Fachhochschule Dortmund
University of Applied Sciences and Arts

International Research Conference 2017

CONFERENCE PROCEEDINGS – 30 June - 1 July 2017

- International Forum for Researchers, Master and PhD students
- Colleagues from different Faculties and Partner Universities
- Presentation and Discussion of Trends and Research Results
- Several Modules contributing to Project Management

International Research Conference in Dortmund 2017

The International Research Conference at the Dortmund University of Applied Sciences and Arts took place on June 30th -July 1st 2017 for the seventh time.

The complete series of conferences is documented and results are available as a wikispace http://internationalresearchdortmund.wikispaces.com/ .

The conference was initiated by the community of the European Master in Project Management – EuroMPM. It is our main tool for giving our master students, our PhD students and our partners from Bilbao, Leuven, Kaunas, Trondheim, Kiev, Ternopil, Zaporoshje, the Netherlands, France, Latvia, Pakistan, Palestine, and many more countries a forum for meeting, presenting new results and thoughts, and discussing future research and cooperation. The conference was supported by the DAAD Strategic Partnership "European Partnership for Project and Innovation Management (EuroPIM)" which we set up based on the EuroMPM with our partners in Bilbao, Kaunas, Leuven and Trondheim. Furthermore, the Ruhr Master School (established by the Universities of Applied Sciences in Dortmund, Bochum and Gelsenkirchen and funded by Stiftung Mercator) supported the conference. The conference has become the central event of our partnership and an attractive meeting point in the middle of the academic year.

The scope of the conference covered a wide range of topics. A key issue for future projects is the sustainability in all its facets. Sustainability was therefore the common ground for many contributions and a continuous topic in the discussions. It was considered to be the underlying principle in project management, in economics and business, and in technology. The special quality of the research is the transdisciplinary and applied character. Many contributions show results from cooperation with industry and society.

This conference has its own spirit and power since the beginning in 2010.

A special thank you goes to the organizing team, headed by Clara Decelis Grewe, Schanet Berhe, Ala Nuseibah and Christian Reimann, and all the active and supportive members of the team.

For the second time, the conference was followed by a summer school in Dortmund, starting on July 3rd and ending at July 7th. The summer school was taking some of the topics of the conference and developed them further into new results and new teaching modules. The summer school was organized into the following 6 streams:

- Sustainability in Project Management (Jose Ramon Otegi)
- Usability Engineering (Rimante Hopeniene, Christian Reimann)
- Automotive Software Engineering (Robert Höttger, Carsten Wolff)
- Digital Marketing (Elena Vitkauskaite , Michael Reiner)
- PhD Summer School on Project Management (Beverly Pasain, Ala Nuseibeh)
- Case Study Workshop: Writing Cases and Teaching with Cases (Jan-Philipp Büchler)

*Photo Title Page: Clara Decelis Grewe

In 2017 the conference had 8 sessions, covered on two days:

Friday, June 30:

Session on Competences & Education (chair: Wolfgang Tysiak)

- The relationship of emotional intelligence, creative potential and efficiency of the project manager, Sergey Bushuyev, Denis Bushuiev, Nadiia Rusan and Olena Verenych
- International Postgraduate Grant Programs - How To Help Students Use Them, Anna Badasian
- Working in International Project Teams: Life-Long Perspective, Olga Mikhieieva
- Managing the Digital Transformation – Digital & Projectized Master Education, Carsten Wolff

Session on Methods & Tools in Project Management, Part 1 (chair: Nerea Toledo Gandarias)

- Increasing probability of successful projects complete, Pavlo Teslenko, Svitlana Antoshchuk and Victor Krylov
- The project-level and firm-level alignment in electrical utilities. A multiple case study, Maria Aguilar, Jose Ramon Otegi and Leticia Fuentes
- Qualitative and Quantitative Benefits of Knowledge Management in Projects: A Combined Approach from Literature and Praxis. Marina Mayor Musetti, Ekaterina Terenteva, Natalia Carranza Madrazo, Ala Nuseibah
- An Approach for harnessing maximum benefits from Knowledge Management Systems. Sarosh Khan, Matthias Waidmann, Thomas Strücker

Session on Projectized Business (chair: Galyna Tabunshchyk)

- Service-oriented collaborative business models enabling elderly people to stay longer in their homes, Jelena Bleja, Uwe Großmann and Igor Khess
- Sales and Operations Planning - An analysis of job offer requirements, Jose Maripangui Gonzalez and Katja Klingebiel
- Conceptual and theoretical insights from ecodesign pilot projects: The basque Industry case, Paulina Bienvenida Jones Mercedes

Session on Risks in Project Management (chair: José Ramón Otegi Olaso)

- Influence of Project Risk on Performance of Software Projects, Rao Aamir Ali Khan and Syeda Komal Anjum
- Risk Management and the Agile Approach, Wolfgang Tysiak
- Controlling Aspects in International Project Management, Werner Wetekamp

Saturday, July 1:

Session on IT Project Management (chair: Anatoly Sachenko)

- Features of the application of Agile & Scrum Methodologies in Media Monitoring, Mykhailo Yavorskyi
- Issues Related to Implementing Project Management in IT Sector, Bilal Khalid
- Analysis of admissible limits for changing parameters of project planning, Oksana Dunets, Carsten Wolff and Anatoliy Sachenko
- Impact of Risk Management Measures on Project Success in IT Projects, Lateef Olayinka Akinyemi

Session on Sustainable Project Management (chair: André Dechange)

- The Project Knowledge Management: a key factor in the integration of Sustainability in Project Management, Leticia Fuentes Ardeo, Maria Aguilar and Jose Ramon Otegi Olaso
- Strategic Postures for Sustainability in Projects of the Project Based Organization, Gilbert Silvius and Ron Schipper
- Sustainability in the Educational Process through Sustainable Software, Peter Arras, Polina Shynkarenko and Galyna Tabunshchyk
- The blended mental space as one of the factors for sustainability and success in project implementation process, Olena Verenych
- Project Management Office (PMO): An Operating Model for Public Enterprises in Cameroon to achieve Sustainability and Corporate Social Responsibility, Ekomenzoge Metuge

Session on Technology & Entrepreneurship (chair: Peter Arras)

- Field report: Entrepreneurship in the Medtech sector, Alexandru Sereseanu and Sascha Richter
- Multi-Agent System to the rescue! Approach to support production planning, Andreas Wojtok, David Grimm and Martin Hirsch

Session on Methods & Tools in Project Management, Part 2 (chair: Rimantė Hopenienė)

- Different Dimensions of Knowledge Management Benefits in Projects – An Empirical Overview. Kamran Musa, Subin Baidya, Tribane Saha, Ala Nuseibah
- Enhancing cognitive readiness of construction project teams, Chinwi Mgbere
- Project Management Research & Practice. Beverly Pasian

We say thank you to all authors for the contributions to the International Research Conference in Dortmund 2017. The contributions are important – as well as the discussions – for the evolution of the community and the growing power to meet the requirements of the future.

Greetings from the flow of strong projects

Carsten Wolff & Christian Reimann

Table of Content

The relationship of emotional intelligence, creative potential and efficiency of the project manager

Sergey Bushuyev
Email: SBushuyev@ukr.net
Affiliation: professor of KNUBA

Denisy Bushuyev
Email: Bushuyevd@ukr.net
Affiliation: associated professor of KNUBA

Rusan Nadiia
Email: rusan.nadya@yandex.ru
Affiliation: assistant of KNUBA
University: Kyiv National University of Construction and Architecture of Ukraine (KNUBA)
Address: Kiev, Vozduhoflotsky Avenue 31

Abstract: *Nowadays, the market of goods and services is full of similar manufacturers. They produce similar goods or provide similar services and differ from each other only names. This causes the high level of competition. The leaders of these companies raise the question: how to become a leader in their field and not allow others to occupy this place? That is why there is a need in constant development, introduction of innovations and offer new, original and innovative ideas. These and many other factors led to the emergence of creative management. Under the creative management means the management of the creative process. Creative management cannot be applied without a developed emotional intelligence. The project manager must to interact with their partners, subordinates to achieve the goals, to obtain the desired effect (change of behaviour, thoughts, relationships, etc.). Thus, the ability of the manager to recognize and interpret the emotions that arise in the course of activity, use them to solve management problems define the specifics of the problem field of our study. The possibility of increasing the creative potential of the project manager through the development of emotional intelligence opens up new prospects of innovative development of the business community in General.*

Keywords: emotional intelligence, creativity, emotions, IQ, management, efficiency.

1. Introduction

Today, one of the characteristics of creative abilities (creativity) is intelligence. As a complex mechanism of intelligence includes creativity as its own part, i.e. creativity is the natural mechanism of the brain when solving problems, and creative management is designed not only to manage knowledge-intensive industries and creative teams, but also to show the art, make the right decision in unforeseen situations. Therefore, the aim of this work is to study the implementation, use and development of the creative potential in the job manager and the process control system adopting creative solutions creative employees, teams, etc. To achieve the above goal, the writing work was assigned the following tasks:

1) To determine the role of emotional intelligence in the development of the creative potential of the project manager;
2) To determine the structure of the building manager creative type;
3) To determine the relationship between emotional intelligence and the effectiveness of the project manager.

2. Emotional intelligence in the development of the creative potential of a project manager

The ability to quantitatively measure emotional intelligence has allowed scientists to estimate the extent of its impact on the achievement of the head. Most studies prove that EQ is one of the central success factors. Well-developed emotional intelligence enables you to achieve success in business, management and politics.

Studies have shown that IQ affects the success of a project manager from 4% to 25%. For example, to become a project manager, you must have a certain level of IQ, and in order to become a successful manager, you must additionally have more abilities of another kind, namely abilities associated with understanding and managing emotions. 85% is a "merit" developed emotional intelligence (EQ).

Under emotional intelligence (EQ) mean the set of capabilities that enable the project manager to recognize and understand how their own emotions and the emotions of others. People with a high level of emotional intelligence, able to control their emotional sphere, their behaviour more flexible, so they more easily attain the goals set through interaction with other people [1, p. 124].

Today it is known that without emotional intelligence, effective leadership is impossible. D. Holman presents convincing data studies at Harvard University: the success of any activity, only 33% is determined by technical skills, knowledge and intellectual abilities (i.e. IQ), and 67 % – emotional competence (EQ). And for heads, these figures differ even more: only 15% of success is determined by IQ, and 85 % – EQ [5, p. 178].

An attempt to formulate reasons why some studies observed a positive effect of external motivation on creativity, is the assumption T. Amabile that divided external motivators into two types: synergistic and psynergies. The first type is associated with the provision of the information manager, which helps him to solve the problem efficiently, and this type faciliterait the creative process; the second type of motivators causes the head to feel that control it, and, accordingly, is detrimental to creative activity (Collins and Amabile, 2005).

An attempt to unite the conceptual field of creativity and emotion have been taken of John. Averill expressing the original understanding of the problem through the concept of "emotional creativity" as the ability to change the content of their emotional reactions (Averill, 2000). In understanding the relationship between intelligence, emotions and creativity, the author has proposed to move "from trichotomy to triunity": according to this position, not to speak about the mutual influence of emotions and creativity, as emotions themselves can be creative products, and creative behavior consists of the construction of emotional episodes.

Analysis of recent researches and publications allows you to combine all the existing models of emotional intelligence in three groups: skills models, characteristics models/rice, mixed models.

The model of emotional intelligence Mayer and Salovey

The model consists of the following components:

- The accuracy of estimates and expression of emotions;
- The use of emotions in mental activity;
- Understanding of emotions;
- Control emotions [8].

Model of competencies D. Holman

Among the mixed models of EI has become a popular concept of D. Holman after the release of his bestseller "Emotional intelligence" (Table 1).

Table 1

The structure of the emotional intelligence project manager (D. Holman)

Personal characteristics that contribute to the development of emotional intelligence	**Characteristic**
Identity	emotional self-awareness, self-esteem, self-confidence

Self-control	emotional control, adaptability, will to win, initiative, optimism
Social sensitivity	emotional control, adaptability, will to win, initiative, optimism
Relationship management	inspiration, influence, assistance in self-improvement, facilitating change, conflict resolution, teamwork and cooperation

The mixed model of emotional intelligence R. Bar-on .

Canadian clinical psychologist R. Bar-on proposed a model of emotional intelligence as an alternative to the definition of a measure of cognitive intelligence (IQ), which is actively spreading [2].

The structure of EI. According to the theory of R. Bar-on, emotional intelligence is "the multiplicity of non abilities and skills that affect the ability of the individual to successfully overcome the obstacles and the pressure of the environment." The structure of the emotional intelligence model of Bar-on comprises five main components (Fig. 1).

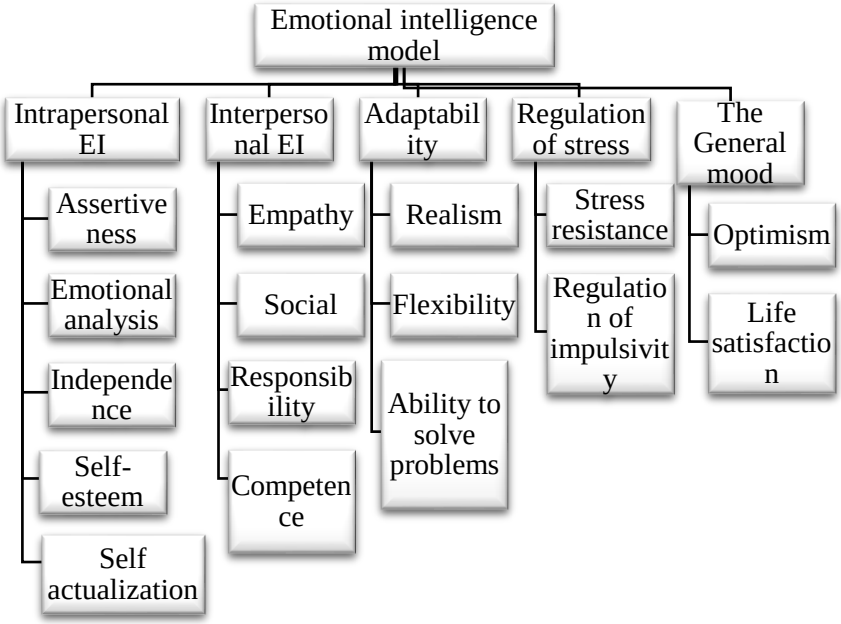


Figure 1 – Structure of emotional intelligence of the project Manager (model R. Bar-on)

Dispositional model of Petrides and Verhnem, describing EI, used not only a set of abilities, proposed by famous researchers of the problem Meyer and Saloom, and propose to consider his disposicin components (Table. 2).

Table 2

Aspects of detection of EI project manager

Aspects of detection	Higher detection levels of EI show that the head
Adaptability	perceives itself as flexible, ready to adapt to new conditions of life
Assertiveness	is straightforward, honest, has a desire to protect the rights of others
Awareness of own emotions and emotions of other people	able clearly to perceive own emotions and the feelings and emotions of other people
Emotional expression	is able to render adequately in communication your feelings to other people

Regulation of other people's feelings	can affect the feelings of others
Emotional self-regulation	able to control emotions
Impulsiveness (low)	does not be impulsive urges
Relationships with other people	able to maintain friendly and healthy personal relationships with other people
Self-esteem	feels successful and confident
Self-motivation	motivated to achieve and demonstrates a low probability to lose confidence in case of complications
Social awareness	has a high social ability
Stress management	able to withstand pressure and regulate stress
Empathy as a trait	readies to sympathize with another person
Happiness as a personality trait	experiencing joy and satisfaction with own life
Optimism as hell	is confident and ready to see the bright side of life first

Probalby model emoting intelecto project Manager: model emoting intelecto Mara I Salavea; model of competencies D. Holman; smenu model emoting intelecto R. Bar-on; dispositio model of Petrides emoting intelektu Verhnem. This is done by the opportunity to trace the relationship between emotional intelligence and creative potential of the project manager.

3. The structure of the creative potential of a project manager

A main feature of formation of the manager, creative type is the capacity manager, who must be constantly improved. Potential is the ability and opportunity of the individual to ensure the achievement of goals.

The ability of a person is the disposition to control in different situations on the basis of leadership, intellectual energy, activity and initiative. The ability of the project manager are manifested through its quality [9, p. 97].

Quality is the ability to react to factors in the environment.

The structure of the potential manager creative type is presented in Table 3.

Table 3

The structure of the potential Manager creative type

Structure	Criteria	The basic qualities
1. Intellectual and moral potential	Values (culture, etc.)	Education, education, culture, ethics, treatment, intelligence project manager
2. Organizational and behavioral potential	Leadership	Organisation, efficiency, communication skills, initiative, self-control, authority
3. The psychophysiological potential	Independence, sustainability project manager	Type of higher nervous system, emotion, conflict, endurance, speed of thinking, memory, performance

4. Vocational and educational potential	The level of knowledge, experience	Professionalism, competence, the level of education, experience, ability to analyze, criticality, innovation, innovation

For the modern manager is not as important to have the know-how to think creatively, to be able to know new realities and to solve new problems arising in management activities. Creativity is the ability to find and define the problem; generate large number of ideas; to make different between a problem (that is, to have the flexibility of mind); look for creative answers, creative solutions; to improve the facility by adding specific details; to see the object of new signs, the scope for the new use (i.e., to analyze and synthesize the elements of the problem) [12, p. 21].

There are three essential elements that contribute to the development of creativity:

1) competence – knowledge, skills, experience;

2) creative thinking, flexibility and persistence in finding solutions;

3) internal motivation (personal interest in solving problems) and external (financial incentives and career promotion) [7, p. 101].

On the development of creativity is influenced by two groups of factors:

- the first (outer) due to the impact on the individual environment in which it is located, as well as those of people with whom she comes in contact.
- the second (internal) driven by the needs, interests, and individual psychological characteristics of the person [10, p. 233].

A creative leader is not someone who always have a ready strategy, but the one who can see her potential behavior of another and effectively adapt to the current situation.The main characteristics of a creative leader are:

- prefers and knows how to set goals which received enthusiastic employees, and does not dry formulations of the problems facing the company. Practically, this involves the talent of balancing on the verge between uncertainty and specifics;
- this guide concepts: it reacts sensitively to ideas and able to implement in your organization that they will receive the support and resources necessary for their implementation;
- convincingly demonstrates the validity of the principle of "every failure is an opportunity to learn something" and encouraged risk-taking initiatives;
- creates a team with a high level of confidence to each other;
- gives your employees the freedom to pursue other activities and contributes to the realization of risky and contentious projects;
- helps others to analyze and understand the external environment;
- possesses the leadership style from a "coach" or "counselor" in the "generator of conflict", "comedian", "hero". Creative leader has the ability to change leadership style, moving from one to another, without losing the confidence of subordinates [11, p. 76].

4. The relationship of emotional intelligence with the effectiveness of the project manager

According with D. Holman, leadership always had an emotional basis, and most of the competencies needed for success of a manager has a social and emotional nature. In the modern organization in front of the head, of course, is the task of creating in a team a positive atmosphere, because of the success of this feature depends largely on the productivity of the group. An effective leader not only varies his style of leadership depending on the situation, but also able to apply a variety of skills related to emotional intelligence. Infecting the group with his optimism, he thereby motivates the employees to work [4, p. 108].

Emotional intelligence or emotional competence, in the broadest sense combines the ability of the individual to communicate effectively by understanding the emotions of others

and ability to adapt to their emotional state. Professional success of a project manager, undoubtedly, is connected with the knowledge, skills, erudition and ability to think in General, that is, with the level of intelligence. However, in most cases, a high level of General intelligence is not enough. The idea of emotional intelligence was the result of the development of ideas about social intelligence. The main reason for the allocation of social intelligence as an individual ability or character traits was a discrepancy between level of General intelligence in interaction with the social environment [3, p.140].

One of the most popular styles in the study of emotional intelligence is the study of its role in the effectiveness of leadership and management. Thus, the level of emotional intelligence of the leader is highlighted as another factor affecting the efficiency of its activities along with the traditional describes the socio-demographic (age, gender, education) and psychological characteristics of the head (temperament, abilities, personality traits). The range of problems of social psychology traditionally fall leadership style and gender characteristics of managers as factors of their effectiveness.

The main difficulty faced by almost all the leaders, - addressing performance problems and issues with people.

The working atmosphere created by the leader, depends first of all from the style of his leadership. Such styles are six ("dictators" leaders, "mentors" leaders, "partners" leaders, "authoritative" leaders, "democratic" leaders and leaders of "model" style). The possession of each of these styles depends on the characteristics of emotional intelligence of a particular leader. A good leader must to apply various styles, choosing the best for each situation which has a positive effect on the overall climate of the company. And it is necessary to have a developed emotional intelligence [4, p. 106].

So, leaders who want to achieve the best results, the same must be proficient in multiple styles of management. The more styles in the manager's arsenal (Table 4).

Table 4

Six management styles

№	The name of the style	Feature
1	"Dictators" Leaders	❖ require immediate execution of instructions; ❖ destroy the morale of the organization. And above all suffers flexibility; ❖ people stop to offer new ideas, knowing that nothing good still does not work; ❖ negatively affects motivation; The dictatorial style you need to apply very carefully and only in emergency situations. It is absolutely necessary, for example, in the restructuring of the company or in the event of a threat of crisis.
2	"Authoritative" Leaders	The authoritative style has a positive effect on flexibility: head proclaims the ultimate purpose and, as a rule, leaves the subordinate enough freedom for initiative. A leader who adheres to the authoritative style may not always achieve the desired results. So, we should not count on success if his team there are people more experienced in a specific business than himself.
3	"Partners" Leaders	The motto of the leader - "partner" - "People first!". Leader - partner is trying to keep his subordinates happy and in a state of harmony. This leader builds strong emotional bonds between employees, and reward him with a passionate devotion. For the team, led by the leader - "partner", is characterized by trust among colleagues, readiness to innovations and risky actions, flexibility. As such, the director acts as the head of the family, which changes the rules of behavior as they grow older children: it does not

		dictate hard conditions of work, giving subordinates the freedom to do things the most effective, in their opinion, way. Know how to create subordinates a sense of belonging.
4	"Democrats" Leaders	The leader spends the time and give the opportunity to all interested individuals, thus achieving their trust and respect. The leader of the Democrat thus holds them accountable and achieves greater flexibility. But in a democratic style also has shortcomings. The most unpleasant consequence of it - the endless meetings, which are ten times discusses the same ideas. Under what conditions democratic style is most effective? If the manager doesn't know which way is best, and needs to be Council employees-professional. But if the leader is a "Democrat" have a clear vision of the final goal, it can offer unexpected ways to achieve it. This style is not successful if subordinates are not competent enough.
5	Leaders who prefer a "model style"	The leader sets high standards of work and on his own example proves that they can be observed. Such a leader destroys morale in the company. Often using his high demands workers give up. Subordinates of the head there is no feeling of belonging to a common cause - they have no one explains how their work affects the overall results. This approach is appropriate in situations where all employees are well motivated, have high qualification and have a strong need in the guide.
6	"Mentors" Leaders	Leaders "mentors" to help subordinates to see their strengths and weaknesses and to evaluate their prospects for personal and career. They encourage subordinates to set themselves a long term goal and help them achieve it. Leaders - "mentors" have a great ability to delegate. Through established dialogue with the "mentor" they also know what awaits them and how their work fits into the overall strategy of the company. Mentoring style is particularly effective when, for example, subordinates, knowing their weaknesses, want to learn how to work better or to develop a new capacity to move forward. This style is not suitable when the leader lack of experience.

In recent times, emotional intelligence is increasingly coming to be regarded as one of the factors of effective leadership work team. The skills of managing emotions, are clearly linked to the leadership style. If you divide the leadership of instrumental and emotional, it seems more likely the realization of his emotional intelligence of a leader due to its focus on the relationships within the group. Leader, focused solely on objective, apparently, will have a lower emotional intelligence. Some studies do show a link between high levels of emotional intelligence and the tendency to democratic, focused on relationships, style of management decision-making. Moreover, women leaders with a low level of communication skills exhibit the policy and strategies of humiliation, and men – only strategy of humiliation. However, a number of authors tend to think that the emotionally competent leader effective and successful regardless of them realized the style of leadership, as they are able to act adequately in a situation, adapting to the external environment. On the other hand, the desired style of leadership may, in turn, be a determining factor in the use and application of the personality of his emotional intelligence, speaking as a motivational basis [6, p. 173].

5. Results and Conclusion

There were analyzed models of emotional intelligence of the project manager: a model of emotional intelligence Mayer and Salovey; model of competencies D. Holman; mixed model of emotional intelligence Bar-on It, dispositio model of emotional intelligence, Petrides and

Verhnem. Installed relationship between emotional intelligence and creative potential. Elucidated the structure and criteria of the creative potential of the project manager.

Installed how emotional intelligence affects the effectiveness of the leader. Given six management styles. The emotional state of the leader affects the psychological climate in the team. Emotions are passed from colleague to colleague. If we are environment cheerful and energetic people, their emotions are transferred to us. Conversely, the sad leader is able to discourage us. This emotional characteristics of the leader that preserve the balance and inner motivation serves as an example to subordinates, inspiring them and conveys his feelings. Optimistic and energetic leader able to increase the activity of the entire organization. Sensitivity and the ability to interact help motivate, inspire, and unite employees. Emotional intelligence allows a leader to treat a subordinate as a whole person with your feelings, thoughts, ideas, needs, abilities and dreams. It is the emotional intelligence helps the leader to develop staff and maintain high self-esteem of every employee. Emotionally intelligent leader creates an atmosphere of trust and respect that gives meaning to the work of subordinates so that they tend not only to satisfy personal needs, but also to bring the maximum benefit to the organization.

