# Positive Risk of Creativity in Software Projects: an Expected Result, a Threat or an Opportunity?

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Abstract— Positive risk of creativity appears when there is an excess of creativity. This paper aims at exploring the concept of positive risk of creativity in software projects. It presents a taxonomy of positive risks as well as case studies of positive risks in diploma software projects. It also attempts to answer the question whether positive risks should be treated as expected results of applying creativity process, or they cause additional threats, or they can be treated as sources of opportunities. It appears that actually all options are possible depending on circumstances and each option requires a different approach to their management.

Keywords—creativity, positive risk, software project, opportunity managment, case studies.

### I. Introduction

Creativity plays a very important role in innovative applications of information technologies (IT) including humansystem interaction technologies. Enhancing the development process by adding creativity techniques allows to gain a better control over creativity and its impact on final products or innovative solutions. Thus, there is an increasing interest in applying creativity in software project [1,2,3]. However, the application of creativity can also generate some risks. Typically, risk is defined as a negative outcome of some activities. Examples of typical negative risks of creativity include: generation of ideas which are not novel (although the developers think they are), products which are not considered as useful by their potential users, products which are not accepted by the market, and investments on innovations with no commercial success. Negative risk of creativity has been addressed in [4], and relation between risk and creativity at personality level in [5,6,7]. The main reason of the risk is uncertainty and no method can guarantee that negative outcome will not appear.

The concept of positive risk has emerged recently in risk management community and it is still viewed as both useful and controversial idea. There are two approaches to positive risk. In the first approach, positive risk is related to unexpected events which have positive impact on IT project. Thus, positive risk management is similar to opportunity management. In the second approach, positive risk is related to excess of good things. For example, as a result of success in marketing and huge interest in the product, a company can have delays in manufacturing or delivery of these products; or a huge number

of website users can cause problems with accessibility. In case of positive risk of creativity, the second approach is more relevant and thus it is exploited in this paper.

At first glance, it seems that the more creativity is the better. Having large numbers of ideas, all what is needed is just proper selection and management. However, when looking into details, it appears that it is not so simple. The fact of applying creativity process makes the difference with possible side effects such as problems with feasibility of the project, inconsistencies in the solution, stress and frustration of team members or even further obstacles to creativity.

The goal of the research described in this paper is to explore area of positive risks of creativity in IT projects. The results contribute to effective and efficient application of creativity in development of innovative IT solutions. The following questions arise: How to define positive risk of creativity? What are the consequences of positive risk of creativity? How this concept can be applied in this context of IT project? What is the taxonomy of positive risks? When they can be treated as an expected result? When they cause threats? When they can be used as opportunities? How to deal effectively with all these cases? What is the impact of using different creativity techniques? How it can be integrated in software process? What is their impact on innovations?

A sketch of the research method is shown in Fig. 1. A theoretical part aiming at developing a taxonomy of positive risks of creativity is conducted with use of interdisciplinary knowledge transfer from creativity research [8,9,10,11,12], especially the idea of directed creativity [13] customized to software project specifics [14]. An empirical part consists of case studies performed in order to validate and enhance the taxonomy. Three of them are presented with the purpose of demonstrating how positive risks of creativity might appear as expected results, threats, or opportunities.

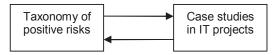


Fig. 1. A sketch of the research method

The paper is structured as follows. Section 2 presents the taxonomy of positive risks in IT projects. Section 3 describes case studies. Section 4 draws conclusions.

## II. TAXONOMY OF POSITIVE RISKS OF CREATIVITY

The taxonomy is based on creativity dimensions of product and process. It allows to ground the results in creativity research including methods for directing creativity. The types of consequences of the excess of creativity are underpinned to the above mentioned categories with additional discussion whether these positive risks can be treated as expected results, threats or opportunities. An overview of the upper side of taxonomy of positive risk of creativity together with their relation to categories of expected results, threats and opportunities is presented in Fig. 2.

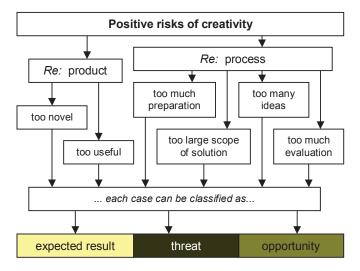


Fig. 2. An overview of upper side of taxonomy of positive risks of creativity with classification to expected results, threats or opportunities

## A. Dimension of Product

In the dimension of product, the frame of reference is set by definition of creativity as activity of generating novel and useful products or solutions. Although both novelty and usefulness are undoubtedly relative concepts with dependence of their perception on individuals, times, domains, communities and other factors, there is a common agreement in creativity research that they constitute the essence of creativity [8]. Thus, the sub-questions are: What are the positive risks of the excess of novelty? What are the positive risks of the excess of usefulness and overwhelming users' interest in the product?

