Context dependence of project management competences

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RESEARCH MEETS PRACTICE:
TOWARDS PROJECT MANAGEMENT 3.0

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REFLECTIONS ON THE PM CONGRESS 2019:

RESEARCH MEETS PRACTICE: TOWARDS PROJECT MANAGEMENT 3.0

Delft University of Technology, the International Project Management and the Project Management Institute (PMI) Netherlands Chapter were delighted to host the

international Project Management Congress "ADAPT or DIE" on Thursday 11 April and Friday 12 April 2019.

The Project Management Congress 2019 revolved around the theme of 'Research Meets Practice'. A Congress is about 'walking together', and there was indeed a lot of walking (and not just talking) together over the two days of the PM Congress.

There was a rich array of activities planned, including keynote presentations that got participants to reflect on the importance of people, knowledge, and innovating through projects, work shops on promising practices, conversations about story-telling, discussions about a future research agenda, and a packed programme of cutting-edge research presentations in the field of project management.

Collaboration and engagement between researchers and practitioners form the key thrust in the deliberations during the PM Congress.

There is more still that can be (and needs to be) done. The opening keynotes pushed participants to think about ways in which we can move beyond the boundaries of academic research and industry practice, and to find new and simple ways of translating complex theoretical models into practicable outcomes, not just on how to do projects but more crucially also on how to build effective project teams.

To create and sustain a thriving community of practitioners in project management, there is a need to move away from our silos and reach out across organisations and between disciplines. As the congress theme highlights, adapt to this clarion call to build critical friend ships for exploring intersections between theory and practice or risk a dying profession.

The PM Congress 2019 is definitely a starting point for this ongoing adaptation and transformation in the field of project management.

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Abstract

Higher Education is incorporating project management in their curricula, but literature on project management education, higher education practice and practitioner needs show little agreement (Nijhuis, 2017a). Guidance for curriculum design in Project Management is available (Task force on PM curricula, 2015), but also stresses that the development of the curricula should take the (local) context into consideration.Several studies points at a context dependence of project manager competences like leadership styles needed to achieve success (Turner & Müller, 2006) or competences required for success based on regional requirements (Turner, Müller, & Dulewicz, 2009).Several authors have tried to categorize projects (Busser, 2010; Crawford, Hobbs, & Turner, 2006; Dias, Tereso, Braga, & Fernandes, 2014; Dvir, Sadeh, & Malach-Pines, 2006; Müller & Turner, 2007), but on a whole not agreeing on what actually characterizes a project.This paper explores the concept of context from several points of view: does the project type (ICT vs engineering vs organizational) play a role in needed competences. Is there a difference between junior and senior project managers and what consequence could this have for higher education? Several sources of data are incorporated in this paper: 10 focus groups with experienced project managers revealing information on process and personal competences. A small survey on process and personal competences for junior project managers. A workshop with mixed experience project managers discussing the same items and several dedicated workshops aimed at finding ideas and perceptions of differences between junior and senior and contexts.

Keywords

Project Management, Competences, Context, Attribute Competence, Process Competence.

Project Risk Conceptualization by Metaphors

ABSTRACT

We discuss alternative ways risk is characterized by metaphorical thinking in the literature. Although it is acknowledged that risk may have positive and negative consequences, risk is usually considered as an "enemy" that has to be "defeated" or a "disease" to be "treated". Metaphors such as dice/coin and black swans divert the attention of decision-makers to only one source of uncertainty, aleatory or epistemic, but not both. Integrative thinking is required where risk can be conceptualized as a "picture" that involves all sources of uncertainty as well as project vulnerability and resilience, considering the "knowledge" and "perspective" of the decision-maker behind the "risk picture".