If before the creativity was considered a privilege of artists and crossed paths with commerce only on the basis of patronage, since the beginning of the last century representatives of the business community are showing increasing interest in this phenomenon. And do it rightly. For example, the General Electric Corporation after holding a two-year course of development of creative potential of employees received result in a 60% increase in the number of patentable ideas.

Creative employees are the initiators of innovation, bringing enormous profit (under creativity is the ability to generate unusual ideas, to deviate from traditional patterns, to quickly resolve the problem).

Ways to enhance the creative potential of employees is very diverse. It is important to choose those that meet the specifics of each organization, its goals and objectives, its staffing. There are no universal prescriptions for the development of creativity of workers is the task which, in turn, requires the manager of a creative approach and high professionalism.

6. References

[1] Golman D. Emotional intelligence at work / Daniel Holman; lane. from English. A. P. Isaeva. – M.: AST: AST MOSCOW; Vladimir: VKT, 2010. – 476 p.

[2] Chetveruk-Burchak A.G. Emotional intelligence, as integrativna vlastiti osobistosci / Alina Grigorivna Chetveruk -Burchak // Materials VIII mineralno Naukovo-praktichna Konferenz "Psikholingvistiki have modern in – 2013" (18-19 Zhovtnya 2013 R. M. Pereyaslav-Hmelnitskiy, Ukraine). -2013. – P. 73.

[3] Abulkhanova-Slavske K. A. the Life prospects of the person / Ksenia A. Abulkhanova-Slavske. – M.: Nauka, 2011. - P. 137-145.

[4] Golman D. Emotional leadership: the Art of managing people based on emotional intelligence. /D. Holman. – M.: Alpina Business Books, 2012. – P. 104-109.

[5] Golman, D. Emotional intelligence in business. - Mann, Ivanov and Ferber, Moscow; 2013. – 356 p.

[6] Howard K., Manager Experience: Teaching aid / K. Howard, E. M. Korotkov – M.: research center Infra-M, 2013. – 224 p.

[7] Kozulin, Y.G. Theoretical and methodological foundations of the training and development of creative thinking. // Herald KSPU them. V. P. Astafeva, 2009, (1), – P. 99-105.

[8] Agarkov S. A., Kuznetsov. Gryaznova.About. Innovation management and innovation policy of the state. – M.: Publishing of Th "Academy of Sciences". 2011. – [Electronic resource]. – Mode of access: URL: https://www.monographies.ru/112

[9] V. P. Okonski Kreativni management : navch. posb. / V. P. Okonski, A. M. Valyuh. – Rune: NUWMNRU, 2011. – 211 p.

[10] .Svidrak. I. The essence kreativnost peredumovi lberta creative menedgment / I. I. Swidrak // NLTU Ukrainy : ZB. Sciences.-tech. Ave. – Lviv: RVV NLTU Ukraine, 2013. – VIP. 23.11. – 400 p.

[11] Makarenko O. G. Creative management: textbook / O. G. Makarenko, V. N. Lazarev. Ulyanovsk: UlSTU Publ., 2011. – 154 p.

[12] Yakubov M.R. Creative management: practical aspect / Yakubov M. R.//. Creative economy. — 2010. — № 11 (47) — p. 19-24.

International Postgraduate Grant Programs - How To Help Students Use Them

Badasian Anna

a.g.badasian@gmail.com
Master student
Kiev National University of Construction and Architecture
31 Povitroflots'kyi Ave, Kiev, Ukraine, 03680

Keywords: international study, postgraduate, consulting center.

Abstract:

The era of integration and cooperation between countries allows people to change their occupation for different purposes: job, education, traveling and etc. The main goal is exchange of experience between countries. Students are the greatest steering mechanism in the country's improvement, especially Master and PhD`s students, and the best way to change their place of study is to find an appropriate postgraduate program. This work will elaborate the purpose and necessity of opening the consulting and preparation center of international postgraduate grant programs.

1. Introduction

"Companies are operating over so many international boundaries, so the more languages and experience with different cultures you can bring to a company, the more you can help expand its global reach." - Oliver Watson, the Managing Director for UK, North America and the Middle East at Michael Page, the search firm. This statement shows that more and more employers are looking to recruit students with an international outlook, who are aware of other cultures and have skills to work with colleagues, stakeholders and customers from all over the world. Ben Searls, a senior manager at recruiter Badenoch & Clark, says: “If you have international work experience, you’re likely to be confident and have an outgoing personality, which helps you engage with stakeholders”. He believes those without work experience abroad will struggle to get the top jobs [2].

2. Worldwide statistics of international study

“Our clients increasingly operate seamlessly across borders. Our people need to be able to do the same,” - Peter Lacy, managing director of strategy for the Asia-Pacific

region at Accenture, the management consultancy. “That mindset comes from being exposed to new business cultures and experiences that come with international placements” [2]. Six out of ten employers around the world give extra credit for an international student experience. According to a study done by NACE, about 49% of the general population of recent graduates finds a job within 12 months of graduation, compared to 97% of studied abroad alumni, and their salaries are also higher [1]. This perspective breeds a demand for the international study and it continues to increase.

The charts below show the most widespread host countries in two different years and number of foreign students in various countries as percentage to total number of universities` students (fig. 1 and 2 respectively).

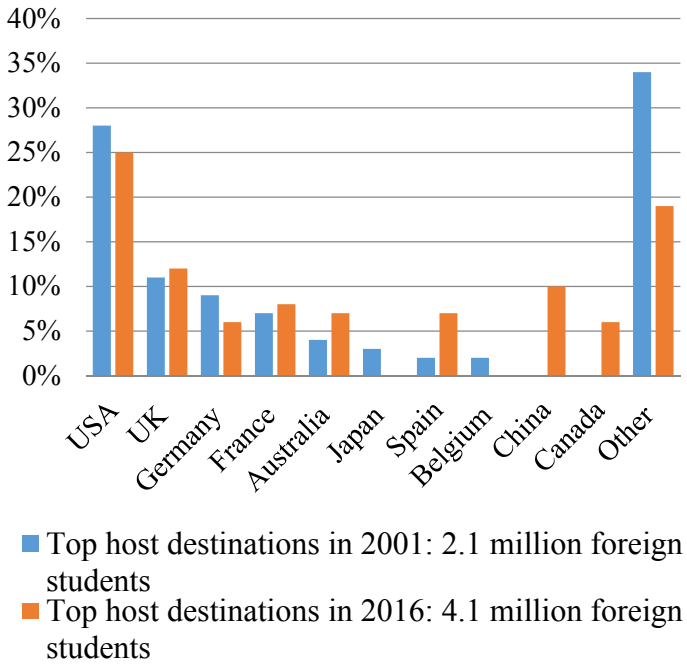


Fig. 1. Top host destinations in 2001 and 2016 [3]

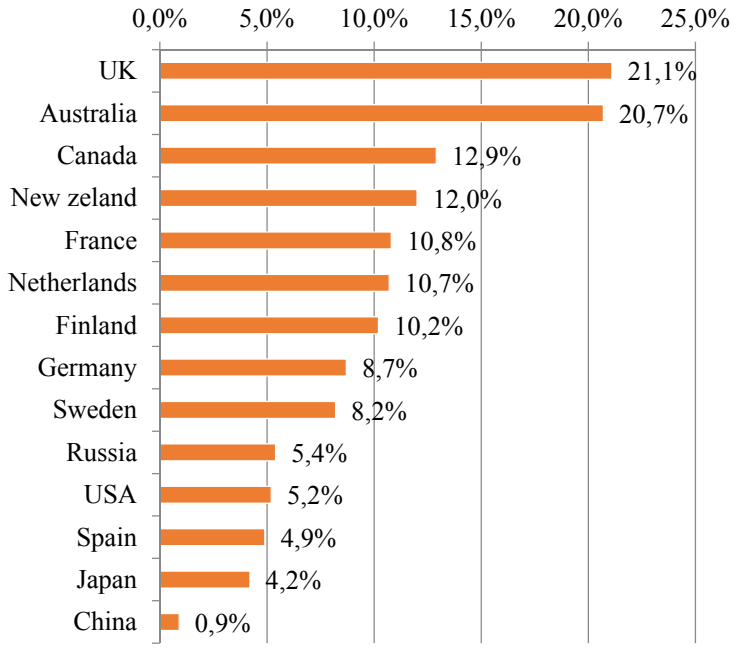


Fig. 2. International students as percentage of total higher education enrollment [3]

It is worth mentioning that receiving a foreign postgraduate degree is not the only aim in the international study. The alumni attain the full range of qualitative skills but, additionally, there are other positive consequences: exchange contributes to cultural understanding, expansion of friendship, reinforcement of students' personality and maturity, decreasing the chance of long-term unemployment and etc. Moreover, 98% of alumni reported that study abroad leads to better understanding their own cultural values, 96% said that it increases self-confident and 86% - that it influences subsequent educational experiences [4].

3. Necessity of consulting and preparation center

Turning back to the consulting center, more and more students try to find any foreign university program which they can afford. Due to this, the question of how enrollees can find and apply cheap as well as worthy postgraduate program arises. There is a huge variety of different Master and PhD`s programs and one of the most available is the exchange or grant program which allows postgraduates to get a program of any duration and complexity they want, which has a little fee or absolutely free of charge. Thus, to avoid wasting time on searching and selecting a particular grant program, gathering all required documents, arranging a dormitory, opening a visa and etc.

students would rather shift responsibility to the special company, that can do all preparations instead.

4. Results and Conclusion

The benefits from opening the consulting center of postgraduate grant programs can be revealed from the view of the country and an individual. From the side of the country, creation of such centers all over the country can increase opportunities for international cooperation, improve a potential of the country, exchange of knowledge and etc. From the side of the postgraduates, overseas education can help to expand the world outlook and enhance a personal development, gain the language skills, improve career opportunities and other.

5. References

[1] GO overseas: https://goo.gl/VyvLUY. Author: Elaina Giolando. What Do Employers Think of International Experience?, 12 September 2016.

[2] Financial times: https://goo.gl/0qu8DU. Author: Janina Conboye. How valuable is international work experience?, 6 November 2013.

[3] Project Atlas: https://goo.gl/QWiEKp. A quick look at Global Mobility Trends, 2016.

[4] SmartStudy: https://goo.gl/lTVDSS. Author: Ruth Kinloch. 46 Study Abroad Statistics: Convincing Facts and Figures, 24 August 2016.

WORKING ABROAD IN INTERNATIONAL PROJECT TEAMS: LIFE-LONG PERSPECTIVE

Olga Mikhieieva

Olga.mikhieieva@fh-dortmund.de
M.Sc. in Project Management
Dortmund University of Applied Sciences & Arts
Otto-Hahn-Str. 23, 44227 Germany

Abstract: *Individuals who work in international project teams experience specific challenges in their personal development and career. Such settings itself create both risks and opportunities for an individual. The concept of life-long learning offers a broader view how a project manager develops him or herself working abroad or having acquired an experience abroad and in international project teams. First, requirements for an individual who works abroad create a different competency profile. Secondly, challenges and opportunities that arise during such work have to be clearly identified and used for a personal development in the life-long perspective. Finally, any project manager who has moved to work abroad, eventually, has to consider a choice either to stay abroad and become an expat or move back to the home country. When an individual decides to stay abroad, such challenges arise as assimilation into a new culture, a new career development system, conditions of retirement, and different issues connected with a legal status of a foreigner. When an individual decides to come back to the home country, another kind of issues arise. Thus, a development path of an international project manager in the life-long perspective require follows its own specific phases. In the given paper, the author explores main challenges that affect project managers working in international projects. Influencing development dimensions in an international aspect are represented and analyzed from the life-long perspective. Additionally, the challenges that arise before, during, and after working abroad are formalized and suggestions for a consistent development path are given.*

Keywords: international project, life-long development, competency profile

1. Introduction

In the twenty first century, Project Management (PM) as a profession is becoming international more than ever before. Globalization and IT development increase the amount of international project teams and, consequently, the amount of project managers who opt for working abroad. Due to the fact that projects end and project assignments sometimes vary from a project to a project, the career of an international project manager assumes a significant amount of changes. Especially in the international scope, the project manager may have to deal with a new geographical location and environment, differences in time zones, acclimatization, etc. Working abroad adds new challenges with legal documents that ensure legal and social status in a new country: visas, working permits, medical and social insurances, etc.
The life cycle of the project manager in the international scope implies more complexity and uncertainty than the one in a familiar working environment in the country of birth or permanent residence. An individual needs a careful planning and readiness to develop specific competences when choosing a working destination.

2. Competency profile of an international project manager

The international project manager needs to possess an extended set of competencies in order to be successful in the international scope. The literature analysis shows that behavioral competencies, or so-called ‘soft skills’ play the most important role for the international project

manager [1]. At Fig. 1 three categories of the international project management are presented. The soft skill category contains the list of the skills most mentioned by scholars in the literature [2], [3], [5], [6], [7].

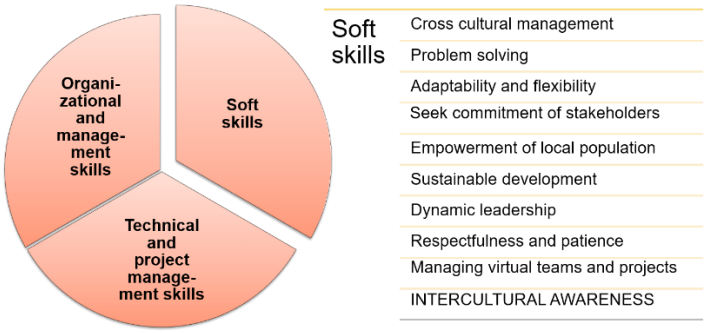


Fig. 1. International project manager's skills

Such a set of competencies is also called a 'competency profile'. The competency profile of the international project manager is a tool that helps to plan personal and professional development both on the individual and the organizational levels.

3. Challenges in working abroad

Working abroad creates a range of challenges that are naturally caused by differences. The differences causing issues in international projects that can be categorized in the following groups:

- Language
- Culture
- Personal perceptions
- Technology
- Legal aspects, etc.

These categories point out to the areas that require major attention and efforts from the international project manager.

Overall, it can be said that these challenges demand some specific qualities from the international project manager, like those that are covered by the international project manager's skills list (see Fig. 1). In other words, not every individual is capable to work abroad successfully and with satisfaction.

4. Three-fold development in a life-long perspective

In the international scope, a life-long perspective of the project manager includes such elements as development of language skills and intercultural competence; adjustment of the competency profile to a new market requirements and validation of previous experiences through additional certification or educational systems. In general, the development of the international project manager in a life-long perspective can be represented as simultaneous development in three dimensions such as professional, personal, and intercultural (see Fig. 2).

Fig. 2. Threefold development of the international project manager

The concept of the threefold development highlights the importance of the intercultural development.
In the literature, intercultural development is often represented through the notion of the intercultural competence. Intercultural competence includes the competencies that allow to communicate and interact with member of other cultures in an effective and appropriate way [4]. Besides the intercultural development, there is a category of personal development, which also includes social, friendly, and family bonds. It plays an important role for the international project manager. The quality and satisfaction in a private life and personal qualities provide a support when: a project is finished and an individual comes back to the home country; the project starts and the project manager moves in in a new environment accompanied by the family; or there is a gap between projects and there is a free time without any occupation.

5. Life-long perspective of the international project manager

Based on the above mentioned specifics, the life-long perspective of a project manager's life cycle in international projects is represented at the Fig. 3.

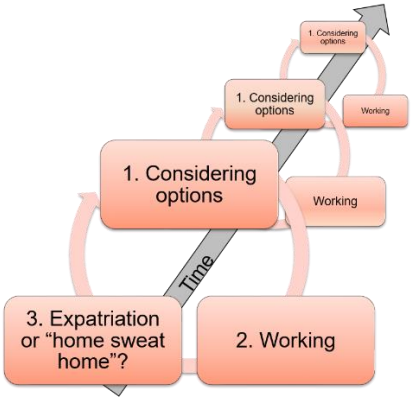


Fig. 3. Project manager life cycle in international projects: life-long perspective

The international project manager's life cycle includes three phases. During the first phase, the project manager considers different job options and makes a decision, taking into account not only a salary level and job conditions, but also the opportunities to develop one's own competency profile, validity of the acquired competencies in the home country or in perspective destinations, and legal document aspects in a new country. During the working phase, the project manager faces most challenges and opportunities, developing intercultural competence and sometimes language skills. The third phase implies a period of time when an individual decides whether to stay in a new country and become an expat, or to come back to a home country. In both cases, an individual has to deal with the legal documents aspects. When an individual decides to go back to home country, it does not automatically mean that he or she can simply come back to the social and working patterns he or she is used to. Staying abroad changes personal traits and perceptions, therefore, a new period of cultural and social re-adjustment has to be faced.

6. Discussion and conclusions

Overall, it can be stated the working abroad requires from the individual to face specific issues caused by differences in language, culture, legal aspects, etc. An individual has to possess a specific set of competencies and determination to be open-minded and adaptive.
While working abroad, it is important to pursue the threefold development, taking care about professional, intercultural and personal development. The development of the soft skills is very important for the international project manager, too. As each country has its own educational and job standards, requirements for a competency profile value may vary from country to

country. Therefore, the international project manager has to be aware of the fact that newly acquired competencies may not be valid or recognized in another country or the home country. The concept of life cycle phases of the international project manager introduces an approach that facilitates dealing with the issues mentioned above and planning of the balanced development in a life-long perspective of the project manager.

7. References

[1] O. Mikhieieva and M. Waidmann, "Communication management tools for managing projects in an intercutlural environment," in *Int. Scientific Conference on Project Management in the Baltic Countries, Riga, Latvia*, pp. 159–170., (2017).

[2] M. Alam, A. Gale, M. Brown, and C. Kidd, "The development and delivery of an industry led project management professional development programme: A case study in project management education and success management," *International Journal of Project Management*, vol. 26, no. 3, pp. 223–237, (2008).

[3] PMBOK 5, *A guide to the project management body of knowledge (PMBOK guide)*. Newtown Square Pennsylvania: Project Management Institute Inc, (2013).

[4] C. I. Barmeyer and P. Franklin, "Applying competencies and resources: handling cultural otherness as the second step towards generating compementarity and synergy from cultural diversity," in *Intercultural management: A case-based approach to achieving complementarity and synergy / edited by Christoph Barmeyer and Peter Franklin*, New York: Palgrave Macmillan, (2016).

[5] ICB 4, *Individual Competence Baseline for Project, Programme & Portfolio Management*, (2015).

[6] T. U. Daim *et al.*, "Exploring the communication breakdown in global virtual teams," *International Journal of Project Management*, vol. 30, no. 2, pp. 199–212, (2012).

[7] R. Arent, *Bridging the cross-cultural gap: Listening and speaking tasks for developing fluency in English / by Russell Arent*. Ann Arbor: University of Michigan Press, (2009).

Managing the Digital Transformation – Digital & Projectized Master Education

Carsten Wolff

carsten.wolff@fh-dortmund.de
Institute for the Digital Transformation of Application and Living Domains (IDiAL)
Dortmund University of Applied Sciences and Arts
Otto-Hahn-Str. 23, 44227 Dortmund, Germany

Abstract: *The way people work and live is changing due to trends. Two very important trends are the digital era and the organizational shift towards projects. We are starting to live in a projectized and digitalized world. The adaptation of organisations (e.g. companies, but also Higher Education Institutions - HEI), processes, methods & tools, and of technologies are forcing a change process with a tremendous pace on people, companies and nations. The HEI system does not fully reflect this change in their educational programmes which are still mainly oriented towards teaching knowledge in a well-defined scientific domain (e.g. social sciences, informatics). In the bologna system the Master's programmes offer the chance to move ahead of this towards job-field-orientation and applied sciences. This gives the chance to design educational programmes cross-faculty, cross-organisation. And therefore inter- or multidisciplinary and inherently international – if HEIs from different countries are involved. This is much better suited to today's work in interdisciplinary and international project teams than traditional study programmes. It can be achieved by building a virtual Master School, a competence network (as a community of practice) and respective open standards (and open educational resources – OER). The basis is the "3-layer digitalized & projectized development approach" for the Master programmes in which all three layers are based on projectized and digitalized methods. The paper will present this approach and the efforts of a consortium of 8 European HEI to develop a joint Master School on Managing the Digital Changes.*

Keywords: Digital Transformation, Digital & Projectized Education, Virtual Master School

1. Introduction

The European Higher Education System is an important player in the mission to shape the digital transformation. Within the systems competences and contributions, various aspects in education and scientific research, but also in third mission areas like continuous education (CE), technology transfer and innovation (TTI) and societal engagement (SE) form important drivers for the digital change. In this contribution, the specific role of Master programmes is addressed by developing a conceptual framework for the strategy and implementation of such programmes and for the cooperation with partners from science, industry and society.

Master programmes form the level 7 of the European Qualification Framework [1]. They are intended to form a bridge between science and application, but also a transition between the first stage of the Bologna systems and the third stage. This is the reason for a special role within the contribution of Higher Education Institutions (HEI) to the digital transformation. This role is highlighted and analysed in the second chapter of this paper.

The *digital transformation* is by far not only a technical (or even IT) topic. Digital transformation involves technology, but in addition the respective business models, processes and services, the operational excellence of the innovation and transformation process, and of course the impact on the socio-economic environment (involving the humans). This is a very

interdisciplinary field. In addition, it is not a well-defined scientific domain but one of the great challenges for society which needs to be treated in transdisciplinary work with partners from science, industry and society.

In addition to the digital transformation another important trend is influencing the way we live and the competences we need. This is the transition towards the *projectification of society* [2]. It resolves the traditional structures and hierarchies in any kind of socio-economic system into a much more agile and adaptive portfolio of projects. People come together to address a specific topic within a team and they resolve the team after finishing the task. Many of these teams stress the 3 "i": interdisciplinary, international, intercultural. And many of these projects (which are not even necessarily perceived as projects) use digital means for organizing their work and for the dissemination and exploitation of the results. "Virtual" setups are becoming a common environment for humans (and things) to interact with each other. Meaning, projects and digital transformation have to be thought together as two sides of the same medal.

Finally, the complexity and nature of the digital transformation and its broad impact on Europe (and the world) hint in a very-straight-forward way to a pan-European cooperation on the topic. The fact that the European Research Area (ERA) exists and that the Bologna process established a joint framework for Master programmes makes it reasonable to set up "Master programmes for the Digital Change" on a European level.

All three aspects (digitalization, projectification, European cooperation) lead to the concept of a virtual, cross-border "Master School on Managing the Digital Transformation" which is described in chapter 3 of this paper.

In chapter 4, the goals of the Master School and the educational approach are described. This is based on a holistic view on the results on different levels. It can be supported by the so-called results-oriented monitoring (RoM) as a tool for the measurement of effectivity and efficiency.

Chapter 5 outlines the conceptual model of a Master programme for the digital transformation as it is followed by a European consortium. It involves a projectized and digitalized approach for the development and delivery of the curriculum in a virtual, cross-border Master School.

2. Why Master education can contribute on delivering the competences for the digital transformation

Delivering the competences for "Managing the Digital Transformation" in a Master's programme is facing several challenges:

- The competences are interdisciplinary and even transdisciplinary. Therefore they cannot be delivered out of a single scientific domain. HEIs are usually organized (e.g. in faculties) according to scientific domains. Many Bachelor's programmes deliver a basic academic education in one scientific domain. Therefore, delivering a Master's programme for "Managing the Digital Transformation" is not straightforward for a HEI since it involves cross-faculty and transdisciplinary cooperation. Nevertheless, setting up Master's programmes with a specific application or job-related focus is a common thing for HEI. Since students have already a foundation in a scientific domain due to their previous Bachelor's degree, it is possible to expand into a cross-disciplinary area instead of diving deeper into the previously studied scientific domain. This makes Master's programmes more suitable for delivering the competence set for the digital transformation than Bachelor's programmes (which nevertheless have to set the foundations).