When too novel solution is generated, several negative side effects may appear for users, e.g. technological problems related to hardware or software; problems with using this solution; problems with understanding what the solution is made for. On the other hand, they can be treated as an opportunity for innovation, related funding, building brand of company or setting benchmarks.

The excess of usefulness and overwhelming interest in the product might result in excessive use of products and solutions. In this situation, there might appear that organizations or websites are not capable to serve all demands which can cause further frustration of users and their disinterest in the products. On the other hand, the large number of users or customers generating income can be treated as an opportunity for further

development of the product, infrastructure and organization itself

## B. Dimension of Process

In the dimension of process, the framework is set by sub-processes of creativity process which include: preparation, generation of ideas, elaboration of the vision of solution and evaluation of solution [14]. These are universal components of creativity methods based on overview of several creativity life cycles. Additionally, they scale up from a single cognitive act of creativity, e.g. generating and validating useful ideas, to entire iteration of elaborating a solution. For example, Design Thinking [15] can be easily mapped to these sub-processes. The sub-question is: What kinds of consequences of the excess of creativity may appear in the sub-processes of preparation, generating ideas, elaboration of the vision of solution and evaluation of solution?

The sub-process of preparation can include (depending on what is needed in a given context): gathering knowledge about the domain and solutions available in the market, usability studies, identification of problems, setting up goals, assessment of constraints, definition of acceptance criteria, etc. It is essential for effective action in further sub-processes. In this sub-process, the main positive risk is excess of problems and constraints which cause that solution is not feasible. The discovery of new problems might suggest redefinition of the problem and in consequence change of the scope of project. Other risks may be related with: excessive use of resources (especially developers and their time) even leading to analysis paralysis; the discovery that similar systems already exist with decreasing motivation of developing yet another such system; facing diversity of users and their needs and in consequence lack of clear understanding of the user profile.

In the sub-process of generating ideas, the main positive risk is the excessive number of ideas. If all of them fit to the scope of project and proper process of managing them is applied, than these phenomena can be viewed as an expected result of creativity. However, some of the generated ideas might be outside the scope of project, they might not conform to some regulations, or they might cause problems with inconsistency of solution. Furthermore, extra resources are needed for analysis and selection of ideas and in case of selecting them, extra resources are needed for their implementation. The awareness of the fact that every generated idea can potentially increase amount of work, sometimes leads to obstacles for creativity. On the other hand, it can be treated as an opportunity for improvement of product quality, adding distinguishing features or product development in following projects.

In the sub-process of elaboration of the vision of solution, there might appear the problem with defining too large scope of solution which causes problems with feasibility. The awareness of feasibility problems might cause frustration in the team. Furthermore, extra resources are necessary for prioritization and making decision about the scope of the solution in a given release. On the other hand, it is a chance for product development and it can produce the input to product management and further development of the product.

In the sub-process of evaluation of solution, the problem might appear when there are too many points of reference which cause unclear criteria for validation, or too many propositions of validation activities which require too much of resources. However, they seem to be relatively small comparing to problems related to other sub-processes.

## C. Expected Results, Threats or Opportunities?

When attempting to answer the question of whether positive risks resulting from the excess of creativity should be treated as expected results, threats or opportunities, it occurs that they may be classified to any of these categories.

When excess of creativity is related with the goals and it fits into the scope of a given project, it can be treated as expected result. It allows to achieve a better quality of products; add novel features; focus on target or niche market better than without using these methods; and shape solutions which are distinguishable in the market. This situation requires proper management of generated ideas and product features with use of prioritization, surveys and other business analysis techniques supporting decision making about the scope of solution as well as their implementation in the iterations.

The excess of creativity might lead to negative outcomes as well. It covers also some negative emotions such as stress (and sometimes even frustration) when facing the problem with feasibility of the project, problems related to excessive novelty or excessive use of product or inconsistency in the solution. This situation requires risk management actions. It is important to turn on a positive thinking about creativity despite it generates feelings that former conceptual structures are challenged or implementation of all ideas in the project is not feasible.

When the excess of creativity is related to redefinition of the problem, useful features outside the goal and scope of project, and the project team has feeling of discovering new horizons for product management, than such a situation can be treated as opportunity. Although implementation of all good ideas in a given project is not feasible, they are useful in broader perspective. Thus, in this situation one can apply best practice from the areas of product management, portfolio management, opportunities management or innovation management.