Keywords: risk, black swans, project risk management, resilience management

INTRODUCTION

Risk is an abstract term which is characterized by mental representation of uncertainty and its impacts. It is an intangible object that cannot exist separately from our ways of thinking. The way we conceptualize and characterize risk influences the way risk is assessed and thus it may have serious implications for risk-informed decision-making in projects. Within the context of risk management literature, risk can be treated as an objective fact or as a subjective construct. As an objective construct, it is characterized by statistics and probability whereas it is treated as an outcome of social processes mediated by the experiences and values of people/organizations when it is considered as a subjective construct. There is a tendency to associate risk with the quantification of probabilities especially in engineering, but it is widely acknowledged that further development beyond probabilistic thinking is needed in situations of deep uncertainty and

emerging risk (Aven, 2016). Depending on the context of decision-making problem and systems (physical, human, environmental etc.) that are subject to uncertainty, risk can be considered as a physical construct, a behavioral construct or a cognitive construct whereas it can be strongly associated with engineering terms such as factor of safety or reliability.

Within the context of project management, risks are characterized, possibility/probability of deviation from project objectives are assessed considering various scenarios and decisions are given to mitigate risks and maximize opportunities. Society for Risk Analysis (SRA) defines risk characterization as a qualitative and/or quantitative picture of the risk; such as a structured statement of risk usually containing the elements like risk sources, causes, events, consequences, and uncertainty representations. The picture of risk or sometimes denoted as risk-related phenomena (Dikmen et al., 2018) depends on experience, knowledge, imagination and assumptions of the person/group of people who are trying to explore what may happen in the future due to uncertainties (Dikmen & Birgonul, 2018). Despite varying views on risk conceptualization, the success of project management is regarded to be strongly correlated with the risk management capability and existence of formalized processes. In order to formalize the risk management efforts, there are various process models and frameworks of risk management proposed in the project management literature (such as PMI and APM), various methodologies to characterize (such as risk matrices, maps etc.), to assess (subjective risk rating, Monte Carlo Simulation etc.) and to quantify risk (such as probability-impact ratings, expected value, etc.). These knowledge artifacts are generally based on the assumption that all can be done should be done to understand and assess what may go wrong in a project due to uncertainties and develop proactive risk response strategies for risk prevention and control. Visualization of risk-related

phenomena is seen as a critical activity within the risk management process as risk information should be communicated well within the project to ensure a common understanding of risk and its impacts.

Apart from these models and frameworks, there are various visual metaphors depicted in PM literature that are used to characterize risk. A "dice" or a "coin" is a widely used visual metaphor to indicate the "chance" (probabilistic thinking) whereas "black swans" are utilized to denote "unexpected" or "extreme events" that cannot be captured by projection of the past. Sometimes, a "balance" is used as a visual metaphor to reflect the risk-return trade-off in projects whereas a basket full of eggs is utilized as a visual metaphor to indicate the "danger" of losing all the expected gains if a portfolio (projects, investments etc.) fails. The famous statement of "Do not carry all the eggs in one basket" is used to reveal the importance of a diversification strategy for portfolio risk management. In any case, a metaphor conceptualizes risk from a different perspective, emphasizes some aspects of risk while ignoring the others and relevant for decision–making in different contexts (Eppler & Aeschimann, 2009).

In this paper, we first explain why we need metaphorical thinking for risk, then discuss various perspectives in project risk management that necessitate integrative thinking to find out new metaphors.