- Academic education at HEIs is facing the stretch between two (sometimes contradicting) goals: to deliver a scientific education and to deliver professional competences. It is the competition between doing something and reasoning about doing something. This is true for the digital transformation, too. It needs practical skills and scientific reflection and analysis. Master's programmes can be designed with the aim to educate scientists or with the aim to educate professional practitioners. Normally, it is a mix between both. Since there is no single scientific domain for the digital transformation but a lot of practical needs and problems, a Master's programme has to be very much job-related and application-oriented. Nevertheless, the special value of an academic education is the ability to apply scientific methods and to do own scientific analysis and research. This ambition can be fulfilled best in a Master's programme. Bachelor's programmes focus on the delivery of domain-specific foundations and do not offer the space and the time for an educated discussion of the ambiguity between scientific and professional domains. The PhD phase of the Bologna cycle is for sure devoted to the scientific work. Therefore, the Master's level offers a good chance to combine scientific and professional ambition in one programme.
- A Master's programme on "Managing the Digital Transformation" has to be conducted in a digitalized and projectized way on all levels (content, delivery, didactics, see Chapter 3). This involves mainly own work of the students (learning instead of being taught) in projects and teams. The didactic model and the delivery have to support the projectification and digitalization of the programme. Students on Master's level are well-prepared to this working style.
- Transdisciplinary work requires involvement of industry and society. A Master's programme with its projectized and "free" structure offers many options to form interdisciplinary teams and let them work on real world cases. Students can even work in companies or projects outside the university and take their experiences as basis for the scientific analysis and reflection. Lecturers from industry (with a possibly less elaborated competence in didactics and science but a much more relevant practical experience) can be involved much easier since students are better prepared for teaching formats which deviate from the "school feeling". Therefore, learning situations can be created which are much closer to professional setting or real world scenarios.
- Master students have the possibility to move on into a PhD as the next step. There is an overlapping area between the scientific work of a PhD students and the work of a Master's student. Therefore, it is possible to create a space within a Master's programme which is connected to the scientific research of a PhD group on digital transformation. The Master's programme can feed the PhD programme with candidates. In addition, Master students can be involved in the research work in various ways (homework, seminars, theses). In combination with the group of professors/lecturers this leads to the development of a scientific community on digital transformation.
- Master programmes offer the chance to create learning settings which are inherently interdisciplinary, international and intercultural. This involves international classrooms, summer schools, projects and students and lecturer exchange.
- Apart from connecting to science/PhD education, Master programmes can connect to professional education and postgraduate programmes, too. This allows the combination with elements from job-related trainings and company internships – reaching up to programmes which a integrating the job into the didactic model and curriculum.

Master programmes are an educational format which is a perfect core for a new field like "Managing the Digital Transformation" since they form a link between the scientific domain (which needs to be developed) and the professional domain, a field for interdisciplinary and transdisciplinary work, a link between different scientific domains (which need to be combined to form a new scientific domain) and a good environment to apply digital and projectized means of competence development and delivery. Other educational formats (e.g. Bachelor

programmes, professional education, PhD programmes) and research can be built around the Master's programmes and benefit from it. This forms a holistic and comprehensive setup.

The curriculum elements need to fulfil the requirements of the EQF level 7 which defines the second cycle of the Bologna process (Framework for Qualifications of the European Higher Education Area [1]):

- It defines that "highly specialised *knowledge*, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research" has to be delivered. The requirement leads to the need of own research on digital transformation and a good access to the relevant scientific community. Different from professional education, the Master level education has to connect the knowledge areas to the ongoing research in the respective field. The insight into the discussions and trends within the scientific community fosters the "critical awareness of knowledge issues in a field and at the interface between different fields". Consequently, the Master's education has to go beyond mature and readily prepared knowledge. It has to provide a regular flow of new trends in research and science.
- Furthermore, EQF requires the delivery of "specialised problem-solving *skills* required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields". This involves own interdisciplinary research and a contribution to the scientific body of knowledge latest within the Master thesis. Scientific skills have to be developed.
- EQF level 7 requires the competence, *ability and attitude* to "manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams". These competences are not delivered by teaching theoretical knowledge but by practical work and scientific reflection.

3. Development of a Master School on Managing the Digital Transformation

The Master School on Managing the Digital Transformation is developed by the EuroPIM (European Partnership for Project and Innovation Management) consortium. The consortium is formed by the:

- Dortmund University of Applied Sciences and Arts (Fachhochschule Dortmund), Germany: international full-time Master programmes on project management (EuroMPM [3]), digital transformation and embedded systems
- University of the Basque Country (UPV), Bilbao, Spain: international part-time Master programme on project management (EuroMPM) for professionals, and full-time programme embedded systems for graduates
- NTNU Trondheim, Norway: international full-time Master programmes on project management (EuroMPM) and information systems
- KTU Kaunas, Lithuania, full-time and part-time Master programmes on project management and computer science
- KU Leuven, Belgium: postgraduates programme on innovation and entrepreneurship, full-time Master in Industrial Sciences
- TNEU Ternopil, Ukraine (associated partner): full-time and part-time Master programmes on project management and computer science
- KNUCA Kiev, Ukraine (associated partner): full-time and part-time Master programmes on project management and computer science
- ZNTU Zaporoshje, Ukraine (associated partner): full-time and part-time Master programmes on project management and computer science

The consortium's HEI operate more than 15 Master's programmes in the relevant field. They have experience in joint curricula development, double degree, lecturer and student exchange and didactic formats for cross-border, interdisciplinary cooperation. The consortium believes that setting up a portfolio of new interdisciplinary modules on the combination of digitalization and project management and by applying them in a high number of educational programmes will lead to a major shift in competences for the projectized and digitalized world and in the establishment of a pan-European de-facto standard and community of practice.

The combination of the 15 Master's programmes, the exchange and intensive interaction, the mixing of students groups, the development of a joint body of knowledge and the formation of a competence group of scientists and lecturers are building the foundation of a virtual, cross-border Master School. The concept of a Master School on a specific (interdisciplinary) topic as the core of a professional and scientific community is not as common as the more scientific graduate schools. But it is becoming more frequently used, especially in the context of industry-university cooperation, e.g. the EU Knowledge and Innovation Communities (KIC) [4].

For the EuroPIM consortium, the conceptual framework for the implementation of the digitalized and projectized Master School on "Managing the Digital Transformation" is the 3-layer approach:

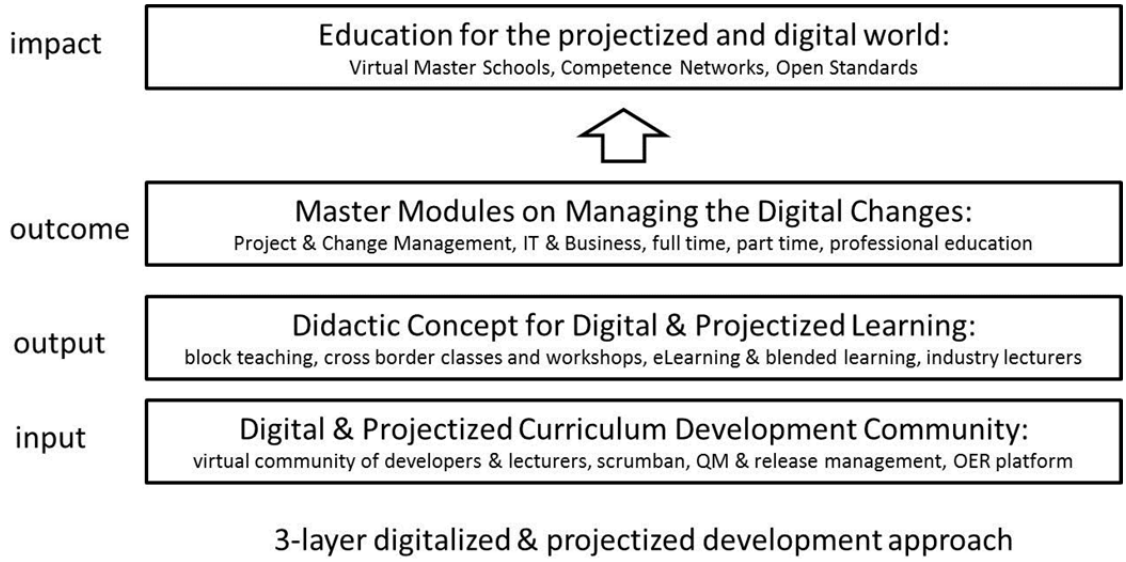


Fig. 1: Conceptual Framework for the virtual, cross-border Master School

The concept was developed during the writing of the funding application for an Erasmus+ KA2 CBHE project called "Managing the Digital Changes: Integrated Master Curricula for Ukraine & Kazakhstan / MANDICS". The framework is based on a 3-layer model:

1. On the first layer – the content layer - the content of the Master modules (as the main outcome) is designed towards "Managing the Digital Changes". The competences delivered by the modules are combining project and change management with methods from IT and business. The modules are designed for full time graduate students, part time students and as certificate courses for professionals and executives. The different target groups have a high demand of competencies for the digitalized and projectized world. By today, they partly seek for this in the United States (e.g. Silicon Valley). The aim is to cover this demand in Europe.

2. On the second layer – the "teaching" layer - the didactic concept is using digital technologies (e.g. eLearning, collaboration tools) and projectized methods (e.g. block workshops, summer school with industry) for teaching.
3. The third layer – the Master School operation layer - is addressing the use of digital and projectized means for the establishment of a community of practice for curriculum development. This means that the partners are organizing their own work according to what they teach.

The concept goes beyond traditional joint degree or double degree programmes. Every partner conducts a complete programme. Curricula are partly aligned, but different specialisations offered by the different partners are encouraged. Furthermore, full-time, part-time and postgraduate education programmes can be combined. Typical cross-border Master programmes offer only one semester at each partner university – students change the university for each semester [5]. This offers fewer opportunities for interaction, less community building between lecturers and scientists and less possibilities for interdisciplinary cooperation. The Master School of the EuroPIM consortium connects different Master programmes with a sophisticated exchange, elective and specialisation concept. The intensive interaction is supported by various event formats like master student conferences, block lectures, cross-border projects, summer and winter schools.

4. How to measure efficiency and effectivity

The EuroPIM concept for the Master School on Managing the Digital Transformation is an ambitious endeavour. The approach needs to demonstrate its effectivity. Does it deliver the competences for the digital transformation? Does it form the community of experts? And it needs to show the efficiency, too. Are there better means to achieve the same outcome? How many graduates are delivered? How well are they prepared?

The consortium intends to apply the results-oriented monitoring (RoM) approach for this purpose. The approach evaluates a project (since the EuroPIM consortium considers the Master School to be a virtual, cross-border project) based on the *inputs*, the *outputs*, the *outcome* and the *impact* (so-called IOOI method) [6].

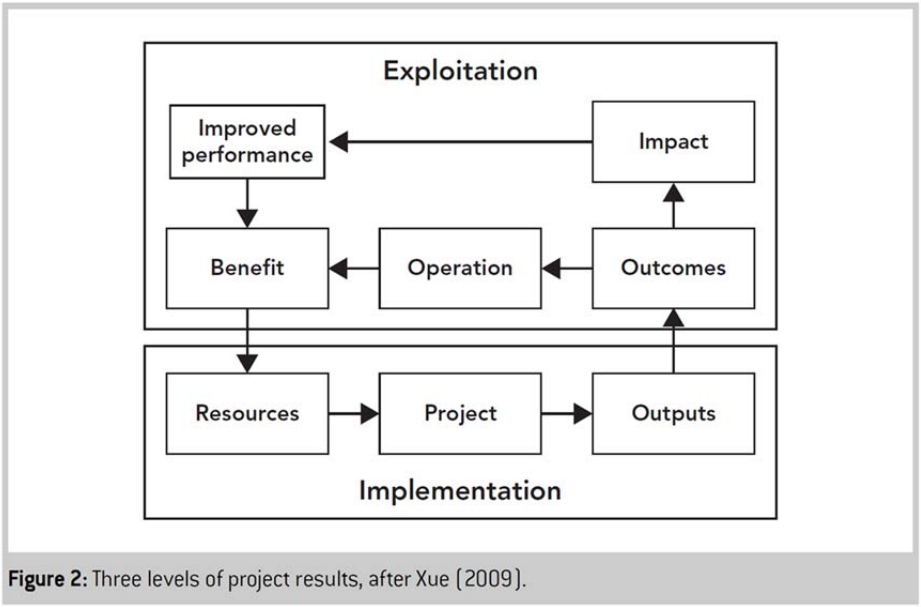


Figure 2: Three levels of project results, after Xue [2009].

Fig. 2: Project evaluation based on inputs, outputs, outcomes and impact (according to [7])

The method is structuring the project into different areas where the results are emerging. Turner and Zolin have used this approach (after Xue (2009) to develop a three-level model of project results [7]. Projects are evaluated based on an inside view into the project where the inputs (resources) are directly transformed into outputs, and into a view on the project environment where the project results are exploited on different levels – the so-called outcomes and the impact. Adapted to the virtual, cross-border Master School this leads to a concept for the evaluation of the 3-layer digitalized and projectized approach (see Fig. 1):

- *Inputs:* this is the foundation of the Master School formed by the virtual expert community of the lecturers and scientists and the projectized and digital tools and means for the organization of their work.
- *Outputs:* the community uses the inputs to create outputs in the form of a curriculum and content for the digital transformation, didactic concepts for the delivery of the competences, and a body of knowledge containing content, but also standards and joint concepts.
- *Outcome:* with the outputs, the Master School is able to deliver competences by conducting modules of the Master's programmes in different formats and with different target groups (e.g. full-time and part-time graduate students, professionals). This is a continuous effort which delivers on an operational level the intended competences to the students. The delivery forms the outcomes of the Master School.
- *Impact:* the impact on the environment is an improved performance in several fields. The Master School in itself is delivered which is an improvement compared to single programmes. The competent community of experts is delivered and (de-facto) standards are developed. And finally, competent graduates are delivered which can help the industry and society to manage the digital transformation. With this, the consortium and the Master School support the digital transformation.

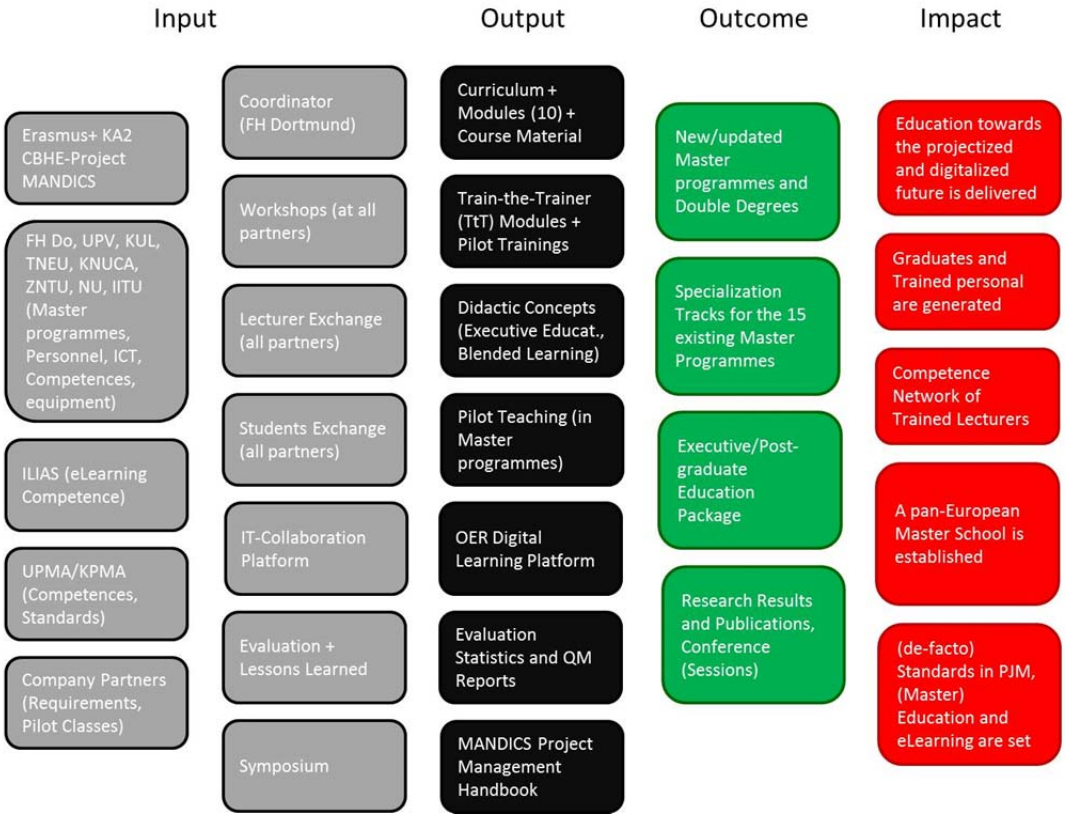


Fig. 3: IOOI-Framework for the results-oriented monitoring of the Master School

5. Curriculum for the Digital Transformation

The Master programmes within the virtual, cross-border Master School are based on an aligned curriculum and delivery model. The basis is a 3 or 4-semester programme with two semesters covering the foundation with mandatory modules, a third semester (in some programmes) with electives and own research projects, and a last (third or fourth) semester with the Master thesis.

Semester	Module Name	Hours	ECTS
1	Innovation Driven Software Engineering	4	6
	Software Architecture	4	6
	Digital Systems 1	4	6
	R&D Project Management	4	6
	Scientific & Transversal Skills 1	4	6
2	Usability Engineering	4	6
	Software-intensive Solutions	4	6
	Digital Systems 2	4	6
	Scientific & Transversal Skills 2	4	6
	Elective 1	4	6
3	Elective 2	4	6
	Elective 3	4	6
	Research Project (thesis)		18
4	Master Thesis		30

Fig. 4: Typical layout of the curriculum and semester concept

The consortium agreed on developing a joint catalogue of modules which can be used as electives or mandatory modules in different programmes. The idea is that each partner develops one or two modules and that a community of lecturers is formed for each of these modules. The lecturers travel to the different partner universities and deliver the modules. This is done in block lectures (e.g. one week) and supported by online tools. The course materials for each module are provided as open educational resources. The planned initial set of modules is:

- Projectized Organizations in the Digital Era
- Agile Management in Virtual Project Environments
- Digital Entrepreneurs
- Fact Based Management – Information Processing and Data Analytics
- Managing the Information Supply Chain
- Intercultural Communication, Negotiation and Conflict Management
- Creative Techniques of Project Management
- Developing Digital Business Ecosystems
- Human Centered Digitalization
- Managing Digital Change

For the MANDICS funding application, the partners proposed a module development process as the core process of the curriculum development community. This process assumes that each module is updated and improved on a regular basis. This leads to an iterative approach for the curriculum development and allows the application of an agile project management process for

the consortium. Modules are "owned" by the respective university as a module owner. The module owner is responsible for the design, development and delivery of the respective module. For the delivery, the module owner forms a lecturer group which is trained on the delivery of the module (e.g. for distance learning or presence teaching). The delivery is evaluated. Based on the evaluation, improvements or updates (e.g. due to new content) are implemented. The consortium has an evaluation committee which is responsible for the quality management. Modules are released based on a stage-gate-process.

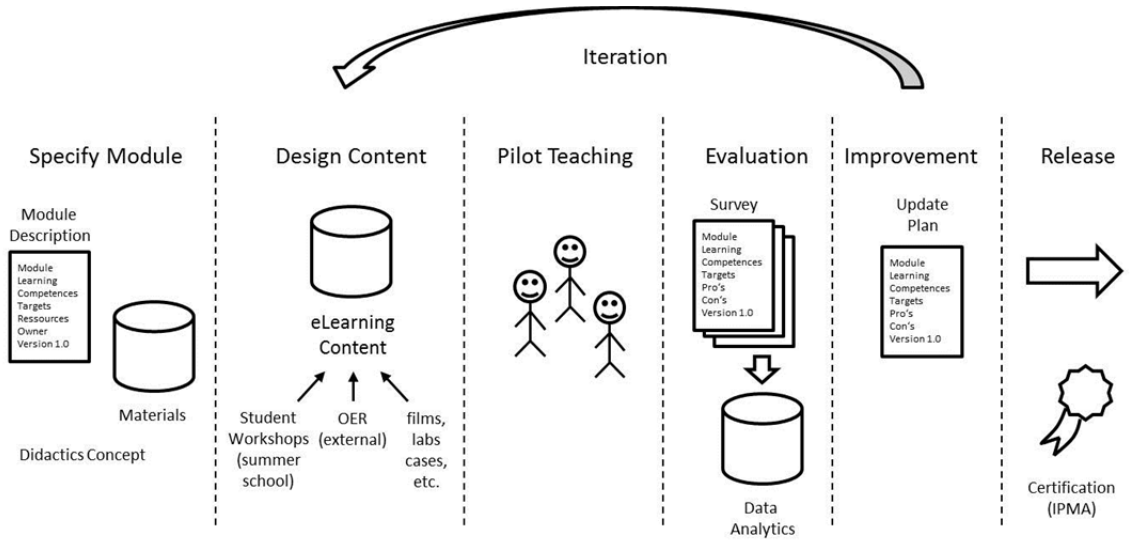


Fig. 5: Curriculum and module development process

6. Conclusion and further research

The virtual, cross-border Master School for "Managing the Digital Transformation" is a joint undertaking of the EuroPIM consortium and its partners. For the Dortmund University of Applied Sciences and Arts (FH Dortmund) it is part of a broader concept on education and applied sciences which is based on an industry-university cluster and several educational initiatives [8]. The consortium is partly funded by the German Federal Ministry of Education and Research (BMBF) within the DAAD Strategic Partnership "European Partnership for Project and Innovation Management (EuroPIM)", (grant agreement number: Projekt-ID 57172312).

For future research it is planned to conduct a continuous evaluation based on the IOOI methodology for results-oriented monitoring. For this purpose, a set of indicators is under development and currently tested in evaluations. Furthermore, the development of modules and curricula and the alignment of the programmes are executed. This led to a number of double degree agreements which are continuously extended. Furthermore, the digital tool platforms and the internal processes of the consortium are continuously improved.

The expectation of the consortium is to form a lively and active community with a major impact on the management of the digital transformation and on the development of the HEIs towards important contributors for the digital change.

7. References

[1] European Qualification Framework (EQF): https://ec.europa.eu/ploteus/content/descriptors-page, last accessed Mar 2017

[2] Söderlund, J. (2008). Competence dynamics and learning processes in project-based firms: shifting, adapting and leveraging. International Journal of Innovation Management, 12(1), pp. 41-67.

[3] EuroMPM: www.eurompm.net, last accessed Mar 2017

[4] KIC InnoEnergy Master School: Available: http://www.kic-innoenergy.com/education/master-school/, last accessed Mar 2017

[5] Calabrese, A. (2013): Master in Strategic Project Management (European), a Worldwide Experience, 26th IPMA World Congress, Crete, Greece, 2012, Procedia - Social and Behavioral Sciences 74, pp. 488 – 497, Elsevier

[6] Bertelsmann Stiftung (2010): Corporate Citizenship planen und messen mit der iooi-Methode, Bertelsmann Stiftung

[7] Turner, R.; Zolin, R. (2012): Forecasting Success on Large Projects: Developing Reliable Scales to Predict Multiple Perspectives by Multiple Stakeholders Over Multiple Time Frames. Project Management Journal

[8] Wolff, C.: RuhrValley and Ruhr Master School (2016): Two Pillars of a New Cooperative University of Applied Sciences in Engineering, International Symposium on Embedded Systems and Trends in Teaching Engineering, Nitra

Increasing probability of successful projects complete

Teslenko Pavlo, Antoshchuk Svitlana, Krylov Victor

p_a_t@ukr.net, asgonpu@gmail.com, victor_krylov@inbox.ru
Odesa National Polytechnic University
1, Shevchenko avenue, Odessa, Ukraine

Abstract: *The project is considered as an open nonlinear system. The increase in the probability of a successful completion of the project is proposed to be carried out in three stages. In the early stages of the life cycle of the project and the stage of strategic planning, it was suggested to use an attractive-evolutionary approach. At the implementation stage, it is suggested to use the project management approach as a sailing vessel.*

Keywords: Probability of successful project certification, an attractive-evolutionary approach, project management as a sailboat.

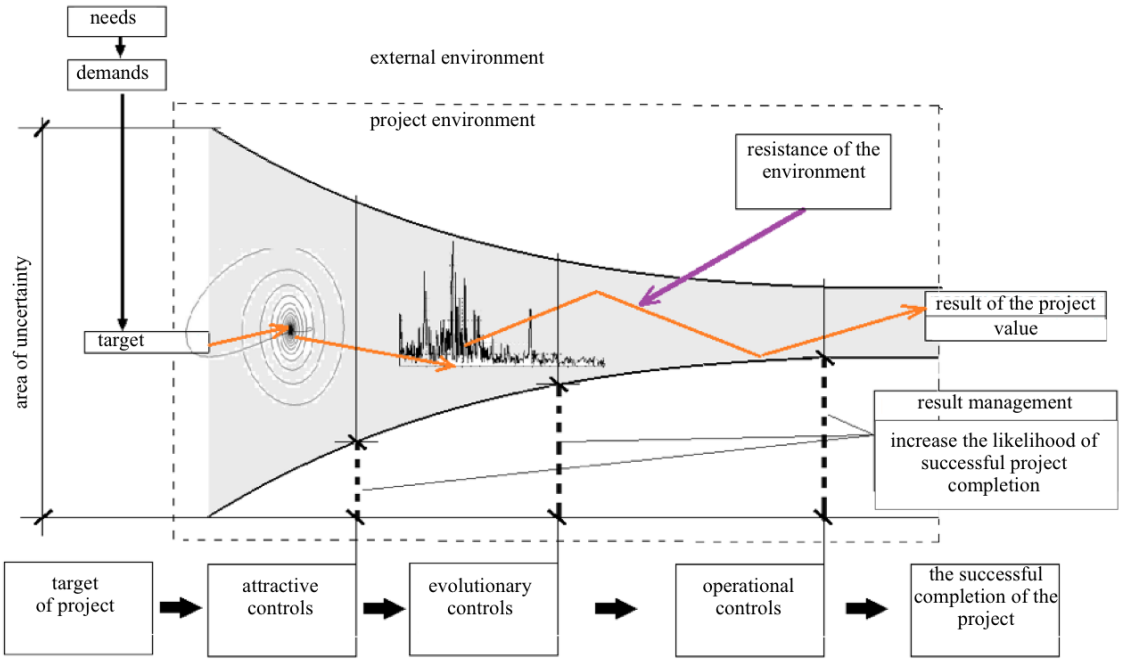
1. Introduction

The modern projects are planned, executed and completed in the face of risks, changes, deviations and uncertainties. But world statistics indicate that almost 70% of the projects started are not successful. This means that the probability of successful completion of projects started is small. Thus, increasing the likelihood of successful completion of initiated projects is an important scientific and technical problem.

