response procedures is an important part of securing that there will be no negative impact on the project outcome. It depends mostly on the project managers’ ability to foresee potential dangers, which in turn, depends on the ability of the person to utilize previously learned knowledge and experience in dealing with uncertain situations. However, not all the

<table>
<thead>
<tr>
<th>Risk</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics Risk refers to events subject to known or knowable probability distribution [23]</td>
<td>Uncertainty is a situation for which it is not possible to specify numerical probabilities [23]</td>
</tr>
<tr>
<td>Psychology Risk is the fact that the decision is made under conditions of known probabilities [39]</td>
<td>Uncertainty is a state of mind characterized by a conscious lack of knowledge about the outcomes of an event [19]</td>
</tr>
<tr>
<td>Philosophy Org. theory</td>
<td>Doubt presupposes certainty [44]</td>
</tr>
<tr>
<td>Dictionary The possibility of something bad happening at some time in the future; the situation that could be dangerous or have a bad result (Oxford Dictionary of Current English, 2005)</td>
<td>Uncertainty is the state of being uncertain; something you can not be sure about (Oxford Dictionary of Current English, 2005)</td>
</tr>
<tr>
<td>Project management Risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one project objective, such as time, cost, scope or quality [36]</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 Risk and uncertainty as defined in different disciplines
risks can be thought of in advance. That is why we think that planning can be considered necessary, but not a sufficient tool in managing risks. Another argument against over exaggerated importance of planning is that one can plan only what one knows for certain. In this sense, we can state that risks are certain or known: project manager can think of potential hazardous events and establish preventive measures.

Uncertainty, in contrast, is an event or a situation, which was not expected to happen, regardless of whether it could have been possible to consider it in advance. In other words, uncertainty is when the established facts are questioned and thereby the basis for calculating risks (known negative events) or opportunities (known positive events) is questioned.

4. Managing uncertainty in projects

In our opinion, uncertainty in projects can not be managed by similar means as risks – or certainties. Indeed, traditional project risk management tools such as planning, monitoring and control are effective for avoiding risks. However, such measures are not enough for managing uncertainty in the meaning we have ascribed to it: implying both risks and opportunities. Many project management scholars point out that there is a gap between traditional project risk management tools such as planning and risk analysis, which aim to grasp the future, and monitoring and control, which reflects the history [31]. Even though project risk management is often seen as a life cycle process [21,35,36], its practical application shows that procedures related to forecasting the future are not repeated at each and every stage of the project. Control as a source of historical data confirms that the problem has already taken place and can not be any longer removed with the help of precautionary methods because the project is a time-bound process [31]. This leads to the fact that project companies loose their flexibility in responding to different situations. Project and its environment are in continuous process of change, which emphasizes the importance of reflecting as means of identifying potential dangers and opportunities, so that the choice between alternative activities can be made as fast as possible. Our case study of solution providers within offshore industry, during which several project managers at different organization levels were interviewed, showed that repetitiveness of risk management procedures at different stages of the project is seen as an important aspect of the company’s strategy. Risk management procedures are perceived by managers as not only as creation of previously unknown information, but also as information sharing, learning, knowledge and competence creation.

The way uncertainty is perceived by project managers depends on personal skills, intuition and judgment. Let us consider an example. One manager A might see potential danger or opportunity arising from doing business with new subcontractor; whereas manager B will not consider the situation as of any relevance to the ongoing project. Managers’ attitudes and understanding of uncertainty do not create or eliminate it. But this understanding affects the way managers “make sense” of the situation and decide on alternative actions. As stated by Weick [41], understanding and sensemaking affect strategic decisions, and consequently, performance of the firm. For manager A there are two options for the decision: to engage into business with new subcontractor, assuming it is more risky and thus more rewarding, or not. Admittedly, manager B does not see any uncertainty in the situation. This can be a result of lack of project management skills. Or on the contrary, manager B has sufficient experience of managing projects in such context and that is why he or she does not recognize it as uncertain. Hereby, we can conclude that development of project management skills is an essential part of understanding and managing uncertainty.

Obviously, not all the elements in project environment or organization are critical to the project success and represent sources of uncertainty. That is why identifying relevant ones from the contextual uncertainty by means of environmental scanning or other analytical models is an important part of project management [31,45]. Judging the source and relevance of information that comes from the outer project environment and, thus, represent contextual uncertainty is an intuitive process rather than a rational one, since the rational processes are isolated from the surrounding world [43]. Therefore, intuitive processes are goal-oriented and reflective. As a result, understanding objectives and purposes of key actors, on whom project success is dependent, as well as developing communication and coordination between the parties involved is of crucial importance [33]. Such actions can be considered as part of project company’s strategy implementation and organization’s competitive advantage supporting customer – centered thinking and facilitating the ability to provide high-value integrated solutions. This is a way of establishing certainty for the project team. Uncertainty becomes either risk or opportunity, which are certain by our definition. It must be mentioned, that uncertainty can not be eliminated completely. Still, continuous reflective learning and information sharing make it manageable by reducing it significantly. We consider these tools as organization’s flexibility enhancers needed in order to faster react to changes by making choice between alternative actions in the situation of uncertainty.

5. Conclusion

The newly emerging trends in strategy, such as customer orientation and continuous improvement, growing number and complexity of projects, internationalization - just to mention a few - are the today’s challenges project companies have to face. It does not necessarily mean that the number of risks companies meet is increasing or uncertainty is higher. The changes are qualitative rather than quantitative. Uncertainty can be regarded as one of the
characteristics of evolution: if you do not have uncertainty, you do not have any evolution. That is why managing uncertainty is one of the core elements in firm’s better performance. Traditional project risk management [35,36] as well as project uncertainty management [7,18,21] have established efficient framework of dealing with risks as certainties. However, they lack common understanding regarding the definition of uncertainty, and as a result, sufficient tools to manage it. Since this term is not self-explanatory, it is important to define it in relation to well-defined terms as “risk” and “opportunity”. In this paper, we have discussed descriptions of uncertainty derived from different disciplines and present our own definition of this concept for the project management field. We have shown that key elements in managing uncertainty are reflective learning and sensemaking as enablers of flexibility and rapidness in decision-making regarding the choice of alternative actions in response to the situation. At the same time, standardized and modularized processes and procedures constitute a necessary basis for supporting reflective processes. All of these measures can be regarded as important tools for project managers to recognize and establish the core competences, and thus perform rather than simply conform to the plan. Continuous following of such procedures at different stages of the project is an essential part of project success. However, these ideas need further empirical support. It is important to mention, that there is no successful procedure, which can be implemented once and for all. Due to fast development of project business, there is a clear need to continuously revise best practices. We believe that recognizing uncertainty as a complex issue of its own will provide basis for the future research and facilitate the development of tools for project management.

References