METAPHORS AND METAPHORICAL THINKING

As Lakoff (1993) argues metaphor is the main mechanism through which we comprehend abstract concepts and perform abstract reasoning. Rather than being "simple" figures of speech, metaphors provide the conceptual schemas through which we understand abstract concepts such as risk (Lakoff & Johnson, 1999). Metaphors help us to understand and experience one thing in terms of another. They transfer information from a relatively well-known domain to a less well-known domain (Tsoukas, 1991). A visual metaphor is the representation of a thing or an idea by means of a visual image that demonstrates a particular association or point of similarity. Metaphors and analogies are used to help us make sense of the world we live in and they assist us to make effective decisions and choices. The use of metaphors and analogies is widespread in organizational and management studies (Morgan, 1986). Our interpretations of organizations and projects are always based on some sort of theory to produce mental models of reality. Models are simplifications, or abstractions, or approximations, or summaries, or metaphors for what really happens (Ben-Haim, 2013). Conceptual models and definitional frameworks are very widely used in management science to make sense of the environment that companies operate, projects are carried out, and also how companies behave and projects perform under various environmental conditions. Models represent abstract terms from different perspectives, focusing on some attributes/components while neglecting some others. For example, visual metaphors and analogies are widely used to explain and hypothesize different perspectives regarding concepts such as "strategy", "organization" and "project". For example, in the paper entitled as "Reflecting on the Strategy Process", Mintzberg & Lampel (1999) argue that we are the blind people and strategy formation is our elephant. With his potter working the clay metaphor, Mintzberg (1987) illustrates the strategy making process as hands-on craftsmanship. In Mintzberg & Quinn (1998), from the perspective of "strategy as position", he presents a visual

metaphor of sorts, consisting of a launching device, representing an organization that sends projectiles, namely products/services, at a landscape of targets, meaning markets, faced with rivals, or competition in the hope of attaining fit. Morgan's types of organizational images (such as machine, organism, brain, culture, political system, psychic prison, flux and transformation and instruments of domination) are metaphors that reflect alternative ways to conceptualize organizations. There are various analogies from sports (Leser, 2010) and orchestra (Hafzoglu & Ozturk, 2009), that deliver key concepts related with project management. Sports metaphors focuses "teamwork" and "objectives", whereas orchestra metaphor demonstrates "leadership" as well as "coordination". Metaphors direct our attention to particular aspects of a subject, focusing our thoughts and actions upon aspects that we might have otherwise overlooked. A researcher who uses a metaphor chooses to focus on some aspects of the phenomenon rather than others, and represents those aspects with one image rather than another (such as using a launching device for strategy as "position" whereas using pottery making for strategy as "art").

PROJECT RISK MANAGEMENT

Metaphors are widely used in the "risk field". Aven (2016) argues that the "risk field" is about understanding the world in relation to risk and how we can and should understand, assess and manage this world. The way risk is conceptualized depends on the discipline that aims to understand a thing (concept, phenomenon, physical system, community etc.) in relation to risk and why risk needs to be conceptualized, assessed and managed. In engineering sciences, researchers are concerned about how a "risk-based approach" is utilized to design reliable/resilient systems whereas in social and administrative sciences, risk

attitude/behavior/pattern is tried to be conceptualized and methods as well as principles are searched to facilitate "risk-informed" decision-making.

In project management, we try to understand the projects in relation to risk and try to find the most effective ways to manage risks to maximize project success. The "risk thinking" is combined with principles and methods of project management to develop "what if scenarios" and formulate strategies to ensure project resilience. Risk is characterized as a "criterion" to select optimum solutions/maximize value, an "event" that threatens project success, or a "source" of uncertainty etc. There are various definitional frameworks and models depicted in literature and also standards (particularly PMI and ISO) that guide project managers in managing risks in projects. Project risk management models give us a mechanism by which risk can be understood, communicated through the system and provide a means for us to identify, classify, analyze and then respond to risk (Flanagan & Norman, 1993). Project management research is usually borrowing the definitional frameworks, emerging concepts and metaphors from the general risk field.