2. Principles of successful completion of projects

One of the reasons for the low probability of successful completion of projects is precisely the imperfection of existing project management methodologies. Thus, in the most common standards and methodologies: integrated management of project deviations, project-vector management of educational environments, security of project management for the development of complex systems, the project is viewed as a closed linear system, where models, methods and tools for increasing the reliability of successful completion of a project in conditions Risks, changes, deviations and uncertainties - are absent.
The analysis showed that the project management system (PMS) exchange information, resources and energy with the environment, are dissipative systems, processes which are irreversible. This means that PMS has all the properties of open and non-linear systems.
This leads to a contradiction between the essence of the Project Management System and the main model, which is provided by the existing project management methodologies. That is, the reason for the low probability of successful completion of projects is precisely the imperfection of existing project management methodologies. To solve it, the following principles is proposed:
- consider the project as an open nonlinear system;
- reliably estimate the probability of successful completion of projects in the phase space through the identification and evaluation of attractors of success, including in the early stages of the life cycle of the project;
- To choose methods of strategic management on the basis of the evolutionary approach that allow to reach the area of global optimum of the multimodal target function of the successful completion of the project by the criterion of achievement;
- to change the methods of operational control in accordance with random disturbances and unforeseen changes in the external environment when planning the project.

Based on the proposed approach, a conceptual model of evolutionary-attractive project management (pic. 1)



Picture 1 - Conceptual model of evolutionary-attractive project management

It is shown that the project as an open non-linear dynamical system is described by a set of parameters and that the probability of successful completion of the initiated project is determined by the multimodal target function of the successful completion of the project.
Analyzing these dependencies, we can say that the successful completion of the project will depend on the availability for the project: financing, resources, information and a qualified project team. On the basis of this and the model of excellence of the projects of IPMA Project Excellence Model, the general view of the objective function takes the form:

$$Psc = P_{pp \rightarrow opt} = f(F, R, I, C) \quad (1)$$

where F - availability of project financing; R - availability of project resources; I - availability of information on the project; C - availability of a qualified project team.

3. Three stage approach to increase the probability of successful completion of projects

Project management as a complex dynamic system occurs in the conditions of uncertainty of its turbulent environment.
Relying on the fact that the models of exchange processes that are intended for socio-economic systems have in their phase portrait an attractor, two competing hypotheses have been put forward that the presence of attractors in the phase space of the project indicates the probability of its successful completion, and vice versa - the absence of attractors Testifies to the failure of this project.
Having executed the modeling for a significant sample of projects, it was determined that under different conditions an attractor is formed or not formed. After examining the results of the simulation, a method was developed to test the hypotheses of the successful completion of the project at the early (and any other) stages of its life cycle.

Increased likelihood of successful completion of projects was due to the selection of pre-successful projects, in which the attractor was present in the phase space. According to the results of the study, the hypothesis was confirmed that the sign of successful completion of projects is the presence of an attractor in its phase space.
The objective function (1) of such a system is multimodal and noisy. Therefore, in this case, for the optimal project management, an evolutionary approach was chosen whose properties are noise immunity and a higher probability of achieving a global extremum of the objective function.
The evolutionary modeling method makes it possible to increase the likelihood of achieving a global extremum of the objective function for the successful completion of the project (1).
The choice of one of the alternative options is based on the criterion of maximum proximity to the achievement of the global extremum, and hence with the largest in the specified conditions, the probability of a successful completion of the project. The developed method of strategic project management whose distinctive feature is the application to the management of the evolutionary approach has made it possible to increase the likelihood of achieving a global extremum of the objective function, therefore, the probability of a successful completion of the project.
But, as it was shown earlier, the project is an open non-linear dynamic system that throughout its life cycle functions in a turbulent environment and receives constant perturbations of the external environment, therefore, in order to increase the likelihood of rapid completion of the necessary models and methods of operational control. Accounting for the resistance of the external environment and random disturbances in the development and implementation of the project was carried out in the form of a sailboat model, which was proposed to be applied to the operational management of the project near the global extremum.

4. Results and Conclusion

Increasing the likelihood of successful completion of projects is an important scientific and practical task. Its solution will provide the project managers and customers with a significant competitive advantage. The paper suggests using an attractive-evolutionary approach to increase the likelihood of successful completion of projects at the planning stage. During the implementation phase, it was proposed to use, as an operational management, an approach based on project management based on the analogy of the management of a sailboat.

5. References

[1] P. Teslenko, A. Voznyi, V. Baryshnicova, T. Fesenko. Two-level project management system. Nowoczesna edukacja: filozofia, innowacja, doświadczenie – Łódź : Wydawnictwo Naukowe Wyższej Szkoły Informatyki i Umiejętności,. Nr 1(5). P. 156-162, (2016)

[2] S.Bushuyev, R.Wagner: IPMA Delta and IPMA Organisational Competence Baseline (OCB) New approaches in the field of project management maturity. International Journal of Managing Projects in Business. Emerald Group Publishing Limited, Volume 2, Issue 7, P. 302-310, (2014)

[3] M. Todorović, D.Petrović, M. Mihić, V. Obradović, S.Bushuyev: Project success analysis framework: A knowledge-based approach in project management. International Journal of Project Management, Pergamon, Volume 33, Issue 4, P. 772–783, (2015)

[4] P. Teslenko, I. Polshakov, D. Bedrii. Strategic management of evolving project-oriented organization. Science and Education a New Dimension, Economics, Volume IV (2), Issue: 94, Budapest, P. 33-35, (2016)

The project-level and firm-level alignment in electrical utilities. A multiple case study

Maria Eugenia Aguilar-Fernandez, Leticia Fuentes-Ardeo, Jose Ramon Otegi-Olaso,

Maguilar003@ikasle.ehu.eus, mariuge.aguilar@gmail.com

PhD candidate

University of the Basque Country (UPV/EHU)

Alameda Urquijo, S/N, 48013, Bilbao

Abstract: *This paper presents a multiple case study of two electrical utilities and their projects. A framework has been created to assess the firm-level and the project-level characteristics of the utilities. The assessment provides insights about how aligned are the firms and their projects regarding to the three dimensions of sustainability: economic, social and environmental.*

The theoretical foundations of the framework are based in two research streams: sustainable project management and sustainable business model. The first one studies the integration of the socio-environmental aspects in the project processes, the second one studies the integration of socio-environmental aspects in the value proposition. Thus, the framework assess how the integration of sustainability in projects add value to the business model of the company.

The research case study is based in Yin and the secondary data is gathered from public information's as well as academic papers.

The papers also proposes a visual canvas than can be used to analyze projects in electrical utilities. The canvas can be used for practitioners to design the completeness of the business model in terms of sustainability as well as to take go/no go decisions in project investment decisions.

Keywords: electrical utilities, sustainability in project management, sustainable business model.

[1]-[14]

References

[1] K. Artto et al. Impact of services on project business. Int. J. Project Manage. 26(5), pp. 497-508. 2008.

[2] N. M. P. Bocken et al. A literature and practice review to develop sustainable business model archetypes. J. Clean. Prod. 65pp. 42-56. 2014. . DOI: 10.1016/j.jclepro.2013.11.039.

[3] F. Boons and F. Lüdeke-Freund. Business models for sustainable innovation: State-of-the-art and steps towards a research agenda. J. Clean. Prod. 45pp. 9-19. 2013.

[4] S. Schaltegger, F. Lüdeke-Freund and E. G. Hansen. Business cases for sustainability: The role of business model innovation for corporate sustainability. Int. J. Innov. Sustainable Develop. 6(2), pp. 95-119. 2012. . DOI: 10.1504/IJISD.2012.046944.

[5] N. M. P. Bocken, I. Weissbrod and M. Tennant. Business model experimentation for sustainability. Smart Innov. Syst. Technol. 52pp. 297-306. 2016. . DOI: 10.1007/978-3-319-32098-4_26.

[6] V. Roy and S. Singh. Mapping the business focus in sustainable production and consumption literature: Review and research framework. J. Clean. Prod. 150pp. 224-236. 2017. . DOI: http://dx.doi.org/10.1016/j.jclepro.2017.03.040.

[7] W. Stubbs. Characterising B corps as a sustainable business model: An exploratory study of B corps in australia. J. Clean. Prod. 144pp. 299-312. 2017. . DOI: http://dx.doi.org/10.1016/j.jclepro.2016.12.093.

[8] R. Rauter, J. Jonker and R. J. Baumgartner. Going one's own way: Drivers in developing business models for sustainability. J. Clean. Prod. 140pp. 144-154. 2017.

[9] P. -. Huang and L. -. Shih. Effective environmental management through environmental knowledge management. Int. J. Environ. Sci. Technol. 6(1), pp. 35-50. 2009.

[10] G. Silvius and R. Schipper. A maturity model for integrating sustainability in projects and project management. Presented at 24th World Congress of the International Project Management Association. 2010, .

[11] E. Rosca, M. Arnold and J. C. Bendul. Business models for sustainable innovation – an empirical analysis of frugal products and services. J. Clean. Prod. . DOI: http://dx.doi.org/10.1016/j.jclepro.2016.02.050.

[12] J. R. Otegi Olaso et al, "Review of research into sustainability and project management ," in International Research Conference of Project Management, Dortmund, .

[13] M. L. Martens and M. M. Carvalho. Key factors of sustainability in project management context: A survey exploring the project managers' perspective. Int. J. Project Manage. 2016.

[14] E. R. G. Pedersen, W. Gwozdz and K. K. Hvass. Exploring the relationship between business model innovation, corporate sustainability, and organisational values within the fashion industry. J. Bus. Ethics pp. 1-18. 2016. . DOI: 10.1007/s10551-016-3044-7.

Service-oriented collaborative business models enabling elderly people to stay longer in their homes

Jelena Bleja, Uwe Großmann, Igor Khess
jelena.bleja@fh-dortmund.de, uwe.grossmann@fh-dortmund.de,
University of Applied Sciences and Arts Dortmund
Department of Economics
Emil-Figge-Straße 44, 44139 Dortmund, Germany

Abstract: *First results of the project Smart Service Power with the aim to allow a longer self-determined life for older or nursing-destitute people in their own home are presented. New business model structures and potential cost savings for external partners of the health area are discussed. The project pursues a holistic strategy to establish a platform in the households of the target groups and an according viable business model.*

Keywords: Ambient Assisted Living; AAL[1]-services; collaborative business model; e-health; Business Model Canvas; cost savings

1. Introduction

Demographic change is a major challenge for our society: an increasing share of the population needs long time care and care achievements. This leads on the one hand to financial restrictions and on the other hand to supply-side obstacles: The nursing and social consequential costs are increasing and there is a lack of full-fledged nursing staff. Technical, age-appropriate solutions are becoming more and more important in this context. They have the potential to ensure the quality of care in Germany and to reduce costs. Besides, they offer the possibility to relieve nursing staff, so that they can increasingly focus on the interpersonal, social component of care. The self-determination right of elderly and nursing-destitute people should be protected in every life phase [1].
For tackling these complex of problems several projects in the area of ambient assisted living had been set up in the last ten years. Within the project "SmartAssist" a platform was developed to support social and health aspects in the design of an age-appropriate autonomous life [2]. The project "SmartSenior" pursued the aim to create a future-oriented platform with infrastructure solutions including a huge number of coordinated uses and services. [2]. Actually IBM Research is developing cognitive technologies to support elderly people at home, through understanding daily activities inferred from passive sensor analysis [3].
Despite the high potential assessment of AAL systems and the increased development of AAL solutions in recent years getting the developed solutions market-ready and establishing them permanently in the market is still the challenge. The reasons given for this are, for example, the health care system with its specific requirements especially in the area of data protection and data security and the fears, difficulties and the lack of acceptance of elderly people to use technical innovations [4]. However, the core problem is the lack of adequate and profitable cooperative business models for the introduction of age-appropriate systems.
This paper presents the first results of the Project Smart Service Power, which is designed to provide intelligent data aggregation and use for innovative functions for age-related technology-based housing in the quarters as well as enabling a longer stay for elderly or nursing-destitute people in their own home. The project "Smart Service Power is funded by the North Rhine-Westphalian State Government (Germany) and the EU (EFRE).

[1] Ambient Assisted Living (AAL).

2. Business models

For analyzing business models, we have to look on the value added chain. Fig. 1 shows a typical value chain for the AAL sector. The value chain consists of several actors cooperating cooperatively for the provision of the service to the end user. Important actors in the AAL area are the housing company or the owner of the apartment, health insurance, technical service provider, portal provider, data broker, data analyst and the medical service provider. Depending on the product or service offered, it may happen that some of the above actors are not involved or other actors are added to the value chain [5].

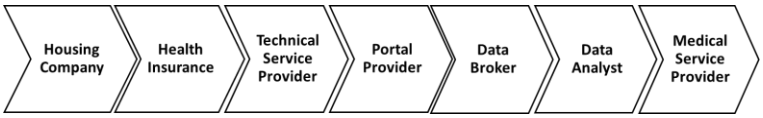


Figure 1: Typical value chain of AAL sector (according to [5])

The value chain delivers the key partners involved in the business model. There are a number of reference models describing the remaining key structures. The Business Model Canvas from Osterwalder and Pigneur is a widely used method for describing business models [6]. The model has the nine key components: key partners, key activities, key resources, customer segments, value promises, channels, customer relationships, cost-structure and revenue stream. The key partners are the partners who are part of the value chain and thus providing the services to the end user. Key activities are necessary to offer the service or the product. The key resources contain all the important resources that are necessary to carry out the activities. For each customer segment, that is every person or organization for who values could be achieved, there is a separate value proposition and thus a combination of product and service tailored to the needs of the respective segment. The key component "channels" comprises all channels for communication with the customer and for transmitting the promised values. The customer relationship component describes the form of dealing with the customer. For example, whether the contact with the customer should be very personal or an automated service is offered. In the "Cost structure" component all variable and fixed costs have to be listed. The description of the revenue stream is intended to provide an overview of revenue opportunities and price strategies. The revenue stream is usually subdivided into direct and indirect revenues.

3. Business Models for the AAL-Area

The sustainable establishment of AAL products and services in the market requires the development of suitable, sustainable, profitable and fair collaborative business models. The development of such collaborative business models, which are characterized by the fact that several partners cooperate trustfully, although they may also be competitors, is very important in the project. In Fig. 3, the individual key actors are illustrated with their activities and services related to the Smart Service Power project.

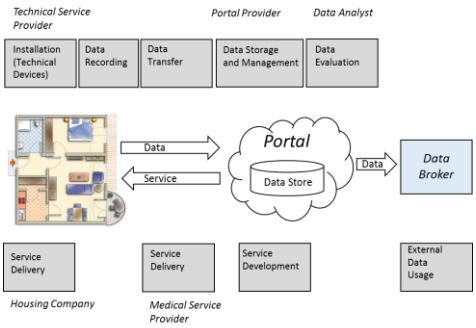


Figure 3: AAL-scenario of partners, activities and services used within project Smart Service Power (according to [5])

In the normal case, there is a so-called typical process, which is similar for all services to be developed. Each individual partner or key partner is responsible for carrying out certain tasks. The place of the achievement will be probably the flat of the patient or the nursing-destitute person. The housing company is responsible for providing the apartment or the house. After the technical service provider has completed the technical installation and equipment of the house, the data will be recorded, transferred to the portal, stored and managed by the portal/cloud provider. Data are transmitted to the data analyst and potentially anonymously (and aggregated) to a data broker. Data are evaluated according to the booked service option by algorithms, which are able to detect specific situations and initiate an emergency chain in case of a related event being detected [5].
The Project Smart Service Power has the fundamental advantage that heterogeneous partners work together interdisciplinary from the outset along the value-added chain in order to reduce costs, optimize processes and open up new markets. The project identifies eight typical situations in which services can be offered. They can be divided into the four categories: safety, food/drink, cognition and comfort. In the category "Safety", are the use cases "danger of falling" and "changes in vital signs". Changes in vital signs means that a regular measurement and checking of certain vital data (e.g. pulse, weight) is necessary. In the category food/drink, the use cases "forget eating and drinking", so there is a risk of dehydration and quantitative malnutrition and "irregular medication". The typical situations "no contact to a doctor" and "relatives are worried", are treated in the category cognition, while "wrong nutrition" and "door can not be opened" are in the category comfort.
The Business Model Canvas is intended to be used as an economical business model structure for single enterprises. As part of our project, a higher-level view is considered and therefore a business model is required for a collaboration of several enterprises. Therefore, the business model canvas is not adequate to describe the economic scenario of the project Smart Service Power. There is a need for several aspects of an extension of the business model. In the project, there are external partners (e.g. insurance companies) who are not key partners in the sense of Osterwalder and Pigneur. Nevertheless, they play an important role in the business model. A holistic view of the complex service system and the partners involved is required. The business model has to be flexible. Additionally further aspects have to be included in the model, such as data protection aspects and the location of the service.

4. Cost Savings

Typically, business relations are carried out between two persons, for example, the customer who receives a certain service and paid for it and the supplier who provides the corresponding service. In health care, however, the different actors and their relationships to one another are much more complex. The actors in the health care system are the recipient of services, for example the patient, the service provider, for example the medical doctor and the financing sources who financially pays for the services [7]. This triangular relationship leads to a large number of possibilities for relationships, which in turn results in different applications and services. However, the Business Model Canvas do not considers such a consortium of actors as observed in the health care sector. This aspect goes beyond the Business Model Canvas and demand an extension.

The long-term care insurance and the social security office can be indirect partners of the business model, because they generate positive external effects, if the duration of the stationary care can be reduced. Accordingly, the municipalities, insurances and the relatives have a great interest in delaying the entry into the stationary care. As a result, they play an important role in the development of financing options for age-appropriate assistance systems in addition to other actors to be identified. With the help of a developed tool, cost savings can be calculated and assigned to different actors. The savings are calculated for a certain period of time (optionally one month) in which a person in need of care is able to be longer outpatient rather than inpatient. By selecting an appropriate care level and entering additional data, such as the income and assets of

the person in need of care, of his partner and his children, cost savings can be calculated. In addition, the corresponding costs and cost savings are allocated to the individual cost carriers. These calculation tools can contribute to a fair distribution of proceeds and cost savings. They also show the advantages for actors who at first glance are not involved in the project. So they can be motivated to participate financially in the project.

5. Results and Conclusion

The project Smart Service Power was set up to create the basic preconditions for extending the period in which elderly people can stay in their own homes before moving to nursing homes. In addition to an intelligent data aggregation and the development of innovative functions in the age-appropriate technology-based living, suitable, profitable and fair collaborative business models are necessary in order to achieve a sustainable establishment. For this purpose, an extension of the Business Model Canvas has to be developed as well as solutions for the fair distribution of cost savings and revenues. A prepared calculation tool can help to identify indirect partners, to demonstrate their advantages and motivate them to participate and support.

6. References

[1] A. Barth, G. Doblhammer: Physische Mobilität und Gesundheit im Alter – Ansätze zur Reduktion von Pflegebedürftigkeit und Demenz in einer alternden Gesellschaft. In: T. Mayer: Die transformative Macht der Demografie. Springer Fachmedien Wiesbaden (2017), pp. 207-244.

[2] BMBF: Assistenzsysteme im Dienste des älteren Menschen: Porträts der ausgewählten Projekte in der BMBF-Fördermaßnahme „Altersgerechte Assistenzsysteme für ein gesundes und unabhängiges Leben – AAL“ (2012).

[3] IBM: Age-at-home. Online in Internet: URL: http://age-at-home.mybluemix.net/ (Stand: 26.05.2017).

[4] U. Fachinger, S. Helten, S. Nobis, B. Schöpke: Meta-Geschäftsmodelle - eine Möglichkeit zur erfolgreichen Einbindung von assistierenden Techniken in Quartiersnetze. Discussion Paper 23/2016, Institut für Gerontologie – Ökonomie und Demographischer Wandel der Universität Vechta, (2016).

[5] U. Grossmann, B. Horster, I. Khess: Collaborative Business Models for AAL-Services based on M2M-Communication, (2017, in print).

[6] A. Osterwalder, Y. Pigneur: Business model generation: a handbook for visionaries, game changers, and challengers. Amsterdam, Modderman Druckwerk (2010).

[7] T. Lux: E-Health – Begriff und Abgrenzung. In: S. Müller-Mielitz; T. Lux: E-Health-Ökonomie. Springer Fachmedien Wiesbaden (2017), pp. 3-22.

Conceptual and theoretical insights from eco-design practices: The Basque case

Paulina Bienvenida Jones-Mercedes

pbjones001@ikasle.ehu.eus, jonespaulina@hotmail.com
Ministry of High Education Science and Technology of the Dominican Republic
International Scholarship Program Recipient
Universidad del Pais Vasco (UPV/EHU), Departamento de Expresión Gráfica y Proyectos de Ingeniería
Escuela Técnica Superior de Ingeniería de Bilbao
Alameda Urquijo, S/N, 48013, Bilbao, Basque Country, Spain

Keywords: Project management, Eco-design, Pilot projects, Practice, Project research

Abstract:

Globally recognized frameworks (Brundtland, 1987; United Nations, 1972, 1992 and 2015) seek to share guiding actions to cope the increasingly unbalanced metabolism of our socioeconomic systems that has been creating a burden to natural environment at a planetary scale [15] .At a first approach, governments enacted protective environmental legislations to enforce stewardship of sustainable development principles to the industry [17]. In the context of environmental management systems, Eco-design emerged as a proactive management approach that integrates environmental aspects into product design and development and related processes (such as purchasing, marketing and research & development) with the aim of reducing adverse environmental impacts throughout the product's life cycle without compromising other essential criteria (such as performance, functionality, aesthetics, quality and cost) to assure similar or improved services to the end customer [11],[13].

In 1992, the Dutch government started pilot projects to demonstrate the potential of reducing environmental impact through product design. Shortly this initiative broaden into an intervention scheme and between 1995 and 1998 about 100 small to medium-sized enterprises participated in eco-design programs [6]. Concomitant developments in other European and non-European industrialized countries and the increasing attention paid by civil and scientific societies [14] echoed on the released of eco-product policies worldwide. By 2001, The European Commission published the Integrated Product Policy (IPP) which was further translated into product-category directives. In the mean time, in Japan, the concept of the Design for the Environment (DfE) promoted a legislative approach based on the effective utilization of resources (3Rs:Reduce, Reuse, Recycle). While in USA, the Environmental Protection Agency (EPA) bridged a broad spectrum of industries and their supply chain through eco-design and cleaner production initiatives [9].

Therefore, eco-design's terminology roots encompass a variety of terms which is still evolving. Actually, the multiplicity of designations on the literature corpus include terms such as: design for environment (DfE), sustainable product development; sustainable product design; life cycle design, green design, sustainable design, life cycle engineering, design for sustainability (DfS),environmentally conscious design [3],[[4],[13] or product eco-innovations [8].

By 2002, the local government of the Basque Country Autonomous Community (CAPV) via Ihobe (Environmental Management Public agency) released the Basque Environmental Framework Program:-Basque Sustainable Development Environmental Strategy 2002-2020. This community located in the Northeast region of Spain stands out from other communities for its strong industrial background (29% of the Basque GDP is industrial, page [1]) and the greatest concentration of ISO 14001 Spanish registered companies [2].

The program laid down the basic principles, objectives and commitments to promote an integrated product policy that encourage the market to act in the interests of the environment. Ihobe committed with financial aid to support auditing and consultancy costs as well as the development of project management framework, tools and infrastructures. By 2006, a first public-private partnership agreement was reached with 40 companies to facilitate the implementation and application of eco-design criteria in Basque industries through the execution of pilot projects [10]

These experimentation reports revealed that the integration of life-cycle thinking in the product development processes (PDP) takes play on a dynamic and transdisciplinary ground where project management and eco-design approach intertwine. From an institutional logic, projects are policy instruments mainly applied to introduce or test new practices, concepts or technologies [16]. From an instrumental perspective, project management is one of the three areas of decision determinants in product development. The other two areas are product strategy and planning and product development organization [3].

Yet, insights into the knowledge gap between eco-design and project management intersection have been roughly explored and scarcely researched [3], [5] . On the one hand, for the last two decades, eco-design research has been focused on the development of methods and tools to evaluate environmental impacts, revealing potential problems and conflicts and facilitating the choice between different aspects through the comparison of eco-design strategies [3], [13]. On the other hand, over the past 15 years, several authors argued for a reexamination of theoretical foundations, a practical reconsideration of prescriptions and for adopting diverse paradigms or methodologies [7], [12].

Adopting an abductive approach, the purpose of this paper is to analyze the project management framework developed by Ihobe to implement an eco-design methodology in the Basque industry. Floricel toolbox [7] combines Nicolini's five dimensions of practice and three social theories (activity theory, actor–network theory and structuration theory) as an entry point for extending and renewing the theoretical and conceptual bases of project management from eco-design practices.

References

[1] 2010. The Basque Country, eco-innovation pole. Ihobe, S.A. Basque Environmental Public company.