# III. CASE STUDIES

The goal of case studies is to demonstrate positive risk of creativity with phenomena which have appeared in diploma software projects and they can be classified as expected results, threats and opportunities. The diploma projects were made by the students of Bachelor program of studies in Computer Science and they took two semesters. They were supervised by the Author of this paper. Comparing to typical diploma projects, these projects had the phase of analysis extended by the application of creativity techniques [9]. Software projects are difficult to compare because of different topics, different personality of team members and different techniques in use. All these factors have impact on phenomena which occur in the project as well as the results of applying creativity techniques. Sometimes, a creativity technique which has a successful

application in one project, is not considered as useful in other context. Another specific feature of applying creativity techniques is lower level of repeatability of results comparing to application of software engineering techniques. In order to give a feeling of the context, characteristics of each project including domain, number of developers in team, creativity techniques in use, and other techniques in use are presented. They are followed by description of the phenomena with argumentation for the assigned categories.

# A. Case of Positive Risk as an Expected Result

The characteristics of this project are the following:

- domain: travel planning
- number of developers: 2
- creativity techniques in use: brainstorming, six thinking hats (by E. de Bono), naive questions, collage
- other techniques in use: domain analysis, overview of similar systems, vision, UML models, personas, user scenario, user interface prototyping, system design documentation, case study.

The team performed creativity activities carefully. Some of them were intuitive for team members and they felt comfortable using them, while for others creativity techniques it was rather difficult to find a useful application. Application of brainstorming resulted in 18 ideas for features of the application. Results of performing action with six thinking hats technique supported prioritization and selection of the best features for implementation. Naive questions applied to enrich awareness of the need of identified features have not fulfilled the expectations. Collage has been applied for user interface prototyping with use of elements of user interface in similar systems.

It is worth to appreciate proper management of outcomes of creativity in this project. It was made using commonsense supported by the use of some techniques, such as prioritization. Proper relationships between the creativity techniques can be observed, e.g. brainstorming generated ideas and six thinking hats allowed to prioritize them. Clear relationships between use of creativity methods and both software engineering and usability methods are the next characteristic of this project. There was an excess of ideas comparing to features which were implemented. However most of them have fit to the scope of the system and their selection has been under control. This project has achieved almost the best possible results. The excess of creativity in this case, can be considered as an unavoidable cost of enriching the solution, thus leading to the expected result of applying creativity in software project.

# B. Case of Positive Risk as a Threat

The characteristics of this project are the following:

- domain: gamification, application in education
- number of developers: 2
- creativity techniques in use: brainstorming

 other techniques in use: domain analysis, vision, UML models, system design documentation, demonstration of the system.

The team performed creativity activities in a joyful but rather chaotic manner. Inspired by the gamification mechanisms, they have identified several rather unrelated features which they wanted to implement. Despite of supervisor's remarks, documentation of vision and modeling with UML, they could not get rid of inconsistencies. It has been continued to the end of implementation.

The excess of creativity in this case was not properly managed and one can classify it as the threat while comparing to the situation in which instead of creativity just methodological activities would be performed in this project.

## C. Case of Positive Risk as an Opportunity

The characteristics of this project are the following:

- domain: project portfolio management, public administration
- number of developers: 3
- creativity techniques in use: naive questions, reverse brainstorming, Chinese dictionary, what if..., brainstorming
- other techniques in use: domain analysis, overview of similar systems, vision, user interface prototyping, UML models, system design documentation, interviews with potential users.

The team performed creativity activities carefully. For almost all techniques, the outcomes were outside the scope of the project. Naive questions allowed to gain a better understanding what system can be for and allowed to see more criteria for evaluation. Reverse brainstorming has shown a few defects in existing solutions as well as their own approach. Chinese dictionary has led to identification of several types of project which should be identified in the system. What if... technique supported risk analysis and better performance of the team. Application of brainstorming generated several ideas for the use of new technologies, such as drones, satellite images or Internet of Things.

Application of creativity techniques gave a feeling that they implement a small part of really useful solution. Some frustration has been observed when gaining understanding that the system covering all useful ideas is not feasible. Just a few ideas discovered during creativity activities have been implemented. This project ended successfully with respect to initial goals and time constraints. A side effect was the number of ideas to be considered for implementation in further projects. The excess of creativity in this case had small impact on the product, but it has potentially large impact on the following projects. Thus, it can be classified mainly as opportunity.

## IV. CONCLUSIONS

This paper has addressed a concept of positive risk of creativity in IT projects. The taxonomy of positive risks of creativity has been developed on the basis of the results from creativity research. The paper has made proposition how to classify the positive risks of creativity to the categories of expected results, threats, or opportunities. Furthermore, it has given suggestions how to deal with these positive risks after they were classified to a given category. The positive risks were demonstrated with case studies. The list of possible positive risks is far from being complete and it opens a space for further research. However, the taxonomy and the classification frame to expected results, threats and opportunities with suggested actions, seem to be the universal contribution and it can be used in several IT projects which make an effort to manage creativity on a more advanced level.

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