Project risk management is defined as the process of identifying, analyzing and then responding to risks over the life cycle of a project to meet its objectives. Although, the process of project risk management is well-defined, theoretical pluralism still exists in conceptualization of risk as well as its assessment. Zhang et al. (2011) identify two schools of thought about risk management; risk as an objective fact and risk as a subjective construct. Risk as an objective fact depends on probabilistic assessments whereas the subjective school considers risk as an "attribute" that is subjectively constructed by the observers themselves. Risk characterizations are results of social

and organizational positions, knowledge, culture, experience and disposition. Jasanoff (1993) points out that risk is a construct which we, with our bounded human imagination overlay on the world around us. In order to assess risk, assessors make some assumptions about the context in which it arises. The kind of imagination they bring to this activity depends on their values, experience and training. The risks therefore exist not in reality but only in an artificial "micro world" of the assessor's creation. Similarly, Slovic et al. (2004) mention two fundamental ways in which decision makers comprehend and assess risk . The "analytic system" uses algorithms and normative rules, such as probability calculus and quantitative risk assessment which is relatively slow and requires conscious control. Although there are various quantitative RA methods (such as Monte Carlo Simulation), these probabilistic methods can hardly be utilized in practice due to the lack of data and time limitations. The usability of analytical methods is also challenged due to characteristics of risk that involves subjectivity. The "experiential system" that relies on subjective judgements also depend on "quantification of risk" by semi-quantitative methods that capture expert opinion. The experiential system is intuitive and fast. Analytical school conceptualize risk models as a pattern that is drawn by probabilistic thinking whereas the experiential school acknowledges that risk model can be conceived in a different way from various perspectives.

Most widely used risk characterization method in projects is utilization of risk checklists and matrices using subjective probability and impact risk ratings (Williams, 2017). Risk is conceptualized as an aggregate factor considering probability of occurrence of individual risk events and their probabilities of occurrence or magnitude of individual risk sources weighted according to level of uncertainty, controllability, and/or project vulnerability. In this "factor-

based" approach, a list of factors that are determinants/agents of the overall risk of the project are identified, a risk checklist is prepared and risks are treated individually. PM Toolkits, PMI and ISO31000 prescriptions are the knowledge artifacts which are mainly based on factor-based RM. On the other hand, the utilization of risk toolkits and matrices is widely criticized in literature due to neglecting the interdependency between risk-related factors (ignoring the propagation effects), the assumptions hidden in risk ratings and potential bias of experts (Berner & Flage, 2017; Dikmen et al., 2018)

The tension between those who believe that best decisions are based on quantification and numbers by looking at the past or those who believe that best decisions are based on subjective degrees of belief about the uncertain future is a controversy that has never been solved in the risk field. Zhang et al. (2011) call for a feasible framework for integrating different risk thinking in the context of project management by unifying different schools of risk assessment. Jasanoff (1993) points out the potential benefits of bridging the two cultures (such as analytical vs. experiential).

Uncertainty is a result of randomness (aleatory) or imperfect/incomplete information/knowledge about a hypothesis, a quantity, or the occurrence of an event (epistemic). Main focus of risk management changes with respect to different conceptualization of uncertainty; prediction is the main focus if it is assumed that past data can be used to predict the future, whereas developing resilient project systems becomes the main focus if risk is defined as an emerging concept due to

deep uncertainty. It is evident that both sources of uncertainty exist in projects necessitating an integrated thinking and management of aleatory and epistemic uncertainties.

Communities, organizations and projects as temporary organizations have been conceptualized as "complex system" by a variety of authors (Dooley 1997, Burnard & Bhamra, 2011). A complex system is composed of interconnected agents that form a network of linkages that interact nonlinearly. This interaction gives rise to emergent behaviour. As identified by Burnard & Bhamra (2011) when an environment's complexity increases, a system's performance decreases, which is a result of the system requiring a significant increase in information exchange and coordination in order to integrate the multiple levels of system operation and decisions caused by the increase in environmental and system complexity. As a result of this, in order to establish a strategy for reducing risk in uncertain environments, a system should create a balance between prediction/preparation and resilience. Thus, proactive management of risks and designing resilient systems are both required to ensure a project's performance. ISO 31000:2018 - Risk Management Guidelines, provides principles, framework and a process for managing risk ; whereas with the increased uncertainty and complexity, a new standard ISO 31050 – Guidance for managing emerging risks to enhance resilience, deals with designing robust strategies rather accurate risk estimation.