[2] Arana-Landin, G. and Heras-Saizarbitoria, I. (2011). *Paving the way for the ISO 14006 ecodesign standard: an exploratory study in Spanish companies*. Journal of Cleaner Production 19:1007-1015

[3] Brones, F., Carvalho,M.M. &, Zancul, E. (2014). *Ecodesign in project management: a missing link for the integration of sustainability in product development?.* Journal of Cleaner Production 80:106-118

[4] Brones, F.& Carvalho, M.M.(2015). *From 50 to 1: integrating literature toward a systemic ecodesign model*. Journal of Cleaner Production 96 :44-57

[5] Carvalho, M.M. & Rabechini Jr., R. (2017). *Can project sustainability management impact project success? An empirical study applying a contingent approach*. International Journal of Project Management 35: 1120–1132

[6] De Vries, J.L. & te Riele, H.R.M. (2006). *Playing with Hyenas:Renovating Environmental Product Policy Strategy*. Journal of Industrial Ecology 10 (3): 111-127.

[7] Floricel, G., Bonneau, C., Aubry, M. & Sergi, V. (2014). Extending project management research: Insights from social theories. International Journal of Project Management 32,1091–1107

[8] Hojnik, J. & Ruzzier, M. (2016).*What drives eco-innovation? A review of an emerging literature.* Environmental Innovation and Societal Transitions 19:31–41

[9] Ichikawa, Y. and Sasaki, T. (2005). Standardization to realize global eco-design harmonization. In Proceedings - Fourth International Symposium on Environmentally Conscious Design and Inverse Manufacturing 18-21.

[10] Ihobe in association with IK Ingeniería. 2012. 10 years of the basque Ecodesign Classroom 2002 – 2012. Ihobe, Environmental Management Public Corporation Department of the Environment, Regional Planning, Agriculture and Fishing. Government of the Basque Country

[11] ISO 14006:2011.Environmental management systems — Guidelines for incorporating ecodesign.

[12] Padalkar, M & Gopinath S.(2016).S*ix decades of project management research: Thematic trends and future opportunities*. International Journal of Project Management 3:1305–1321.

[13] Pigosso, D. C. A., McAloone, T. C. & Rozenfeld, H. (2015). Characterization of the State-of-the-art and Identification of Main Trends for Ecodesign Tools and Methods: Classifying Three Decades of Research and Implementation. Indian Institute of Science. Journal, 94(4):405-427.

[14] Rousseaux, P., Gremy-Gros, C., Bonnin, M., Henriel-Ricordel, C., Bernard, P. Floury. L., Staigre, G. & Vincent, F. (2017). *"Eco-tool-seeker": A new and unique business guide for choosing ecodesign tools*. Journal of Cleaner Production 151:546-577

[15] Sihvonen, S. & Partanen, J. (2017*). A Eco-design practices with a focus on quantitative environmental targets: An exploratory content analysis within ICT sector*. Journal of Cleaner Production 143:769-783

[16] Vreugdenhil, H., Taljaard, S. & Slinger, J.H.(2012). *Pilot projects and their diffusion: A case study of integrated coastal management in South Africa*. International Journal of Sustainable Development 15(1-2):148-172

[17] Zhang, X. (2014*). Paradigm shift toward sustainable commercial project development in Chin*a. Habitat International 42:186–192

INFLUENCE OF PROJECT RISKS ON PERFORMANCE OF SOFTWARE PROJECTS

Rao Aamir Khan (Assistant Professor)
rao_aamir@comsats.edu.pk
Syeda Komal Anjum (Researcher)
komal_syed@yahoo.com
Comsats Institute of Information Technology (CIIT), Park Road, Tarlai Kalan Islamabad, Pakistan

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Abstract: *This paper sheds light on the identification and classification of critical risks that impact the performance of software projects. To achieve project success, it is crucial for organizations to develop better understanding of risk management specialist for in software development projects. In order to complete this research, we have identified the critical risks from literature that occur in software projects. Then pilot survey has been conducted in order to validate the findings of literature, purpose of industry survey is to classify identified risks based on their occurrence by obtaining opinion of software professionals. After finalizing critical software risks from literature and industry survey, data collection has been done via questionnaires to find out the association between projects risks and project performance. Finally which allow us to develop a model to quantify software related risks "Software Risk Quantifying Model" - (SRQM)". The objective of identifying and categorizing software risks is to help project managers and organizations to quickly classify and quantify the implicit restraints to project success.*

Keywords: Risk Management, Software Project Performance, Software Risks, Risk Quantify, Software Projects, Identification of Risk, Categorizing Risk

1. Introduction

The software industry is the largest engineering industries, which sold $350 billion software's each year. Regardless of the fact that numerous organizations have capitalized money, time and energy to develop and improve their software's, but the failure of projects is still very common. There are number of factors that results in project failure, poor risk control is one of the critical factor leading in project failure. Due to poor success rate in majority of software projects, performance improvement and risk management has always been the focus of Software industry. According to CHAOS report (2015), it shows that only 29% of the projects have been delivered on time, within budget, scope and quality attributes which represents mere 1% increase of from 2014 results (Standish Group – CHAOS report 2015). The overall results do not evident high project performance (i.e. project is ended on time, in financial plan, with satisfying requirements and reliable outcomes). High failure rate of software projects direct to address the necessity of more operative risk management. Failure to identify critical software risk results in; delaying timely completion of project, loss of revenue, additional software development and maintenance costs, possibly of reducing quality and dissatisfied customers.

Most of the writers have shown different researches voids regarding software risks i.e. different studies focused on identifying, classifying and mitigating risk factors (Shan Liu and Lin Wang (2014), Taylor (2012), Suprika Vasudeva & Urvashi Rathod (2017)). The relationship between project performance and software risks shows contradictory results based on studies of different

authors i.e. in 2008 Han & Huang found that user and requirement has direct negative influence on software project performance on the other hand other researchers stated their effect as indirect (Keil 2013, Wallace (2004b)).
Such issues are associated to major hands-on glitches because project risks have adverse effect on performance in a specific project perspective but may be different impact on other context. This discrepancy would inhibit project managers and shareholders from capitalizing redundant budgets and resources. Therefore, in this paper we tried to bridge such gaps observed in previous researches on identification and classification of software risks. This study led to the formation of a framework to identify, classify and quantify critical software risks that impact the performance of software projects. The aim of this research is to identify and rank critical risks based on their probability of occurrence in software projects, to investigate the influence of identified risks on project performance and finally to develop a method to evaluate critical risks "Software Risk Quantifying Model (SRQM)" based on work done by Khan and Spang (2013).

2. Literature Review

This section reviews software project risks from the literature. Since 1981, there are a number of studies on software risks that recommend potential software risks. McFarlan (1981) identified 54 risk related to software projects and introduced 3 dimensions of software risks i.e. project structure, technology experience and project size. Boehm (1991) surveyed different qualified project managers for identifying software related risks and suggested ten risk factors. Schmidt (2001) conducted an international study using Delphi method to collect suggestions from various experts from different areas of world i.e. Hong Kong, Finland and USA and identified 33 soft risk factors which were latterly divided into 14 dimensions of risks. From literature Addision and Vallabh (2001) reviewed 14 risks. In 2003 Addision considered risks in the development of ecommerce project and showed 28 risk factors and categorized in 10 dimensions for software risks. Wallace (2004) reviewed 27 risk factors and categorized software risks into 6 dimensions. Pare et al (2008) also followed Delphi method to conduct his study and conduct findings of 19 Canadian experts and showed results of top ten risk factors for software projects.
It is also supported by many researchers that risk management is an important factor and it is largely acknowledged by way of an operative approach to increase project performance (i.e. S. Liu & L. Wang (2014); E. Art man, H. Taylor & J. P. Woelfer (2012)). Several authors proposed different techniques for risk management; that are related to tools for risk evaluation, risk assessment methods and risk ranking. For example in 2015 Pfeiffer proposed model on the quantification of risk associated with the project performance mainly on those factors which results in the delay in project. Paul, Camastra, & Chandima S.K. (2015) proposed technique for the assessment of risk. H. Iranmaesh focused on the ranking model that ranked the risk factors centered on the comparison between the pair wise combination of their probabilities and severities.
From the above discussion and review of literature, it is vibrant that there is requisite to identify critical risks in software projects. Especially those risk factors which impact the performance of software projects.

2.1. Most Cited Risks from Literature and Field Study

Earlier research studies have identified different risks that influence the performance of software projects, among those identified risks; user risk, requirement risk, planning & control

risk, team risk, technical risk and organizational environment risk are considered to be most critical risks and broadly accepted by number of researchers (Wallace (2004); Liu & L. Wang (2014)). This list of software risks dominate top risks identified by different authors in various studies (S. Liu & L. Wang (2014); E. Art man, H. Taylor & J. P. Woelfer (2012); Wallace (2004); Mark Keil, Arun Rai and Shan Liu (2013)).

As stated earlier the aim of this study is to interpret the findings of literature review and to select mostly identified software risks for the model of the study. For identification of critical software project risks, we have done review of literature. And then we have conducted industry survey in order to validate the findings of literature review. All the factors identified while conducting literature review and industry survey are following:

2.1.1. Requirement Risk

Requirement risk is the major risk in software projects that critically effect project performance. Repeatedly changing requirements, improper, insufficient & impracticable requirements rise the glitches with a software project. While conducted field study, one of the software professional stated that requirement risk impact schedule and financial resources. Poor requirement gathering influence the project throughout the software development. Therefore, it is one of the most important software risk which is negatively related to project performance.

2.1.2. User Risk

Another critical risk in software projects are the issues related to users. The deficiency of user participation during project development is another utmost mentioned risk in the software risk literature. If the outlooks of users headed for a new application are uncomplimentary, it can be expected that they will not collaborate during development of software application or project, which results in augmented risk of project failure.

2.1.3. Planning and Control Risk

We found that there are number of various elements regarding planning and control which enables riskiness of a project. Poor planning and control often results in impractical schedules and budgets and unable to achieve milestones to evaluate either the project is generating the planned deliverables. As stated by our interviewee managers with inappropriate schedule estimation leads to poor estimation of resources for development effort. This results in the extreme schedule pressure that increase project risk.

2.1.4. Team Risk

Team is one of the most significant part of projects because team is finally accountable for the delivery of the project. Acquaintance, skills and capabilities of the project manager and team are decisive. Issues interrelated to members of project considered as team risk that can rise ambiguity of a project's outcome; such as inadequate information between members of project team, collaboration, motivation, and team communication issues.

2.1.5. Technical Risk

Factors associated to the technicality of project are very imperative for the successful delivery of any software project. Technical risk is stated as exertion of the project being carry out, which symbolizes another software project risk. Number of different elements of a project that can point out how technical it is, i.e. use of new technology, processes automated in the execution

of project are complex, untested engineering processes and enormous number of essential associations to existing systems and peripheral entities.

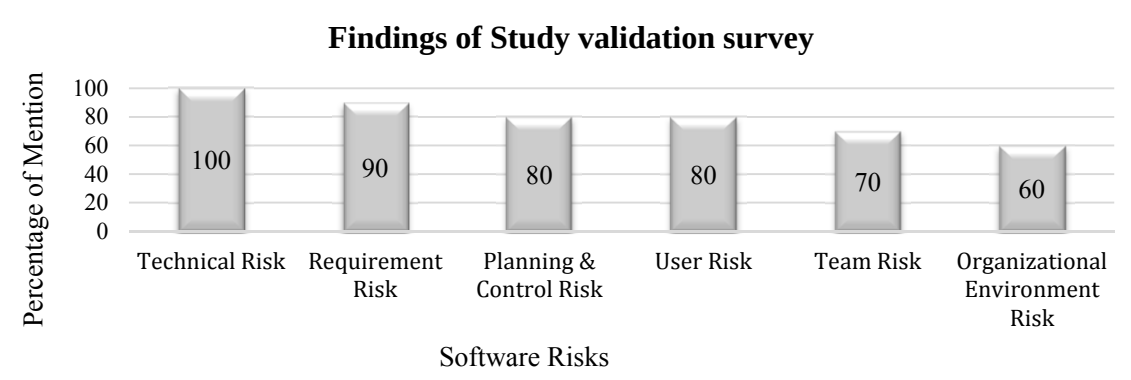
2.1.6. Organizational Environment Risk

There are number of factors related to organizational environment that effect the project performance. Ambiguity adjoining the organizational environment in which a software project takes place, structural politics, the solidity of the business environment, and absence of top management provision for a software project leads to poor project performance and hence results in project risk.

2.2. Validation Survey

From literature we have compiled list of top 25 risks in software project that found to be critical in different studies. It was not possible to find the influence of all 25 risks on the software project performance, therefore a pilot study was conducted with industry professionals working as project managers, team leaders in software development industry. Under this survey, a total of 10 professionals were reached out to finalize and validate literature results. List of different software risks which were found to be more viewed in literature were given to respondents and asked them to select and prioritize those risks which, based on their experience in field and observation, they think have relatively more existence and effect on software project performance and then we finalized only those risks which have percentage of equal to or greater than 60% of selected software risks for further research.

Table 1 - Findings of Validation Survey

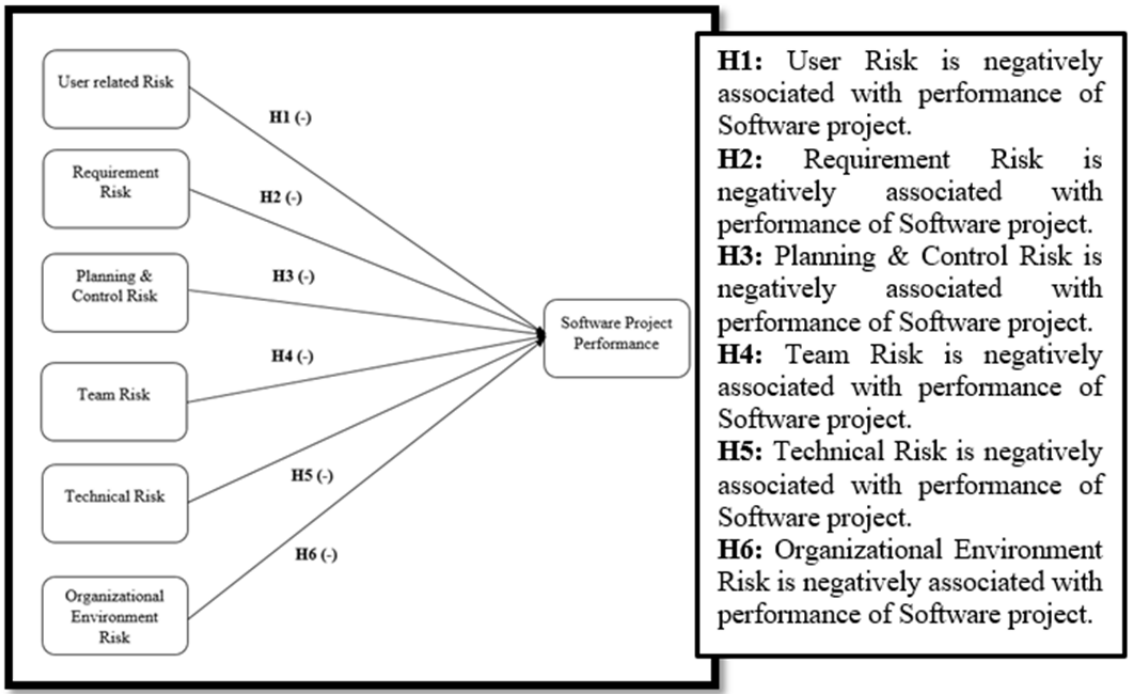


2.3. Software Risk Quantification Model

Constructed on the findings of literature, field study and the results of data collection through survey; we devise a quantifying model "Software Risk Quantifying Method" (SRQM) to quantify risks occurred in software projects. Detail of the method developed is provided in section 4.1.

2.4. Research Model and Hypothesis

Model developed for this research study based on the sources collected through literature and field study is as follow:



3. Research Methodology

Based on literature findings and field study results, a list of research questions were developed. To check the validity of results: first of all an activity of initial interviews was conducted. For interviews we approached the software industry's experts to gain a deeper knowledge about software risks, then survey strategy was used to collect data. The targeted population were individuals working as Risk Managers, Project Managers, and Project Team Leads in software organizations. The data collection has been done via self-administered questionnaires, and five points Likert scale has been used to collect data from participants. The risk managers, project managers and respective team leads being part of software industry were approached and distributed the questionnaires. In total 200 questionnaires were distributed among the software development professionals. Total number of returned valid questionnaires were 177 and then on the basis of responses the data analysis has been taken. Reliability analysis has been adopted to confirm the quality of data (Saunders, Lewis and Thornhill 2011).reliability analysis has been tested using Cronbach α. To perform data analysis on the data gathered from respondents via questionnaires, SPSS has been used for data analysis purpose. Insertion of data in SPSS was the first step towards data analysis. After insertion of data, the next step was finding descriptive analysis. To evaluate the strength of relationship Pearson correlation has been applied and Regression analysis has been used for estimating the relationship among dependent and independent variables.

4. Results & Discussion

This section provides the details of results against projected research paper. For demographic analysis four facets were considered for analysis i.e. Age, Gender, Qualification and Experience. Respondents who contribute their responses, among these 49.2 % have age between 20 to 30 years, 40.1% have age between 30 to 40 years, 9.6 % have age between 40 to 50 years and 1.1 % have age older than 50. In case of gender, who contribute their responses, among these 78.5 % are male respondents and only 21.5% are of females. Regarding qualification

details, on the basis of responses received 1.1 % were intermediate, 48.0 have bachelor's degree, 48.0 % have master's degree and about 2.8 % respondents have other degree i.e. PhD's or any other certifications. For work experience details, which ranges from less than 2 years to greater than 10 years. On the basis of responses received 14.1% have less than 2 years of experience, 43.5% have experience between 2 to 5 years, about 28.8% have experience greater than 5 years and less than 10 years and 13.6% respondents have experience greater than 10 years.

Table 2 - Reliability Statistics

Cronbach's Alpha	N of Items
.801	7

As shown above in table 2 that value for Cronbach alpha is 0.801 which shows that data is reliable. Findings of the correlation analysis depicts that all the correlation between dependent and independent variables are negative and significant.

The table 3 shows that the value of R square is 0.776 which specifies that the 6 independent variables (risk factors) are bringing about the 77% change in the dependent variable (project performance).

Table 3 – Model Summary

Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.881[a]	.776	.768	2.17422

Table 4 – Coefficients and Significance

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	36.062	1.005		35.889	.000
User Risk	-.210	.091	-.157	-2.316	.022
Requirement Risk	-.235	.099	-.186	-2.368	.019
Planning & Control Risk	-.259	.092	-.220	-2.826	.005
Team Risk	-.196	.082	-.155	-2.387	.018
Technical Risk	-.329	.119	-.255	-2.766	.006
Organizational Environment Risk	.020	.090	.015	.223	.824

Table 4 represents that beta coefficient values and significance against each variable. Findings show that user risk is significant and negatively related to Software project performance (β = -

0.157, $p < 0.05$). The findings are similar to the results obtained by Shan Liu (2016), Lin Wang & Shan Liu (2014) and Mark Keil & Arun Rai (2013). Similarly, during our interview session with industry experts; one of the professional admitted that in many cases users are reluctant to give feedback on time which results delays in development of project. User risk depicts that the software professionals must diagnose various impacts of risks on project performance and need to minimize them so that they can gain high performance that will lead in achieving ultimate goals.

In case of requirement risk it is shown that the beta value is negative and significant ($\beta = -0.186$, $p < 0.05$). By ensuring acceptance; our objective has been achieved. The findings are similar to the results obtained by Shan Liu (2016), Lin Wang & Shan Liu (2014) and Mark Keil & Arun Rai (2013). This result implies that software companies which take requirement risk in consideration and take precautionary measures to minimize this risk reach out to achieve high project performance and less failure. During interview with our industry professional it was stated that feasibility study for gathered requirements is the most important task as whole development depends on the requirements defined by customers. Once clear and defined requirements are communicated to project team it is easy to manage and develop project on time. Requirement risk depicts that the software professionals need to minimize critical risk like requirement risk that results in low performance, by minimizing this risk it will lead in achieving ultimate goals.

The findings for planning & control risk are similar to the results found by Shan Liu (2016), Lin Wang & Shan Liu (2014) and Mark Keil & Arun Rai (2013). This result implies that planning & control risk cannot be ignored and IT companies should keep in mind that favorable planning and control is an important factor in success. Planning and control for project is the key factor to achieve project goals. As planning phase is the most important part of software development life cycle if every task is planned well and you have control strategy for any uncertain circumstance you can easily get out of any problem occurred in project (stated by interviewee).

Team Risk is significant and negatively related to Software project performance ($\beta = -0.155$, $p < 0.05$). Findings implies that software companies which take team risk in consideration and take precautionary measures to minimize this risk will reach out to achieve high project performance and less failure. To avoid team risk, project managers should enthusiastically share their ideas and norms to their teams and build trust between team members and need to improve good relationship with their project team members (Chaudhary and Sabherwal 2003).

Beta value for technical risk is also negative and significant ($\beta = -0.255$, $p < 0.05$). In the case of technical risk we can see that among all identified risks highest beta value is for technical risk which shows that in context of Pakistan technical competence is low as compared to other developed countries. This result suggests that technical risk has greater influence on software projects which effects their performance. To minimize technical risk, better reliance on formal control approaches would be a better choice to mitigate technical risk (Kirsch 1997) from software companies. Project managers need to define procedures and techniques to execution of project and then evaluate outcome element project performance by considering to what extent the define procedures and processes are followed (Kirsch 2002).

For organizational environment risk, beta value is positive and not significant ($\beta = 0.015$, $p>0.05$). Which shows contradictory results against our intended objective. It is supported by some authors that organizational environment can be vary based on cultural differences between countries and even between organizations. Effect of organizational environment on project performance in accordance with one more study stated that organizational environment is not

directly associated to project performance (Khalifa 2013). Due to unfair responses from respondents this might be rejected as well.

4.1. Software Risk Quantifying Model (SRQM)

Software risks identified from the literature and field study are considered here; as the findings of this study depicts that user risk, requirement risk, planning and control risk, team risk, technical risk and organizational environment risks are critical risks in software projects which are negatively related to project performance. The results are based on the data collected through survey for this study. Mean and standard deviation values against each identified risk has been calculated.

The software risk quantifying model (SRQM 1000) is an initial approach to devise a model to quantify risks occurred in projects in software sector. The selected value 1000 for index is considered here to visibly distinguish small gaps in values against software risks. For the development of this tool we are considering here 3 point rating scale against each components of risks. Evaluator has to mark the influence of each risk from 1 to 3 whereas 1 shows no effect, 2 represents moderate effect and 3 represents high effect. The total of all values rated by evaluator against each item of risk results in *interim value* of risk for a specific risk. The index value determines the amount of risk occurred in an organization or on specific project.

Below Table 5 represents the findings used to calculate the value of index forSRQM. First column contains the software risks that found to be most critical, second column contains total value against a risk, these values are the sum of total values against components of a particular risk. Third column shows the multiplier value that can be calculated as follows; we have calculated maximum value against each risk, maximum value can be calculated by taking mean of a risk divided by sum of all risks and multiply by 1000 index value; for example here we are considering user risk value as an example:

(User Risk/Sum of all risks) * 1000

Mean for user risk = 3.0989; Sum of all risks = 18.2; Index value = 1000

(3.0989/18.2)*1000 = 170

170 is maximum value against user risk. In this study user risk has 5 components and if each item has high impact, value will be 5*3 = 15, and here we are considering it as 15. Next step is to divide the maximum value of risk with this value that is:

170/15 = 11.33 (multiplier against user risk)

Software specific results will be calculated by multiplying interim value with multiplier i.e. I*M.

Table 5 - SRQM Calculations

Software Risks	Interim Results (I)	Multiplier (M)	I*M	Max value
User Risk	13	11.33	147.29	170
Requirement Risk	10	11	110	165
Planning & Control Risk	11	11.13	122.43	167
Team Risk	12	11.27	135.24	169
Technical risk	11	11.07	121.77	166
Organizational Environment Risk	9	10.67	96.03	163
SRQM Index Value Total			**732.76**	**1000**

Generally in SRQM, the greater the value shows that a project has high risk and it'll be more risky for project manager to manage such project. This model gives important information against risk associated with software projects that effect project performance and lead to project failure.

5. Conclusion

In this paper we have identified and classified critical risk factors occurred in software projects and their association with project performance. We found that there is negative association between software risks and project performance which means that increase in software risk results in poor performance. This result implies that to enhance the project performance it is important to minimize critical risks. To achieve high project performance and less failure; software companies should take risk in consideration and take precautionary measures to minimize critical risks. Software Risk Quantifying Model (SRQM - 1000) index values can aid as significant indicator to evaluate and quantify risks on software projects. This model can help project managers in project planning and formulating proactive risk mitigation strategies to enhance their project performance. Project managers need to critically classify and quantify the implicit constraints to project success. Hence software sector need extreme level of risk management to enhance project performance that lead an organization to achieve its ultimate goals.

6. References

[1] Barki, H., & Suzanne Rivard, J. T. (2001). An integrative contingency model of software project risk management. Journal of management information systems, 17(4), 37-69.
[2] B. Hughes, and M. Cotterell. Software Project Management 4th ed, pp. 147, 1996, McGraw-Hill (UK).
[3] B.W. Boehm. "Software Risk Management: Principles and Practices", IEEE Software vol 8, number 1, pp.32-41,1991.
[4] Elzamly, A., Hussin, B., & Salleh, N. M. (2016). Top Fifty Software Risk Factors and the Best Thirty Risk Management Techniques in Software Development Lifecycle for Successful Software Projects. International Journal of Hybrid Information Technology, 9(6), 11-32.
[5] F. Tüysüz , C. Kahraman , Project risk evaluation using a fuzzy analytic hierarchy process: Anapplication to information technology projects, Int. J. Intell. Syst. 21 (6) (2006) 559–584 .
[6] F. MCFarlan. "Portfolio approach to information systems" Harvard Business Review, vol 59, number 5, 1981, pp.142-150
[7] G. Pare, C. Sicotte, M. Jaana, and D. Girouard. "Prioritizing Clinical Information System Project Risk Factors: A Delphi Study", Proceeding of the 41st Hawaii Conference on System Sciences -2008, pp.1-10.
[8] Huang, S. J., & Han, W. M. (2008). Exploring the relationship between software project duration and risk exposure: A cluster analysis. Information & Management, 45(3), 175-182.
[9] H. Iranmanesh , S.N. Shirkouhi , M.R. Skandari , Risk evaluation of information technology projects based on fuzzy analytic hierarchal process, World Acad. Sci., Eng. Technol. 40 (2009) 351–357 .
[10] Jiang, J. J., & Klein, G. (1999). Risks to different aspects of system success. Information & Management, 36(5), 263-272.
[11] Keil, M., Rai, A., & Liu, S. (2013). How user risk and requirements risk moderate the effects of formal and informal control on the process performance of IT projects. European Journal of Information Systems, 22(6), 650-672.
[12] Kardes, I., Ozturk, A., Cavusgil, S. T., & Cavusgil, E. (2013). Managing global

megaprojects: Complexity and risk management. International Business Review, 22(6), 905-917.
[13] Liu, S., & Wang, L. (2014). Understanding the impact of risks on performance in internal and outsourced information technology projects: The role of strategic importance. *International Journal of Project Management*, *32*(8), 1494-1510.
[14] Liu, S., & Deng, Z. (2015). How environment risks moderate the effect of control on performance in information technology projects: Perspectives of project managers and user liaisons. International Journal of Information Management, 35(1), 80-97.
[15] Liu, S. (2016). How the user liaison's understanding of development processes moderates the effects of user-related and project management risks on IT project performance. Information & Management, 53(1), 122-134.
[16] Liu, J. Y. C., & Yuliani, A. R. (2016). Differences Between Clients' and Vendors' Perceptions of IT Outsourcing Risks: Project Partnering as the Mitigation Approach. Project Management Journal, 47(1), 45-58.
[17] L. Wallace and M. Keil. "Software Project Risk and their Effect on Outcomes", Communication fo the ACM, vol 47 number 4, pp. 68-73, 2004.
[18] Muriana, C., & Vizzini, G. (2017). Project risk management: A deterministic quantitative technique for assessment and mitigation. International Journal of Project Management, 35(3), 320-340.
[19] Nidumolu, S. (1995). The effect of coordination and uncertainty on software project performance: Residual performance risk as an intervening variable. Information Systems Research, 6(3), 191-219.
[20] Pfeifer, J., Barker, K., Ramirez-Marquez, J., Morshedlou, N., 2015. Quantifying the risk of project delays with a genetic algorithm. Int. J. Prod. Econ. 170, 34–44.
[21] Qazi, A., Quigley, J., Dickson, A., & Kirytopoulos, K. (2016). Project Complexity and Risk Management (ProCRiM): Towards modelling project complexity driven risk paths in construction projects. International Journal of Project Management, 34(7), 1183-1198.
[22] R. Schmidt, K. Lyytinen, M. Keil, M. and P. Cule."Identifying Software Project Risks: An International Delphi Study", Journal of Management Information Systems vol 17, number 4, pp. 5-36, 2001.
[23] Rodríguez, A., Ortega, F., & Concepción, R. (2017). An intuitionistic method for the selection of a risk management approach to information technology projects. Information Sciences, 375, 202-218
[24] Rodríguez, A., Ortega, F., & Concepción, R. (2016). A method for the evaluation of risk in IT projects. Expert Systems with Applications, 45, 273-285.
[25] Shrivastava, S. V., & Rathod, U. (2017). A Risk Management Framework for Distributed Agile Projects. Information and Software Technology.
[26] Schmidt, R., Lyytinen, K., & Mark Keil, P. C. (2001). Identifying software project risks: An international Delphi study. Journal of management information systems, 17(4), 5-36.
[27] Spang, K., & Khan, R. A. (2013, September). Towards measuring the country specific project risks. In Intelligent Data Acquisition and Advanced Computing Systems (IDAACS), 2013 IEEE 7th International Conference on (Vol. 2, pp. 560-565). IEEE.
[28] T. Addision and S. Vallabh, S. "Controlling Software Project Risks – an Empirical Study of Method used by Experience Project Managers", Proceeding of SAICSIT 2002, pp.128-140.
[29] T. Addision."E-Commerce Project Development Risks: Evidence from a Delphi survey", International Journal of Information Management vol 23, number 1, pp. 25-40, 2003.
[30] Taylor, H., Artman, E., & Woelfer, J. P. (2012). Information technology project risk management: bridging the gap between research and practice. Journal of Information Technology, 27(1), 17-34.
[31] Wallace, L., Keil, M., & Rai, A. (2004). Understanding software project risk: a cluster analysis. Information & Management, 42(1), 115-125.
[32] W.M. Han and S.J. Huang."An Empirical Analysis of Risk Components and Performance on Software Projects", The Journal of Systems and Software vol 80 number 1, pp. 42-50, 2007.

RISK MANAGEMENT AND THE AGILE APPROACH

Prof. Dr. Wolfgang Tysiak

University of Applied Sciences and Arts Dortmund
Faculty of Business Administration
Emil-Figge-Straße 44
D-44227 Dortmund
Tel. 0049-(0)231-755-4996
Wolfgang.Tysiak@FH-Dortmund.de

Key words: project scheduling, risk management, Monte Carlo simulation, agile Methods.

Abstract: There are various methodologies in project management that are collectively known as 'agile', as they promote the values of the 'agile manifesto' and they are consistent with the principles mentioned there. One main idea is that new challenges not require an anticipatory approach, but more an adaptive project management. If you follow this guideline consequently to the final end, you might come to the illusion that risk management seems to be no longer needed in an adaptive and iterative process. In other words: You ignore risks until they manifest into issues!
We want to show in this contribution that you still need to perform risk management even in connection with agile approaches. Especially Monte Carlo simulation should be mentioned here as an appropriate tool to use in this context.

1. Introduction and Background

Although we can suppose that even the construction of the pyramids in Egypt must have had some kind of project management, modern project management came into being about fifty years ago. Project management societies were founded in different countries (USA/Project Management Institute (PMI) in 1969, UK/Association for Project Management (APM) in 1972, Germany/Deutsche Gesellschaft für Projektmanagement (GPM) in 1979) and during the second half of the 20th century we could perceive a huge development in methods, tools, approaches, and models. The number of textbooks increased dramatically, some organizations established their own standards (like PMBOK, Prince2 etc.), and the topic 'project management' was omnipresent. On the other hand in some sense it evoked an impression that it became overloaded, inflated, inflexible, and too complex.
Since the focus of this paper is risk management in projects, let us look especially into that development a little more in detail:
- In the **late 50's** PERT was introduced into project management (c.f. [1], [2]), developed by the United States Navy together with the OR department of Booz, Allen, and Hamilton. The purpose of this development has been to support the deployment of the Polaris-Submarine weapon system (c.f. [3]). PERT on the other hand is based on the Critical Path Method (CPM) that was invented by DuPont (c.f. [4]). CPM assumes deterministic durations of the different activities, but using PERT we choose beta distributions for the durations, usually estimated by so-called three-point estimates (optimistic, most probable, and pessimistic durations). In that way, PERT was the very first – but tiny – step into the right direction. Later on, this PERT approach was modified to GERT (graphical evaluation and review technique) and SCERT (synergistic contingency evaluation and review technique).
- In the **early 90's** there was a shift in the perception of risk: Risk was no longer seen as something that only leads to negative effects, but as a synonym to "uncertainty". Therefore risks can be seen bad or good: a threat or an opportunity.
- In the **first decade** of the third millennium there was an increasing interest in risk management in projects. For example, the number of members of the RiskSIG (risk management special interest group, founded in 1986) of the APM grew between 2004 and 2011 from 350 to 2,700 (c.f. [5]).
- **Nowadays** risk management in projects has become one of the 10 knowledge areas of PMBOK (Project Management Body of Knowledge, [6]) and covers 6 of the almost 50 processes. Like the whole discipline

'project management', risk management in projects evoked the impression to become overloaded, more complex, and by this catchier to handle.

2. Agile Methods

In the light of that development in project management a group of 17 participants of a conference in Utah in the year 2001 discussed, compiled, and signed a manifest that later on became famous as the '**Manifesto for Agile Software Development**' (c.f. [7]).

"We are uncovering better ways of developing software by doing it and helping others do it.
Through this work we have come to value:

- **Individuals and interactions** over processes and tools
- **Working software** over comprehensive documentation
- **Customer collaboration** over contract negotiation
- **Responding to change** over following a plan

That is, while there is value in the items on the right, we value the items on the left more".

Remarkable is the fact that the signatories mentioned in the postscript that they do not want to move into extremes, but want to focus more on the flexible aspect of processes. Afterwards several agile project management approaches were generated, one of the most popular of them seems to be the so-called "scrum" approach (c.f. [8], [9]). This approach is characterized by several pre-sets (e.g. the different roles of the product owner, the team, and the scrum master) and especially a clearly defined time management. The whole workload of the project is broken down into work packages for the next 'sprint'. Such a sprint usually covers a period of 8 to 30 days. And within this period there is a daily 'scum' meeting. By this the main idea is the adaptive and iterative line of action. The whole team is able to permanently react to things that occur over time and therefore this approach is very flexible (see fig. 1).

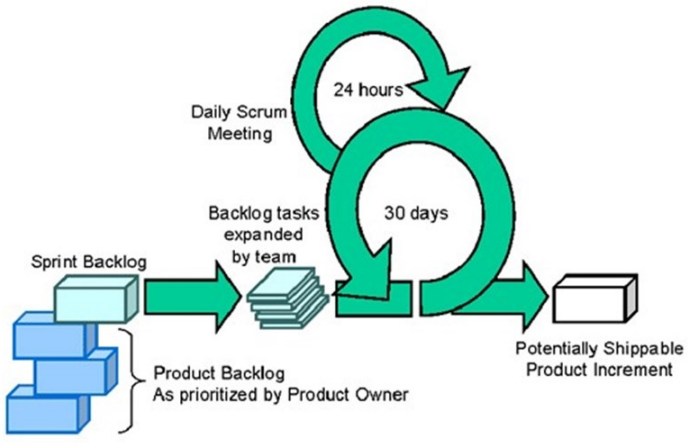


Figure 1. The scrum framework (adapted from [10])

On the other hand it is quite irritating to find statements on the internet like the following (and these are quotations, intentionally given here without reference):

- "This has led many to believe that **risk management is irrelevant in an iterative model.** Some follow the approach of ignoring risks until they manifest into issues; they then manage them through the natural sprint progression."
- "Risk management is an important part of both PMBOK/PMI and Prince2. Most agilists on the contrary find separate formal **risk management in agile practices unnecessary**, as agile inherently addresses risks and mitigates them continuously."

- "One can debate the need for spending additional amount of time in firming up schedules when **agile has the inherent flexibility** about keeping timeline fixed while ensuring only high priority items get delivered."

Obviously some people have not read (or forgotten) the last sentence of the 'agile manifest' and do believe that this iterative, adaptive approach substitutes an elaborated planning and especially risk management.

3. Comparison to Machine/Job Scheduling

In some sense this reminds those of us, who witnessed, followed, or tracked the developments in production and operations management, that a similar process happened there. In the beginning, the dominating perception was that everything can be analysed and planned and that it depends mostly on the available computer performance to calculate the optimal schedule for the execution of a set of orders. The aim was to get via MRP (manufacturing resource planning) a totally integrated CIM (computer integrated manufacturing) in which each order is **pushed** through the production system. But because of the increasing complexity, the high fragility in relation to any disturbance ("butterfly effect"), and the handling of uncertain events, another development took place, mostly initiated in the Asian countries. In this approach orders were not pushed through the system, but rather **pulled**. This approach was characterized by terms like Kanban, just-in-time, and lean management.
In some sense you can interpret this development, as if you "overshot the mark" and had to move back. In this case it sometimes happens that the pendulum that moved too far is then swinging back even too far into the opposite direction. In the end you have to come to the conclusion that each situation needs its own individual approach somewhere in between and that there is not one unique approach that always fits best. You have to decide this again and again and adjust your specific 'hybrid' approach to your specific environment.

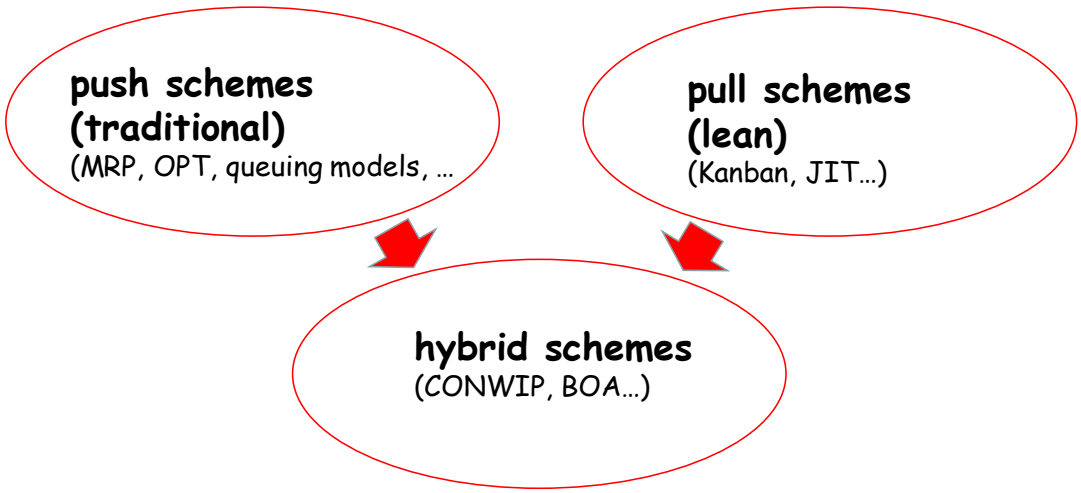


Figure 2. Development in production and operations management (own source)

But since these experiences have already been made in operations management, let us try to learn from them in project management.

4. Example: Pitfall Traps because of Blinders

To illustrate the necessity of planning and the danger of a purely adaptive approach, we adopt one of the examples that have been created in the context of the discussion in production and operations management and that are now known as "*Graham's anomalies*" (c.f. [11]). For the sake of simplicity, a deterministic case has been chosen here, in the sense that no uncertainties of the parameters are assumed.

Suppose that we have a project that contains seven activities with the necessary (deterministic) durations and the predecessor relations given in fig. 3.

activity	predecessor	duration
A	-	4
B	-	2
C	B	2
D	A	5
E	A, C	5
F	D, E	10
G	C	10

Figure 3. The first example project (based on [11])

To handle this project we deploy two teams that are able to perform each activity, but only one activity per team at the same time. If these teams behave in a purely adaptive way, which means that each team consistently takes over the next available task, we get the schedule given in fig. 4 with a total duration of the whole project of 19 units.

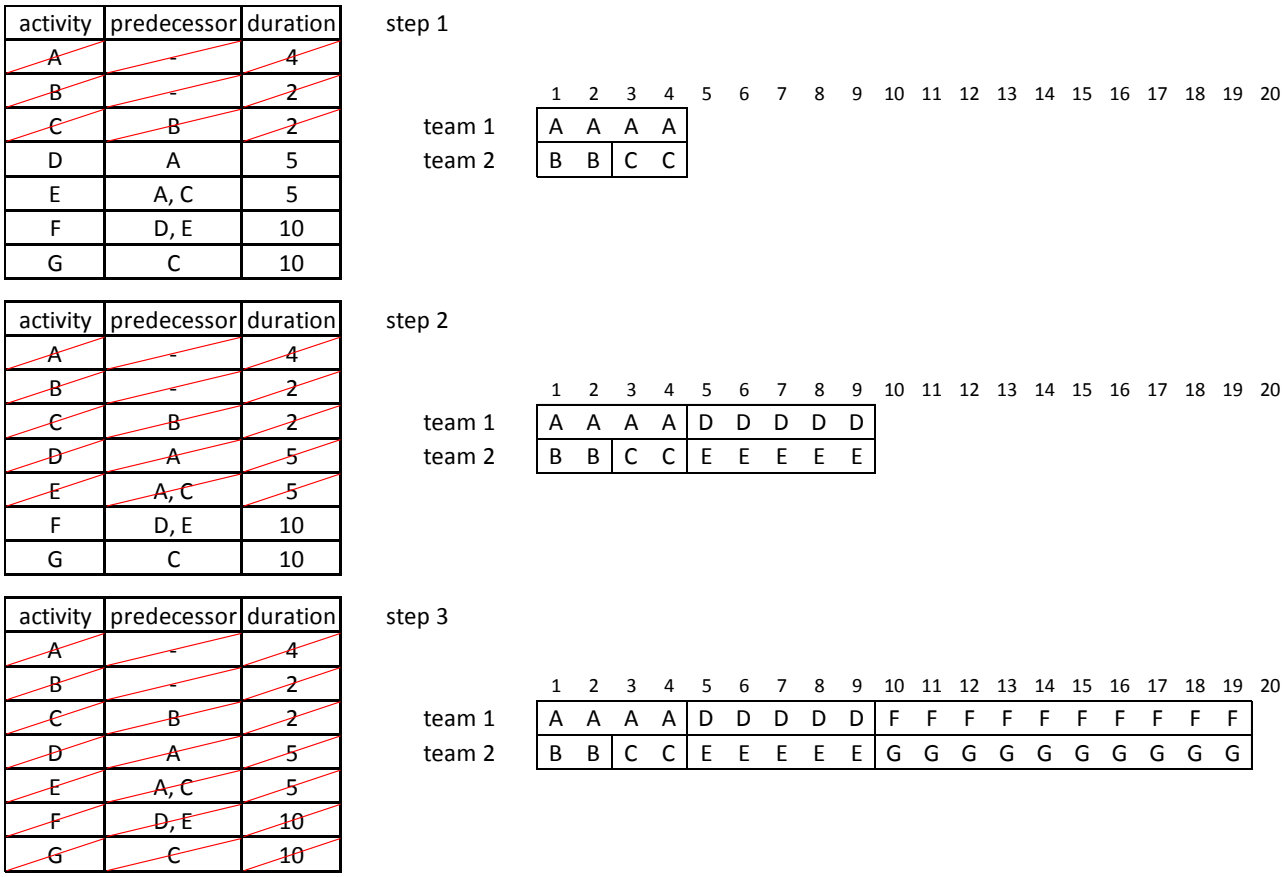


Figure 4. The first example with the adaptive approach (based on [11])

If we now succeed in improving the project in that way that we can shorten the duration of each activity by 1 unit, we get the modification of the project that is shown in fig. 5.

activity	predecessor	duration
A	-	4
B	-	2
C	B	2
D	A	5
E	A, C	5
F	D, E	10
G	C	10
	Σ	38

activity	predecessor	duration
A	-	3
B	-	1
C	B	1
D	A	4
E	A, C	4
F	D, E	9
G	C	9
	Σ	31

Figure 5. Modification of the first example (based on [11])

Solving this modified project in exactly the same adaptive way, now leads to the schedule given in fig. 6. It can be seen that although the total workload decreased from 38 units to 31 units (c.f. fig. 5) the duration of the project increased from 19 units to 20 units. On the other hand one would have expected that having a workload of 31 units and 2 available teams, it would be possible to execute the project within 16 units. And indeed: This is possible! To achieve this, one team needs some idle time short after the start in order that everything fits in the end (fig. 7). But unfortunately the adaptive approach is not able to handle this. It is not the question to have a planning process or not – it is the kind of planning that matters!

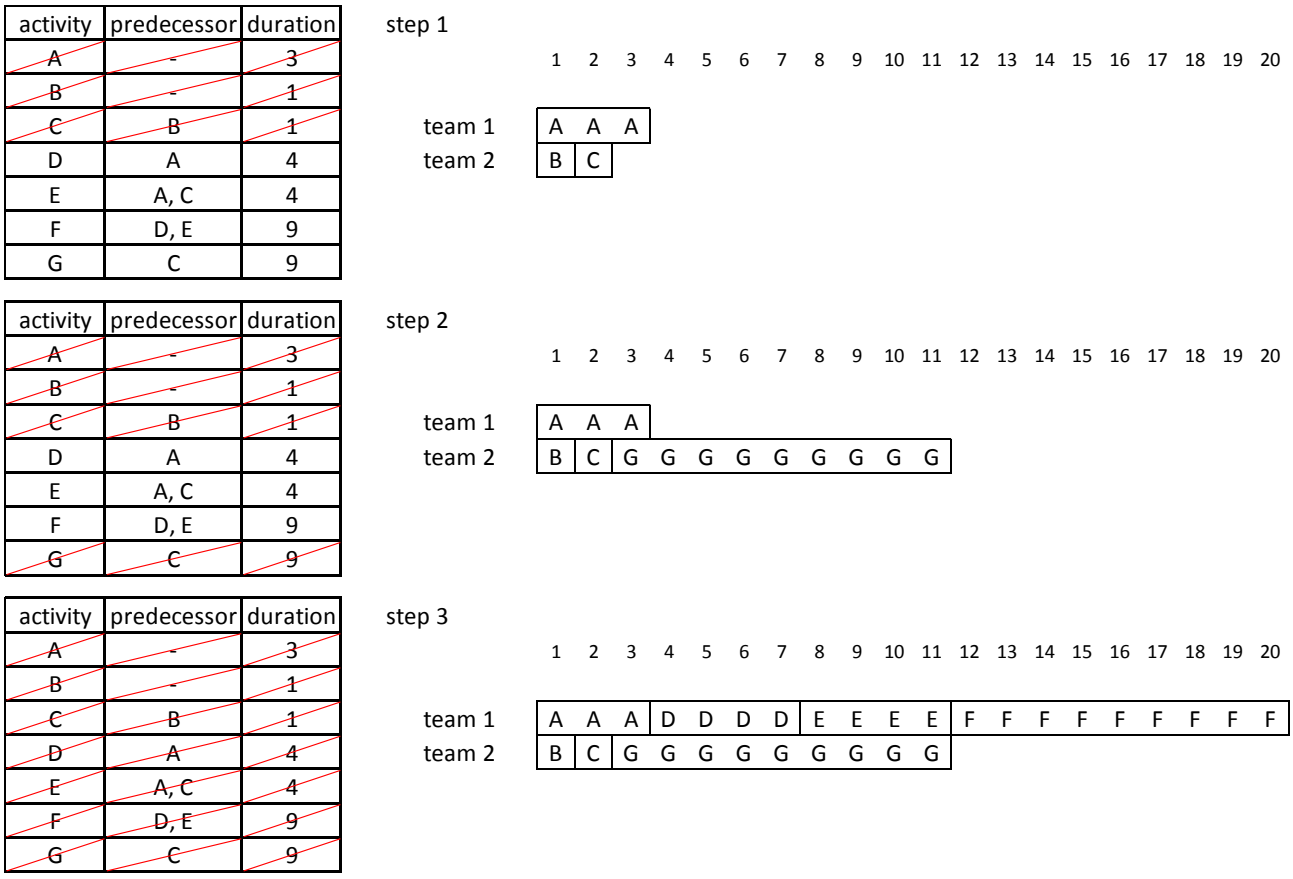


Figure 6. Solving the modified example with the adaptive approach (based on [11])

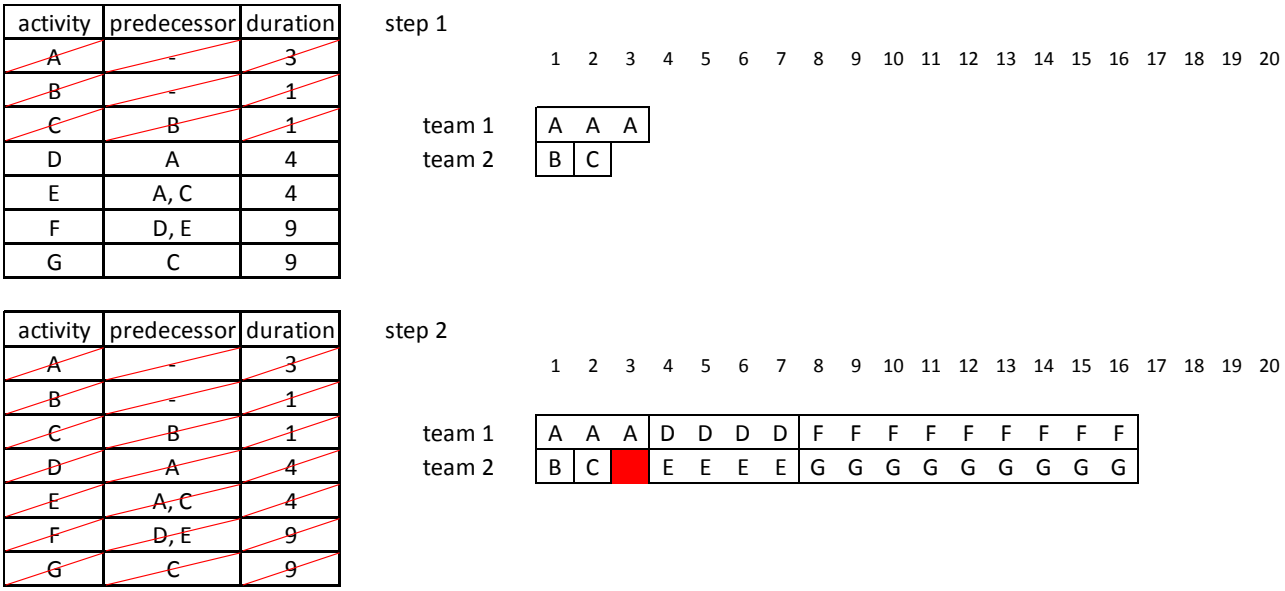


Figure 7. Optimal solution of the modified example (based on [11])

5. Monte Carlo Simulation and Risk Management

After having illustrated that a planning and especially risk planning process is quite useful - if not necessary – let us view, which kind of risk management might fit into an agile oriented process. Since agile oriented processes possess its special timing, the used tools have to be easily applicable with little effort in the sense that they can be used during a sprint or even within a scrum meeting, without the consultation of external specialists or the use of specific software. Therefore we favour Monte Carlo simulation, since it creates a plain output in form of distributions instead of non-transparent indices that need interpretation. Additionally these simulations have to be performed with a tool that is well-known to most of us and that can be handled by most – if not all – of the team members. Excel belongs to this kind of tools.
Let us try to give an impression of possible applications with the following more complex example project (fig. 8). Here the durations of the individual activities are assumed to be uncertain and given by three-point estimates (optimistic (OD), most probable (MD), and pessimistic durations (PD)).