Although in project management literature, majority of the work has been about risk modelling, prediction of how the project will behave under various scenarios due to occurrence of risk events, most recently, there has been a shift from risk modelling to risk understanding and from

risk mitigation and control to enhancing resilience. In engineering, resilience is defined as the ability to sense, recognize, adapt and absorb variations, changes, disturbances, disruptions and surprises (due to uncertainty). It is evident that with the shift in perspective/focus in risk management, the metaphors of risk and related concepts should also vary. The next section deals with some of the current metaphors in RM.

METAPHORS IN RISK MANAGEMENT

Risk is usually associated with "chance" and gambling. Dice and coin as visual metaphors are used to demonstrate alternative scenarios/outcomes under uncertainty. However, these metaphors do not usually reflect the real conditions of the decision-maker in which it is not possible to calculate probabilities and results are partially controllable by reactive strategies. Many authors (such as Young, 2001) draw attention to the fact that risk metaphors are negative. Rather than "uncertainty" that involves "variation" and possibility of positive outcomes as well as negative, risk vocabulary usually contains negative words. Young (2001) based on risk vocabulary in accounting, argues that risk has various conceptualizations such as a "substance", "moving object"," burden", "exposure", "disease" and "adversary", all involving negative connotations.

According to SRA glossary; risk is defined as : "*We consider a future activity [interpreted in a wide sense to also cover, for example, natural phenomena], for example the operation of a system, and define risk in relation to the consequences (effects, implications) of this activity with respect to something that humans value. The consequences are often seen in relation to some reference values (planned values, objectives, etc.), and the focus is often on negative,*

undesirable consequences. There is always at least one outcome that is considered as negative or undesirable." This definition does not imply anything about what actually risk is. Whatever it is, it is defined in relation to its consequences and an activity's initial targets. Risk is conceptualized more as a "condition" (which is uncertain) and a "driver" that may lead to negative consequences. The downside direction is emphasized. In ISO 31000, risk is defined as the "effect of uncertainty on objectives". An effect is a deviation from the expected — positive and/or negative. Thus, it is acknowledged that "risk as an effect" can be negative or positive. On the other hand, in ISO 31000 the strategies to respond to risks are considered under the concept of "risk treatment" (risk as a disease). Similarly, in project risk management vocabulary, although downside and upside effects of risk are acknowledged, risk is usually conceptualized as a disease (eg. risk treatment) and a burden (eg. carry or retain the risks) when strategies to manage risks are concerned. According to PMI, risk is defined as "an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives". Thus, risk itself is an event or condition, rather than effect. PMI identifies negative risks/events as threats whereas positive risks/events are defined as opportunities. The strategies to mitigate negative events are defined as to avoid, transfer, mitigate or accept whereas it is advised that effective ways should be found to "share" positive risks. Consequently, although, it is widely acknowledged in the literature that risk may have negative or positive consequences, strategies to deal with risk are more about avoidance, mitigation, transfer and control rather than strategies to increase the chances of positive impacts. Also, the risk management models/frameworks consider that risks can be identified (known knowns) and threats can be mitigated. Considering risk as a threat and at the same time, considering it as something to be "controlled" reflect only one side of the risk picture. Young (2011) proposes that "risk as chaos" would be a better

metaphor than "risk as threat". If we used this metaphor, we would be less confident of our ability to control or eliminate risk. "Risk as chaos" suggests the unknown and its possible adverse effects may occur despite all our planning.

"Knowledge" dimension (actually "knowing") of risk is another important attribute that is reflected in risk thinking and vocabulary. According to Rumsfeld, "There are known knowns, things we know that we know; and there are known unknowns, things that we know we don't know. But there are also unknown unknowns, things we do not know we don't know." Risk management frameworks are usually concerned with "known knowns" that can be predicted, however even if the prediction models are successful, there will be some residual risk left due to random uncertainty of probabilistic models or remaining risk/secondary risk due to the risk response actions taken. Residual risk is a known unknown, which requires formulation of strategies to increase a project/system's resilience. On the other hand, unknown unknowns cannot be predicted and managed by proactive risk management. Rumsfeld's categorization of uncertainties based on "knowledge/knowing" points out the importance of "Black swans".