Activity	Predecessors	OD	MD	PD
A	-	2	3	4
B	-	3	6	9
C	-	2	5	10
D	-	4	6	9
E	A, B, C	3	7	10
F	C, D	2	7	9
G	E	2	3	4
H	E, F	3	6	8
I	F	3	5	9
J	F	2	7	10
K	G, H, I	2	6	8
L	I, J	3	5	8

Figure 8. A fictitious project plan (c.f. [12])

With a little experience it takes about one hour to create a Monte Carlo simulation model with Excel for this project. This effort might of course increase if the project becomes larger or more complex (e.g. if there are a lot of incorporated conditions or correlations (c.f. [13], [14]), but it remains manageable within a reasonable timeframe. Additionally you have to keep in mind that this creation of the model has to be done only once in the beginning. In this example we have chosen beta distributions for the expansion of the three-point estimates, which is quite easy because of the built-in functions of Excel. The employment of the model is of course as easy as any use of Excel sheets: You simply change parameters, recalculate and notice the changes.
The first instance that can be shown with the model is the probability of an activity to be critical. Therefore we create 10,000 simulations (which only takes seconds of computing time) and calculate how often an activity belongs to the critical path (c.f. fig. 8).

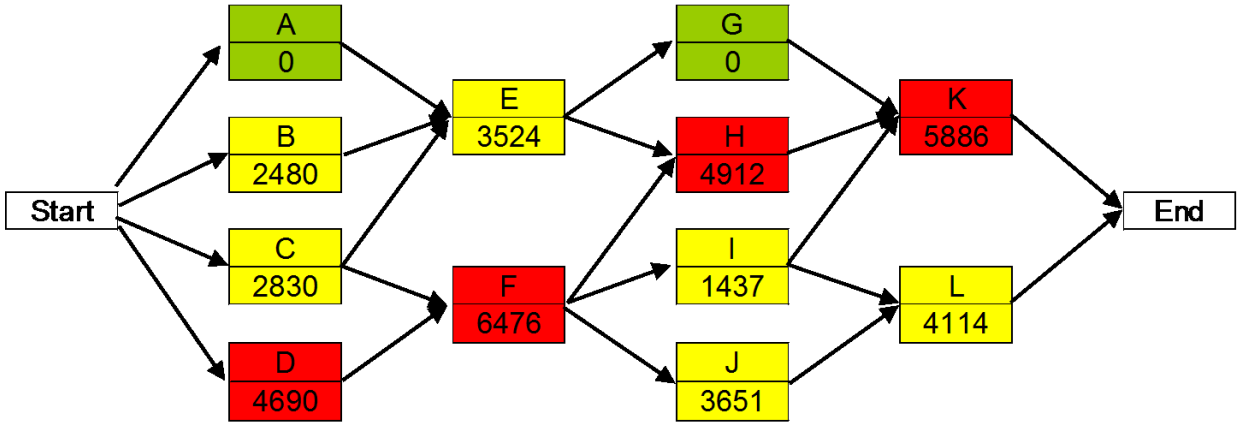


Figure 8. The critical field (number of times (out of 10,000) that a node is critical) (c.f. [14])

Similar to the above given example with the two teams, we could be interested which activities overlap in time, so that they have to be executed (at least partly) simultaneously. In fig. 9 the probabilities of an overlap in time are given. Other figures (like the average length of such an overlap) can also easily be created.

	B	C	D	E	F	G	H	I	J	K	L
A	1,00	1,00	1,00	0	0	0	0	0	0	0	0
B		1,00	1,00	0	0,37	0	0	0	0	0	0
C			1,00	0	0	0	0	0	0	0	0
D				0.43	0	0	0	0	0	0	0
E					1,00	0	0	0,53	0,53	0	0
F						0,47	0,47	0	0	0	0
G							0,95	0,94	0,95	0	0,06
H								0,99	1,00	0	0,44
I									1	0	0
J										0,48	0
K											0,99

Figure 9. Probabilities of overlap (own source)

As a third illustration of the application of such a model, we want to point out that you are able to permanently maintain the model, update the parameters over time, and consider the consequences. Fig. 10 sketchily shows such a process, where the actual values are updated each 5 days and the changes in the distribution of the duration of the whole project are presented. Obviously the standard deviation decreases over time.
These are only three possible instances to show that this approach may provide very useful information in a very short and easy way. Each project will of course generate its own desirable or required analyses.

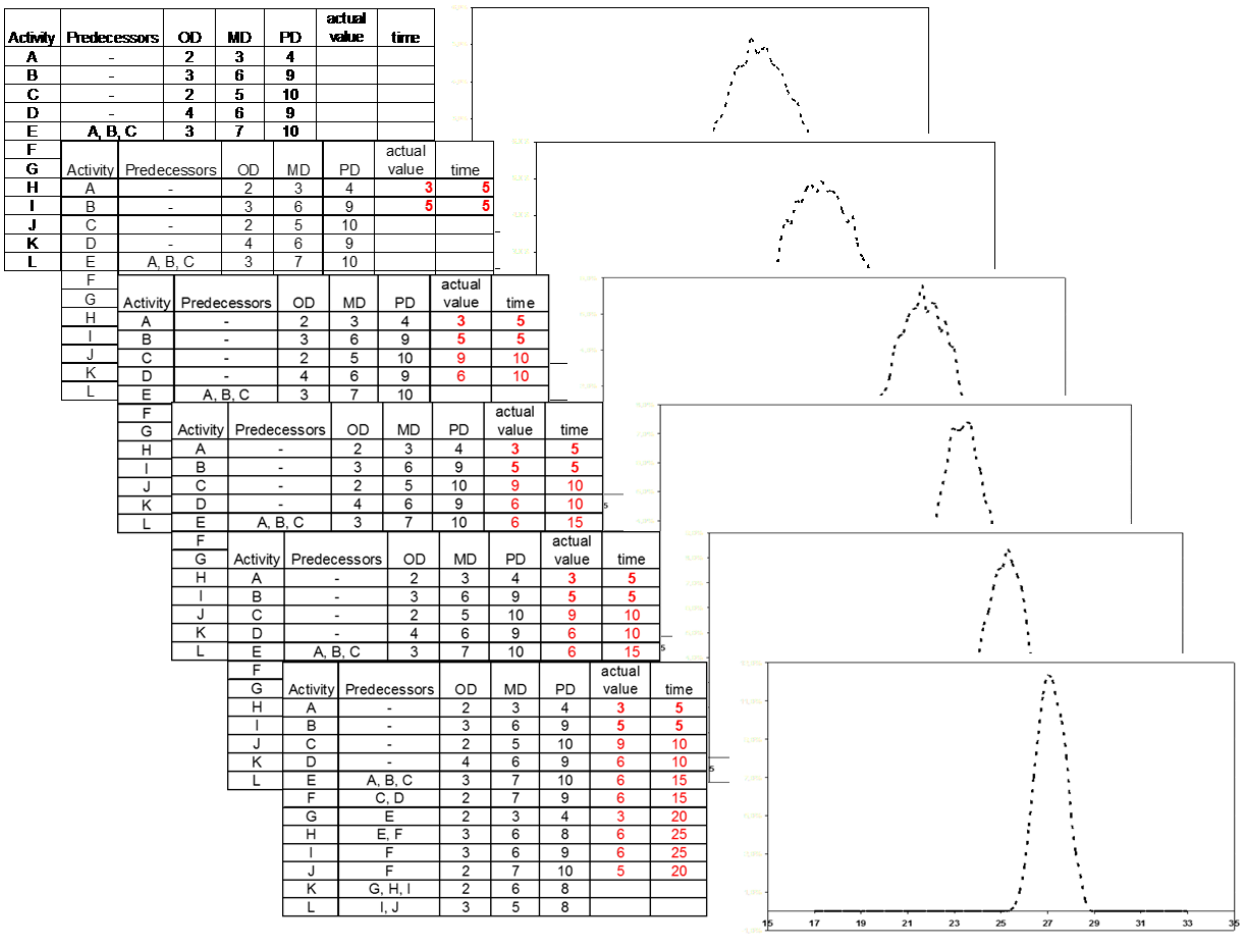


Figure 10. Development over time (own source)

6. Conclusions and Remarks

Although sometimes people argue that a sophisticated project planning and especially risk management planning can be substituted by an agile approach, we illustrated that a pure adaptive line of action might be quite dangerous. Therefore even in agile oriented approaches planning is still useful.

Especially in the context of risk management planning, everybody should be aware that ignoring risks also means the omitting of chances, because uncertainties always cover both tails of the distribution: threats and chances.

Additionally the fact that one approach moved too far into an extreme direction, should not lead to an attitude to move into the opposite extreme. It normally makes more sense to mitigate the extreme approaches: There are a lot of interesting colours between black and white – we need hybrid models that use a mix of the best tools of all known approaches.

One tool that fits quite well into the agile methodology is the Monte Carlo simulation, especially performed with Excel. It is well-known, most people are familiar with it. It is very flexible, analyses can be done very fast and by the team members themselves. Therefore it also might be useful to invest further research in making these simulation models more and more realistic. As the example mentioned in the beginning suggests, also the extension of the critical chain approach could be interesting in that context. But you should always keep in mind the conflict between complexity and applicability and of effort and benefit.

7. References

[1] Kerzner (2009): *Project Management*, John Wiley & Sons, Hoboken, New Jersey, 2009

[2] Taylor (2010): *Introduction to Management Science*, Pearson Prentice Hall, Upper Saddle River, New Jersey, 2010

[3] Fazar (1959): *Program Evaluation and Review Technique*, The American Statistician, Vol. 13, No. 2, 1959

[4] Kelley/Walker (1959): *Critical Path Planning and Scheduling*, Proceedings of the Eastern Joint IRE-AIEE-ACM Computer Conference, December 1-3, 1959

[5] Campbell (2012): *From the Dark into the Light* in: Hillson (ed.): Project Risk Management: Past, Present and Future, Views from the Chair, 2012

[6] PMI (2013): *A guide to the project management body of knowledge,* **(**PMBOK®Guide), PMI – Project Management Institute, Newton Square, Pennsylvania, 2013

[7] Augustine (2005): *Managing Agile Projects*, Prentice Hall, Upper Saddle River, New Jersey, 2005

[8] McKenna (2016): *The Art of Scrum*, CA Technologies, Aliquippa, Pennsylvania, 2016

[9] Maximini (2015): *The Scrum Culture*, Springer, Heidelberg u.a., 2015

[10] Schwaber/Beedle (2008): *Agile Software Development with Scrum*, Pearson Prentice Hall, Upper Saddle River, New Jersey, 2008

[11] Graham (1968): *Bounds on multiprocessing timing anomalies*, Bell Systems Technical Journal 45, 1968

[12] Tysiak (2015): *A Deeper Insight in Some Effects in Project Risk Management*, International Journal of Computing, Vol. 14 (1), 2015

[13] Tysiak/Seresanu (2010): *Project Risk Management Using Monte Carlo Simulation and Excel*, International Journal of Computing, Vol. 9 (4), 2010

[14] Tysiak/Tietz (2016): *The Impact of Correlations in the Critical Field*, in: Project Management Development – Practice and Perspectives – Proceedings of the Fifth International Scientific Conference on Project Management in the Baltic Countries, April 14-15, 2016, Riga, University of Riga, 2016

Controlling Aspects in International Project Management

Prof. Dr. Werner Wetekamp, University of Applied Sciences and Arts, Dortmund, May 2017

Key words: *Controlling, Internationality, Exchange Rates, Project Management, Finance*

1. Introduction

Globalization is one of the most important aspects in our general private life (mixture of the different human population of the world, traveling, consumption of international goods) in our business life of enterprises (global purchasing and production, growth means internationality) and in this move also project management goes global. Global or international projects have impact not only on the language we need to harmonize in order to understand each other in projects. It is crucial to understand pitfalls of internationality (Lück, 2004, p. 79; Macharzina, 1989, p. 242), to handle economic aspects like different currencies, national inflation rates in countries involved or decision taking under different political dangers or chances. Other aspects than economic (different cultures, different behavior of international clients, international corporate governance in projects) will not be discussed in this essay. Within the economic aspects the main focus will be related to steering and controlling projects so the economic task to lead projects to success – other economic aspects of business administration, taxation, information management, finance or human resources will not be touched.

In chapter two a structured overview of the important aspects will be given while in chapter three the toolbox will be developed. A summary will be given in chapter 4.

2. Overview of Economic Aspects in International Project Management

In the beginning we have to distinguish general economic aspects (not content of this article) and controlling aspects in international projects (content of this article). General economic aspects in internationality are for instance the slope of taxes between countries (Macharzina, 1989, p. 123). A lot of projects were undertaken because of tax savings in tax havens. This aspect is a project reason or a motivation and not a special technical aspect of controlling. Other items like different prices for international goods also will not be touched in this article because again they are motivation of international projects (for example to move production to low-salary-countries) and not controlling technique. A lot of more points like customs, international financing or international risk-sharing could be mentioned: again we can evaluate it as project motivation not as technique of controlling.

In this chapter we will follow the flow of project management from the first project decision till the last report about the reached project success in order to identify the important stops where internationality needs to be observed and analyzed in a special way. We will stop and have a deeper analysis in this essay, if the project controlling will be affected. Controlling tools like reports, balance sheets or business cases will be analyzed. These described stops consecutively numbered from A. till F. then will be used to structure the detailed work in chapter 3.

Project controlling starts with decision taking after the ideas for a project grew (Wetekamp, 2016, Page 183 – 236). After the initiation of a project decision taking is the first filter in which from my experience 90 % of project ideas die because of a missing high probable economic success. The economic background of project decisions is caused by internationality and therefore we care about (A.) business cases in international project management.
Part of an economic decision is the international tax slope. These tax-differences themselves are important for projects (Wehrheim, 2007, Page 548) but as mentioned above it is one motivation to start international projects and because of this we will not discuss it further. But the (B.) influence of taxes on WACC (Weighted Average Costs of

Capital) has to be analyzed in controlling because we need to find the right WACC to do the right decisions.
Still in the beginning of Project Management we have to plan the project. For this we need to understand the problem of (C.) different currencies within one project and (D.) inflation in different countries (Wehrheim, page 501 ff.).
After project start we care about forecasting and counter steering but these actions are in general the same in national or international projects. The content of forecasting e.g. is different (for example different exchange rates) but these differences we will discuss in C. and D. and not alongside the controlling steps like planning or forecasting.
During the project we collect services from our international acting enterprise and we need to charge fees for these cross-border-services in order to fulfill rules of international bookkeeping and taxation. Transfer prices are defined as the price for internal cross-border-services. So we have to use (E.) transfer prices between our international parts of our enterprise within the project – Transfer prices have influence on cash out (taxes) and therefor on our project success.
At the end of a project we need a good reporting but as mentioned above the affected issues (currencies, inflation) if we analyze in other chapters already – a good reporting in general does not differ in internal national or international reports. But one special report is very much affected by different national rules: the F) valuation of our project investment in our balance sheet. There are a lot national differences in bookkeeping which causes the need to book in two dimensions: national law and law of headquarter.

(A.) Business Cases in International Project Management
(B.) Influence of taxes on WACC
(C.) Different Currencies within one Project
(D.) Inflation in Different Countries
(E.) Transfer Prices between our International Parts of our Enterprise
(F.) Valuation of our Project Investment in our Balance Sheet

3. The Toolbox of Economic International Project Management

Based on the above deduced agenda we will focus now in detail on the influence of internationality on project controlling.

3.A Business Cases in International Project Management

A Business Case (BC) is a "money-picture" of a project. It shows the financial outcome of a project and is needed to evaluate and adjudicate upon the project from a financial point of view. If the project starts and finishes in a narrow time frame of a few days or weeks like managing an event we can just add plusses and minuses of cash and if the positive result is huge enough we can perform the project. In business life projects have often a duration of several years or after we finish a project it has a long duration of harvest time. In this case we cannot add Euros of this year with Euros in 20 years so we use NPV-Calculations which take into consideration the different value of money in different years. (Kruschwitz, Lutz, p. 52 ff; Hax, p. 9 ff, 1993).

In this chapter we want to discuss two of three aspects of international Net Present Value (NPV) Calculations which is the influence on WACC and the data quality. "Aspect three" (taxes) will be discussed in chapter 3.B.

WACC in International Projects

The Cash of each period (C_t) is discounted with the interest rate "r" as an opportunity interest rate of the company. First we need to describe in a few sentences what WACC means:

- Expressing the costs of capital of the company
- calculations for capital costs as one of the cost types for complete calculations for prices of products and projects
- Target setting for companies for Earnings before Interests and Taxes (EBIT) (by multiplying with the used capital)
- Expressing the minimal internal target for all activities/projects of the company
- calculation rate in NPV

- Based on opportunities of capital allocation (inside out) and shareholders expectations (outside in)

(Wetekamp, 2016, p 114)

The calculation of WACC normally is calculated as the average interest rate between equity and loans of a company. We can add a surplus for risky businesses and a surplus for business abroad. So we get this formula:

$$\mathbf{r = WACC = i_E * a_E + i_C * a_C + z_a + z_r}$$

with

i_E = expected interest on equity

a_E = share of equity

i_C = expected interest on credits

a_C = share of credits (by $a_E + a_C = 1$)

z_a = extra charge for investments abroad

z_r = extra charge for risky investments

Based on the experience of the author international companies use tables created by controlling department for providing "z_a" to all departments calculating projects. As an example: the stable Switzerland gets a $z_a = 0$ % and Greece gets a $z_a = 4$ % which means, that projects in economic dangerous countries have to perform on a higher level than in low-risk-countries. So the way to adjust WACC is to evaluate the needed "za" of your project.

Data Quality

To be successful it is not enough to "paint" a wonderful BC but after the decision and the years of acting the figures should come true. So the reality is important – the business case is just supporting decisions. Therefor it is important to secure the business case already before the decision to be able to say "the business case will happen as we calculated!" If you want to add value to your company in reality (the NPV) you have to make the things happen.

If you take decisions not only in your home country but for projects around the world you would fail if you just copy the business case for example from Germany to Russia or to Africa. The conditions are worse or better – the bribery is high – the conditions must be "forced" to happen – so to be successful (Wetekamp, 2016, p 205 - 220).
We try to extend the NPV-Model by a toolbox which helps in international markets to reduce risks and increase the probability to achieve the targets. The component of gambling we will not accept or include – our target is to reach the named target. The prices for additional chances are additional risks. This is not our way – we want to secure and fix the business case with the following tools:

- **Hedging**
- **Fixed prices on purchase market**
- **Variable prices on sales market**
- **Connecting targets of the project with the bonuses of the leaders/team/manager…**

Hedging

In a business case there are a lot of uncertainties you cannot predict because they are not in your hands. In international controlling this is for example the exchange rate between currencies, the price of Energy on the international markets or the raw material for your production. It is important to find out the most likely shape or value of this position but still it might go a way we didn't expect and this may damage our business. Once again: it is not our target to gamble. We need to secure the business.

Hedging is defined as a future or forward transaction, where you buy now or later for a fixed price of your "planned value" the needed position. There are partners with the opposite problem and we can come together and reduce the risk (and chance on the other side) by fixing the condition for example of exchanging Dollars to Euros right now. Example: you want to earn money in US and send the profit exchanged in Euros to your headquarter / owners. So in future you have dollars but you prefer Euro. There is another market partner on this world like apple that wants to sell iPhones in Germany and wants to transfer the profit to US but not in Euro but in Dollars. Now you can have

a deal between the partners: “let’s fix the exchange rate and we agree to exchange the amount of X Mio Dollars/Euros applying the agreed exchange rate.”

In reality huge banks have own platforms for this hedging and the partners do not know each other. The bank takes fees for the usage of the platform. The fee for the bank we include to the business case.

Fixed prices on purchase market

Our projects are situated between two markets. We buy goods and services on the purchase market and sell our project good on the sales market - and in these times the purchaser (spending money…) is the stronger partner on markets. It is much easier to spend money than to gain money… the power of a buyer you can use to agree fixed prices for example to build your headquarter with an international building company or you fix the price for Chinese IT-equipment and maintenance for the next 5 years already now. So you move inflation, risks, changing exchange rates and all you can imagine to the seller.
Buy in huge components or assets including maintenance or buy a service instead of having own employees and fix the price in pre-contracts before you decide the business case.

Variable Prices on Sales Market

As described it is very difficult to move risks to your buyer on the selling market. Our selling market is the purchase market of our partners and they behave like we described on the last page. They want to fix prices. For our project it is better to move our occurring risks via variable contracts to our buyer (and keep the chances on our side). If you for example sell a project result based on chemical goods abroad and this product you sell consist 90% out of oil, you should convince the buyer that the whole market with oil will go up and down in the world and he/she has to react accordingly and pay less and more to you. You have to convince that a fixed price might lead to additional losses (if oil is getting cheaper for competitors). There is no other way than convincing.

Connecting targets of the project with the bonuses of the leaders/team/manager

Till now we cared about concrete measures to have better data in the business case. What we discuss now is to **achieve the set targets in a better way**.
Background: a project will be discussed intensively during the decision phase while creating a BC and after this the attention towards the BC is shrinking. Especially in international projects the distance between project manager and owner of the company might be high. The impact of the project manager to manage the project successfully is high and if we connect the figures of the business plan to her/his salary we can observe a high motivation to achieve the targets. In international business we have a huge information gap between headquarter and local project participants in all involved countries. We can motivate the participants by motivating bonuses.
With this you also assure that the business case is calculated again at the end of the project based on actual figures to really compare and evaluate the target achievement.

3.B Influence of taxes on WACC

As mentioned above taxes can be the motivation of international projects. Some projects happen only to move business to tax havens in order to save taxes. “Business goes global, taxes stay local”. We will not discuss this further because we want to concentrate on the influence of taxes to the toolbox of international project controlling. Referring to this aim we have to look again to the influence of taxes to WACC in NPV-Calculations – so in project decisions.
The NPV is based on an alternative possibility to use the money for example on the capital market. It mirrors the project with the possible profit elsewhere. This is what we call “r” or WACC (see chapter 3.A). Now if we include taxes in our calculation we also have to keep in mind the taxes for opportunities. We have to pay taxes as well on interests for spending our money on the capital market. So “r” we could get on the market but it has to be reduced as well by taxes. So in case of e.g. r = 0.1 and a tax rate of 20% we have to reduce “r” down to 0.08. This effect is call “interest effect” and it increases the NPV of projects because a reduced “r” increases discounted values.

We have to use in our calculation the WACC based on the taxes of the headquarter because the decisions of alternatives are located in the headquarter and profit of international projects is distributed to the headquarter (Wetekamp, 2016, p 201).

3.C Different Currencies within one Project

International project management leads normally to different currencies in our project (exception: international projects in Euro-zone). Permanent changes in exchange rates deform the results of reporting and mislead analysis, evaluation and steering of the project. If we find out exposure (volume of foreign currencies) and risk-lever (volatility of exchange rates) we can evaluate the influence of different currencies and their exchange rates to our project (Macharzina, 1989, p. 195; Wetekamp, 2016, p. 70 -76). Reporting at first will normally be done in the leading currency of the Enterprise so we have to convert all other currencies into one. If we just convert every figure of the international reporting with the current exchange rate we might face this sample situation: Target in Euro is +90 for a special part of your project – this part will be performed in US and has a value of +100 US Dollar and +100 was really achieved in US-Dollar one year later. But the exchange rate changes the achievement from +90 Euros down to +80 Euro. Solutions were evaluated/given by Lessard/Lorange (1977, p. 630)

Rate Used for Translating Budget	Rate Used to Translate Actual Performance for Comparison with Budget		
	Initial (I)	Projected (P)	Ending (E)
Initial (I)	(II) Budget at Initial Actual at Initial	Budget at Initial Actual at Projected	(IE) Budget at Initial Actual at Ending
Projected (P)	Budget at Projected Actual at Initial	(PP) Budget at Projected Actual at Projected	(PE) Budget at Projected Actual at Ending
Ending (E)	Budget at Ending Actual at Initial	Budget at Ending Actual at Projected	(EE) Budget at Ending Actual at Ending

Lessard/Lorange-Model

PP seems to be the best solution because:

- Planning and realization have the same exchange rate
- We can take measures to secure the PP rate for the actuals (look at chapter 3.A Hedging)
- The costs of realizing the PP exchange rate (hedging) can be evaluated, included into planning and then be realized
- Fair and transparent because known in the very beginning
- Automatically in line with risk management (fixing the profits, no gambling component)
- Forces to agree a strategy together "international subsidiary and headquarter" to hedge. Recommendation: project management in headquarter should hedge (professional, users of the result, counteracting cases might occur in headquarter)

In international project management we have to agree the used exchange rate between currencies upfront in order to be able to steer the project without influences of changes in exchange rates.