The metaphor of "Black Swan" refers to unpredictable events, that have enormous consequences, which has become widely known subsequent to the recent publication of Nassim Nicholas Taleb's bestseller, "The Black Swan: The Impact of the Highly Improbable". Black Swan events are not foreseeable by using statistics and prediction models based on past experiences. Black swan events are unknown unknowns. Taleb (2007) also refers to "gray swans" for "known unknowns". Black swan metaphor points out the inability to estimate the likelihood of occurrence for Black Swan events and importance of development of strategies to manage their

consequences rather than their elimination. Black Swan events cannot be foreseen from observed data, where absence of likelihood information makes risk management methods futile, since even knowledge is of no use because experts do not really know what they do not know. Therefore, Taleb argues that one needs to shift emphasis from risk management to devising strategies for dealing with the consequences of such unforeseen events.

After Taleb's (2007) work, there has been a lively discussion about the meaning of the black swan metaphor and its use in risk management. Aven (2015) mentions that the black swan metaphor created increased focus in the risk field about knowledge and surprises. Black swan is an effective metaphor considering the relativity of risk considering one's knowledge and beliefs. Taleb's perspective approach certifies Aven's definition of Black Swans as surprising extreme events relative to one's knowledge and beliefs (Aven 2013). As this description suggests, the number of people experiencing an event as a Black Swan may vary significantly. Sometimes the event is a Black Swan to the entire scientific community; sometimes it is just a Black Swan for the individuals responsible for analyzing risks (Aven 2015). Aven argues that the element of surprise can be eliminated through the sharing of knowledge and beliefs through effective channels of communication. Lindaas & Pettersen (2016) argue that Black Swans help us to reflect on risk communication as part of predictions to trigger changes in perspectives so that Black Swans may become less black.

As well as the analogies that are based on "type of uncertainty", different aspects of risk (such as its propagation or flow) are highlighted such as "risk as a chain of events". The "domino effect" which is widely used in risk literature is related with systemic risk; risks triggering further risk

events. This analogy again considers risk as a driver and focuses on its propagation Similarly, "perfect storm" is a term (negative) within the risk vocabulary to indicate conditions in which multiple forces join to create a disaster greater than the sum of its individual parts. Researchers such as Pate-Cornell (2012) argue that although black swans indicate extreme events which can hardly be predicted, engineering risk analysis can be used to predict "perfect storms" because even though compounded risk impacts are rare, the individual risk events that lead to perfect storm and their interdependencies can be understood from previous observations. The perfect storm metaphor may be misleading as it implies that its prediction and control is almost impossible.

Recent research points out that the heuristic value of metaphors is fragile and needs to be continuously maintained (Cornelissen, Kafouros, & Lock, 2005). Cornelissen (2004) introduces two criteria, on the basis of which a metaphor can be assessed with respect to (a) its aptness, that is, whether a metaphor fits and is at least meaningful and (b) its heuristic value, that is, the extent to which a metaphor offers new insights into an unfamiliar domain. Metaphors are useful if they reflect the current thinking.

NEW METAPHORS FOR RISK MANAGEMENT

Morgan (2011) argues that when we are talking about the exploration of new metaphors, it is important to distinguish between generative (root metaphors) that can broaden and deepen understanding of the phenomena we are investigating and create important new problem-solving ideas, as opposed to more surface or decorative metaphors that just facilitate communication. He

asserts that the **"generative metaphor"** may open up new discussions on the core aspects of the phenomenon being studied, and new horizons for understanding and action.

It is widely discussed in the risk field that we need metaphors to conceptualize risk. However, are the current metaphors generative and do they really give us the right focus to extend the risk management beyond narrow risk assessments? Some of the ideas are summarized as follows:

- Young (2001) argues that rather than approaching "risk as an enemy" that must be controlled, new thoughts and activities could be enabled if we considered "risk as a teacher". Such a metaphor would allow us to entertain the possibility that risk is "good" and would divert our attention away from control towards learning. Risk as a teacher metaphor coincides with learning-based risk management approach (Dikmen et al., 2008) which diverts attention of decision-makers from prediction to learning and managing knowledge for better risk-informed decision-making.

- Current metaphors of probabilistic thinking and black swans divert our attention to either "prediction" or "knowing (unknown unknowns)" but not both. We need integrative thinking and find creative metaphors to reflect both sources of uncertainty. The general conception of risk as an expected value or a probability distribution may misguide the decision-makers. It is clear that, due to the one-off nature of projects and failure of environmental determinism assumption for dynamic external conditions under which projects are carried out, probabilistic thinking and modelling can have limited relevancy for project risk management. Risk management practices may be successful for the "known knowns" (that can be forecasted by referring to previous experiences) and "known unknowns" (such as force majeure events) but may be of limited use, for the

"unknown knowns" and "unknown unknowns". With an integrative thinking of all sources of uncertainty within the context of risk management, uncertainty (variation leading to negative or positive outcomes) should be conceptualized together with resilience.

- Within the context of projects, it is evident that "turbulence" in the environmental conditions and "complexity" of the project increases "uncertainty" and the impact of "uncertainty" on the project is a factor of its "vulnerability" and "resilience". Factors of vulnerability, complexity, turbulence and resilience as well as uncertainty may better reflect the project conditions and gives a complete picture of risk and opportunity. The "knowledge" that supports our "assumptions" about sources of uncertainty and vulnerability should also be reflected to the "risk picture". Just like any piece of art, what the observer sees in the picture or feels about the picture depend on his/her risk perspective and attitude. "Risk as picture" metaphor (which exists as a phrase in the SRA glossary) may direct attention of decision-makers to different aspects (uncertainty, vulnerability, resilience, turbulence etc., some of them are controllable, some of them are not). Risk as a picture also highlights the importance of "visualization" of all risk-related factors which is vital for effective risk communication.

CONCLUSIONS

Risk as an abstract concept is subject to metaphorical thinking. It is usually conceptualized as a "negative" event or consequence and management efforts are usually directed to its "treatment". As there are different types of uncertainty, mainly aleatory and epistemic uncertainties, each metaphor focuses on one type but not both, drawing attention of decision-makers to either

prediction of consequences (probabilistic assessment using statistical data or subjective judgements of experts) or reactive risk management (due to black swans, unknown events that cannot be predicted by experts). It is clear that in projects, all types of uncertainties may exist and integrative thinking is required to draw a complete picture of risk. It is believed that new ways of conceptualization of risk is required that take into account of all other factors such as vulnerability, complexity, turbulence and resilience that determine how a project is affected from uncertainties. Risk can be conceptualized as a picture that involves all these factors and it has to be acknowledged that it is drawn as a result of various "assumptions" of the analyst and how it is conceived by the decision-maker depends on his/her risk attitude (risk as perspective). Then, this picture may be used to communicate risk-related information (both the controllable and uncontrollable parts, vague parts as well as clear parts etc.) within the project and develop relevant strategies.

Finally, it has to be pointed out that, in this paper, we discuss some of the metaphors widely used in the risk field. However, the mentioned list of metaphors is not exhaustive. The whole risk vocabulary is not covered where the focus was on mainly the visual metaphors that reflect "type of uncertainty" (dice/coin and black swans) which are found more relevant for the current discussions on project risk management. Further research is needed to find out generative risk metaphors that can be used for theory building and lead to new discussions on risk thinking in projects.

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