3.D Inflation in Different Countries

Inflation rates might differ and deform results and mislead analysis, evaluation and steering (Macharzina, 1989, p. 195). We have to react not to achieve "paper profits", deformed figures and incomparable results.

In general Inflation is incorporated in exchange rates. Ceteris Paribus an inflation of 10 % in relation to a country with 0 % should be visible in an exchange rate which compensates the 10 % completely (so also 10%).

In detail you have to react: e.g. If you bought a good for 100 X (X = currency) half a year ago with the intention to sell it for 120. But now after half a year in a high-inflation country you can sell it for 150 because of inflation and you have paper-profits of 30 X. If you send these profits to owners via dividend you lose substance of your company, because you would need e.g. 130 to do the next deal and you have only 100. To compensate this problem of different inflation rates in Projects you need to analyze every position of you project in relation to inflation abroad. You have to identify paper profits and keep this volume in the project – or in reserves of the performing company.

Don’t allow customers or even shareholders of your company to take these paper profits – if they do you will lose substance in your company because you are not able to buy the goods “after inflation” on the same quality level.

3.E Transfer Prices between our International Parts of our Enterprise

The background of transfer prices: If we have internal services, products or management contingents which are exchanged between international acting parts of an international project we can (or have to) find prices for them to picture them in bookkeeping (Macharzina, 1989, p. 2077). Internal services within one country and one project and one company we are not allowed to take it into consideration in bookkeeping. If we have internal services, products within the international project in different countries, we have to book this value (Macharzina, 1998, p. 195). The principle to evaluate them is the “arm’s lengths principle” what means we have to find prices we would have between not so close related partners – so market prices.

If you follow the arm’s lengths principal you still have some “space” in the valuation. If the situation is like this that the headquarter is located in a high tax country and the project contributing part is located in a low tax country it is better to move expenditures to the mother company to avoid taxes there. According to the double-tax agreement the high profit of the subsidiary can be captured in the headquarter with low local-subsidiary-tax – meanwhile the profit (high taxes) in the headquarter is low. Tax authorities check this almost every year so it is important to be in line with the rules. Strong intentions of the headquarter to reduce the over all tax rate should not lead to unsound actions.

3.F Valuation of our Project Investment in our Balance Sheet

We call the local balance sheet (and profit and loss account) in every involved country BS1. The balance sheet and profit and loss account according to the legal frame of the headquarter we call BS2. We need a harmonized project reporting in which the differences between the leading BS2 and BS1 are eliminated. Differences might be in variations of costs of kind for manufacturing costs or different durations of useful life or local opportunities of lower taxation. BS1 is needed to fulfill local needs like taxes, decisions in the supervisory board and calculating the dividends. BS2 is needed for the reporting in the concern – their supervisory board and their decisions. Keep in mind the correction backwards in the next year! All projects – especially at the yearend – have to be analyzed in relation to these possible changes to create a right reporting on both levels of reporting.

4. Summary

Successful international project controlling means to steer a project to the defined goal. Internationality causes a lot of new aspects we need to get under control in controlling. We cannot explain to our steering committee or to our clients that the difficulty of internationality was the reason of our project failure. Project management in general remains the same – but the brunch of possible problems like changing currency rates or tax deviations need to be taken into consideration in addition. International project controlling is more ambitious than national project controlling. It is like NY: if you make it there you make it everywhere.

The necessity of an adjusted project-controlling-organization in the frame of internationality will grow with the share of international projects in relation to national projects.

Literature

Alexander, D., Britton, A., Jorissen, A., (2007), Global Financial Reporting and Analysis, Delhi, Cengage Learning

Hax, H., (1993) Investitionstheorie, Heidelberg, Physcia Verlag

Higson, A., (2003), Corporate Financial Reporting, London, SAGE Publications

Horváth, P., (2006), Controlling, München, Vahlen

Kruschwitz, L., (2007), Finanzierung und Investitionen, München, Oldenbourg

Lessard, D., Lorange P., (1977), Currency Changes and Management Controlling: Resolving the Centralization / Decentralization Dilemma, in: The Accounting Review, P. 628 – 630

Lück, W., (2004), Lexikon der Betriebswirtschaftslehre, München, Oldenbourg

Macharzina, K., Welge, M., (1989), Handwörterbuch Export und Internationale Unternehmung, Stuttgart, Pöschel

Messner, W., (2001), The Practice of Cash Pooling, http://www.globusresearch.com/download/messner_cashpooling_bit_2001.pdf

Wehrheim, M., (2007), Steuerbelastung – Steuerwirkung – Steuergestaltung, Wiesbaden, Deutscher-Universitätsverlag

Wetekamp, W., (2016), Lecture "Controlling Global Business Operations", Dortmund, University of Applied Science Dortmund

Wirtschaftslexikon.co, Internationale Projektfinanzierung, Aktualisiere Ausgabe (2015), http://www.wirtschaftslexikon.co/d/internationale-projektfinanzierung/internationale-projektfinanzierung.htm

Ziegenbein, K., (2007), Controlling, Leipzig, Kiehl

FEATURES OF THE APPLICATION AGILE & SCRUM METHODOLOGIES IN MEDIA MONITORING

Yavorskyi Mykhailo

mykhailoyavorskyi@gmail.com
Master student
Kyiv National University of Construction and Architecture
31 Povitroflots`kyi ave., Kiyv, Ukraine, 03680

Abstract: Among the companies that provide majority types of different services or goods, media analysis is growing increasingly popular nowadays. The advantages of applying Agile management and the Scrum management framework into the sphere of media monitoring are discussed. The adaptation of the methodologies into the media monitoring company is demonstrated.

Keywords: media monitoring, Agile, Scrum, media analysis, Big Data

1. Introduction

The media monitoring is an analysis of potential as well as real impact of media products on society. Companies, which work in media monitoring sphere, provide services to monitor and analyze the information field of a particular company, person, or brand. The key element of the company's development and its attractiveness to new customers is the victory in tenders. The latter translates into rapid and qualitative test monitoring and creation of a test report. Typically, carrying out a test project takes substantial amount of time and labor resources of the company. During this type of projects, a customer frequently adds new requirements, which need to be responded. Therefore, the result of the tender depends on how quickly and qualitatively the test project will be performed.

2. Reasons and benefits

Since monitoring and analysis is carried out in the digital field, the implementation of Agile methodology and the Scrum management framework are the

most appropriate and optimal. Agile is an iterative method of managing the design and build activities of engineering, information technology and other business areas that aim to provide new product or service development in a highly flexible and interactive manner. Scrum is a set of principles on which the development process is built upon, allowing the hard-fixed and short-term iterations (called “sprints”) to provide the customer with a ready-made test monitoring result. At the same time, a strictly fixed, short duration of the sprint gives the process of monitoring and media analysis predictability and flexibility. The introduction of the methodology for running test projects will significantly increase the company's potential, by raising the amount of simultaneous test projects without enlarging of analysts teams. This will allow reorienting the priorities of the projects to communication with the client, responding to changes, benchmarking and, as a result, to short the time and improve the overall quality of the projects.

3. Application of Agile & Scrum

The key feature of the application would be a minimum number of sprints (one or two). Defining elements of Scrum are roles, artifacts, processes, and retrospective. In the media analysis roles are distributed as follows:

- The owner of the product is the head of the analyst department;
- Scrum Master - Head of the Analysts Sector;
- Team - analysts who work on the project.

The essential documents are the product backlog – requirements & conditions for monitoring and analysis along with description of the cost of the provided product and sprint backlog - the tasks that are put before the analysts to complete the project.

Scrum-processes in media monitoring include the following functions. The “scrum - meeting” process focuses on synchronization of the team members’ activities, a free report of each member of the team is provided. This report answers the questions about what was done, what kind of problems arose, and what are the following steps for next scrum - meeting. The peculiarity is that the greatest preference is given not so much to live communication as to the use of corporate messenger. Sprint planning is the creation of a sprint backlog by the scrum master and its approval from the owner of the

product. Sprint review is a demonstration of the final product to the owner of the product and making possible changes before sending it to the client.

Last but not the least, important practice for the team is retrospective. Due to the small number of sprints and team members, its duration is short. It discusses issues, like what was executed well, where problems or questions arose with the team, what could be improved. Retrospective mainly concerns an online platform, where the media analysis takes place, commentary on the skills of team members and actions to amass the best experience from project.

4. Results and Conclusion

The modern and progressive nature of Scrum make it possible to use their potential not only for the software development, but also for making different IT products. With a certain adaptation, they can serve as a good assistance tool in other IT industries, especially Big Data. This work demonstrates the application and practice of Agile and Scrum in the field of media monitoring. The most significant benefits are increasing the company's capacity with participation in tenders, self-organization of analysts, fostering the total number of projects implemented, and significant escalation of company's competitiveness on the market.

5. References

[1] Agile Project Management with Scrum [Book] / auth. Schwaber Ken.

[2] A Practical Guide to Seven Agile Methodologies [Online] / auth. Rod Coffin Derek Lane. – http://www.devx.com//architect/article/32836/1954

[3] Prioritizing Your Product Backlog [Online] / auth. Cohn Mike. – http://www.mountaingoatsoftware.com/system/presentation/file/127/Prioritizing-Product-Backlog-Cohn-ADP2010/pdf

Issues Related to Implementing Project Management in IT Sector

Bilal Khalid

bilal_khalid47@yahoo.com
Dortmund University of Applied Sciences and Arts
Baroper Strasse 335, 44227 Dortmund, Germany

Abstract:
The importance of project management and its practices cannot be over-emphasized. Companies tend to follow a structured approach to achieve their goals and targets. Some companies had successfully implemented project management culture in their organizations but many are still in the beginning phase. This article highlight most important critical success factors needed for implementing project management.

Keywords: Project Management, Project Management Implementation, Critical Success Factors, Project Culture

Methodology

The methodology of this research paper is based on the following parameters, which are as follow;

- Most of the data and information is collected through extensive literature review
- An open ended questionnaire was prepared as a frame of reference in order to conduct expert interviews

Practical implications

This research paper can be useful for the companies who are in the process of implementing project management. This study can also be useful for the research scholars and practitioners in the area of implementing project management.

1. Introduction

The importance of project management can be analyzed by seeing by the presence of project management specialist in each organization either it is small, medium or large company. Effective utilization of project management helps companies to maximize their output or returns by utilizing the same amount of resources. Project management also helps in developing the productivity in employees. Project management helps in systematic timely completion of projects usually; it starts from setting the goals and defining objectives of the project till the end of successful project delivery. Project manager must be able to understand measure and monitor the issues arising during project (1).

According to the statistics, projects management is in high demand now a days and its utilization will expand in the coming days. Project management is a broad term and often referred to a

methodology covering mixture of techniques, process, methods and strategies. The main purpose is to minimize the probability of loss or failure for any given project (2).

2. Why Project Management is Important

Project management is important for organizations in a number of ways and some of them are discussed. Organizations are getting more and more project focused and they think more on the delivery, goals and successful outcome of the projects instead of schedule and working according to the clock. All the businesses need good project managers who can communicate really well throughout the project life cycle and keeping all the project stakeholders intact. Organizations are getting more and more project focused and they think more on the delivery, goals and successful outcome of the projects instead of schedule and working according to the clock. All the businesses need good project managers who can communicate really well throughout the project life cycle and keeping all the project stakeholders intact (3).

Organizations are getting more and more project focused and they think more on the delivery, goals and successful outcome of the projects instead of schedule and working according to the clock. All the businesses need good project managers who can communicate really well throughout the project life cycle and keeping all the project stakeholders intact. Planning and structuring the whole plan holds the upmost importance. Companies give importance and value those managers who have the ability to plan and execute the tasks within the decided timeline. Project management is about making things simple, understandable and clear. Project management helps to make business simple, making things complicate and confusing do not lead to the desired outcomes. Project management assists the managers in implementing and formulating development strategies and ensuring high level of efficiency (4).

Quality, budget and time are the three things, needed to handle on daily basis. No doubt confidence and support of management is very crucial and expedite the issue in the event of crisis (5). Literatures have shown that there has always been a conflict in the above mentioned dimensions. Project management is about how effectively and efficiently you are handling your projects, it can be proactive or reactive. Some organizations really do not understand the benefit of project management and often consider it a big investment or too much complicated (6).

Several studies in the area of implementing project management revealed that companies usually develop a list of critical success factors. These critical success factors share some general patterns, which are listed below;

1. Clearly defined goals
2. Competent project manager
3. Top management support
4. Competent project team members
5. Sufficient resource allocation
6. Adequate communication channel

7. Control mechanism
8. Feedback capabilities
9. Responsiveness to clients

3. Importance of Project Management Implementation

Culture of project management has importance in many ways. In today's business environment competition is getting tough and complex; companies need more reliable approach so that they can better survive. According to Eric Verzuh, companies that follow consistent approach for managing projects are better able to complete 75% projects in given cost in contrast to those companies who leaves management practice to the perusal of individual project managers. Efficiency can be achieved by doing activities and task right. The focus is on the cost reduction, and shortening the duration. Standardizing the process helps to achieve efficiency. Project management assist in attaining effectiveness with a focus on doing the right activities and tasks. Effectiveness can also be increased by implementing multi project management process, methods and tools (7)

4. Results and Conclusions

Successful implementation of project management requires that organizations engage itself in project management practice. Defining the objective, goals and project scope in a clear way helps to avoid "scope creep" (8). Implementing project management is not always so easy. Change management and stakeholder management are one of the major hurdle and obstacle for implementing project management in a company culture where the maturity level of project culture is low. It is very hard to deal with the mind and thinking of people, because people seldom accept change. Any new change will be considered as a threat to their power and status.

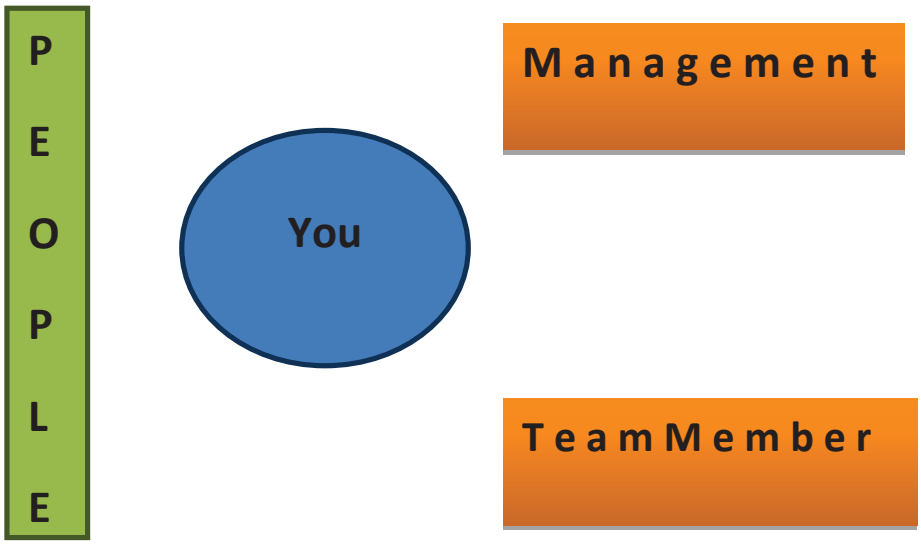


Figure1. 'You' as critical success factor

All the respondents who were requested to fill the questionnaire pointed out change management and stakeholder management as the most critical success factor in implementing project management. The respondents also agreed that the project manager who is acting as a change agent is also considered as a critical success factor. The results of the implementation are dependent on his approach that how he handles and issue and environment.

Appendix A (Questionnaire)

I am a student Project Management and currently doing European Masters in Project Management. As a mandatory part of my degree, I am writing a project thesis on "Implementing Project Management in IT Sector". All of your responses and opinions would be strictly used for research and academic purpose only. Your participation would be highly appreciated.

1. Gender ☐ Male ☐ Female
2. In which main sector have you worked? _____
3. In the field of Project Management, how much experience do you have? _____
4. Are you a certified project manager? ☐ Yes ☐ No

   If yes, Please specify _____
5. Which standard does your company normally use? ☐ PMBOK ☐ ICB ☐ PRINCE 2
6. How important do you think is the implementation in Project Management?
7. Which tools and methods do you normally use for implementing Project Management?
8. What are the hurdles and obstacles in your opinion for implementing Project Management in a company?
9. What improvements in your opinion can be made for Implementation phase in order to make is more robust?
10. In your opinion which are most important critical success factors for implementing project management in companies?
11. What additional comments and opinions would you like to make, if any?

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5. References

1. *Critical Factors in Successful Project Implementation.* **Pinto, JEFFREY K. and Slevin, DENNIS P.** 1987, IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, Vol. 34.

2. **Majeed, Mehwish.** Why is Project Management Important in Business Industry? *Project Management.com.* [Online] April 03, 2012. [Cited: April 23, 2017.] https://project-management.com/why-is-project-management-important-in-business-industry/.

3. **Marvaniuk, Roman.** Quora. *Why is project management important for an organization?* [Online] 14 March, 2016. [Cited: April 23, 2017.] https://www.quora.com/Why-is-project-management-important-for-an-organization.

4. *Project management in strategy implementation - experiences in Slovenia.* **Hauc, Anton and Kovac, Jure.** 2001, International Journal of Project Management., pp. 61-67.

5. *"Implementation attitudes: a model and a measurement methodology", in Implementing Operations Research and Management Science,.* **Manley, J. H.** New York : Elsevier , 1975. pp. 183-202.

6. **Samadi, Michael.** Why is project management important for an organization? *Qoura.* [Online] March 12, 2016. [Cited: April 23, 2017.] https://www.quora.com/Why-is-project-management-important-for-an-organization.

7. **Dechange, Andre.** *PM implementation .* Dortmund, NRW, Germany : s.n., 12 2014.

8. **Davis, B. and Wilder, C.** False starts, strong finishes —companies are saving troubled IT projects by admitting their mistakes, stepping back, scaling back, and moving on,Information. Nonember 1998.

9. **Anwer, Rizwan.** *Implementing Project Management in IT sector.* [interv.] Bilal Khalid. December Monday, 2014.

ANALYSIS OF ADMISSIBLE LIMITS FOR CHANGING THE PARAMETERS OF PROJECT PLANNING

Oksana Dunets[1], Carsten Wolff[2], Anatoliy Sachenko[1,3]

[1]o.dunets@tneu.edu.ua, [2]carsten.wolff@fh-dortmund.de, [2]as@tneu.edu.ua,
[1]Ternopil National Economic University
[2]University of Applied Science
[3]Silesian University of Technology
[1]11 Lvivska Str, 46020, Ternopil, Ukraine
[2]42 Emil-Figge Str, Dortmund, Germany
[3]ul. Roosevelta 26-28, 41-800, Zabrze, Poland

Abstract: *The importance of projects planning is substantiated and scheduling options are proposed. Limits of planning parameters are presented in three project states that enables to present an idealized project, use a search area of planning decisions index and planning accuracy rate. It can be used later as a set of rules for implementing the multi-agent system metrics for planning IT projects.*

Keywords: project planning, project triangle, planning parameters, idealized project

1. Introduction

Project Planning is a lengthy important process that functions as a part of project life cycle [1,2,3,4]. However, it is known that the project contains certain limits that are usually presented by project triangle restrictions (time, volume of work and the budget). It's actual therefore to expiry limits restrictions of planning parameters.
The authors proposed an agent-oriented approach [5] to solve issue of IT project planning, which represented by the structure, context diagram and modeled in the software package AnyLogic the multi-agent system for IT projects planning. The next step of this research should be a developing of a common metric for multi-agent system that aims to ensure that agents can operate. Such system will operate in project management environment during the planning process, where a significant number of scheduling parameters is occupied. To design metrics it's necessary to develop and argue the criteria of THE ADMISSIBLE LIMITS of planning parameters changes, in particular human, financial and time resources that are important in the project.

2. Proposed Approach

The limits of parameters changes in project life cycle have to pass the planning stage [5,6]. Therefore, the authors have established the necessity of developing and substantiating the criteria of the admissible boundaries of parameters changes for project planning.
Parameters that have an influence on the project planning process are illustrated by Figure 1. In particular these include:

- PA – this is planning accuracy or admissible limits of planning parameters. Since is difficult to plan the project from beginning, so that there are no deviations, the parameter PA is presented as the smallest object;
- Search area of planning decision (SAPD) – the outer constraints of the project;
- Project triangle, which is in ideally must be equilateral, that is all constraints of project are satisfy the project opportunities . The sides of project triangle are: T (time) – project time; B - (budget) - financial resources of project; S (scope) - amount of work; Q (quality) – project

quality. Ideally, when these side are equal, it is considered that achieved excellent project quality and the project is ideal one.

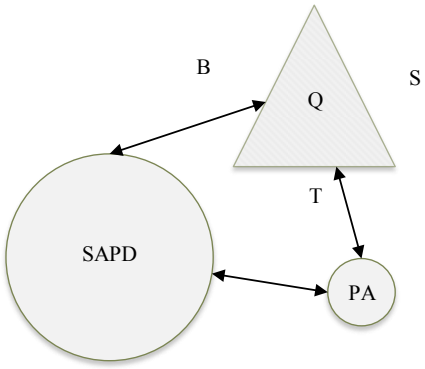

Figure 1 – Planning parameters

Figure 1 shows the initial stages of a project when there are some planned decisions are of there. In this case existing and possibly known external restrictions of the project and, of course, the desire to achieve the perfect project - an equilateral project triangle – a balance between the time, the work volume and project budget that provides a good project quality. The progress of the project during its life cycle presented in Figure 2.

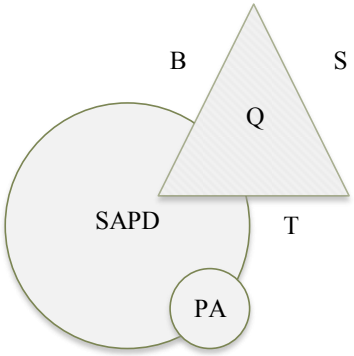

Figure 2 – The Changing of planning criteria at the beginning of the project

As can be seen from Figure 2, objects are interacting tightly with each other. The external factors begin act to accuracy of planning and also to constraints of the project.

During its life cycle the project can be in different states to word the objects which are presented in Figures 1 and 2. Besides the project manager, project team try to align the project restrictions, outside influence and planning according to their requirements, needs and opportunities.

The Figure 3, demonstrates an idealized project, when the project is equipped with everything we need. There are obviously that such kind of project are liked by the all managers and projects leads.

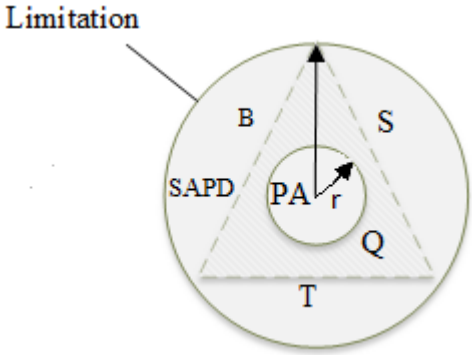

Figure 3 - Idealized project

The two new variables:

R - is the search area of planning solutions;
r - is the index, representing the accuracy planning.
We are considering the difference of two data values as a change in the planning parameters.

4. Results and Conclusion

Analysis of the project parameters considered that achieving the perfect project is a difficult task. Thus considered planning parameters enable to form a set of rules for implementing the metrics of multi-agent system for planning the IT projects using the search area of planning solutions indexes as well as planning accuracy rate.

5. References

[1] M. Conroy: Planning process influences on sustainability in Ohio township plans. Journal of Environmental Planning and Management 59.11, J. Hee-Jung, pp. 2007-2023 ff, (2016).

[2] P. Healey: Foundations of the Planning Enterprise: Critical Essays in Planning Theory. Vol. 1. Routledge, pp. 540 ff., (2017)

[3] E. Tesfay: Key project planning processes affecting project success. International Journal for Quality Research 11.1, pp. 159-172 ff, (2017).

[4] E. Karen: Strategic planning characteristics applied to project management. International Journal of Project Management, Papke-Shields, M. Kathleen, pp. 169-179 ff., (2017)

[5] PMBOK Guide, P. M. B. O. K. "A guide to the project management body of knowledge." Project Management Institute. Vol. 3. 2004.

[6] O. Dunets: Application of multi-agent simulation for planning IT projects. Materials of XII International Scientific Conference "Project Management: Status and Prospects", A. Sachenko, pp. 55-56 ff., (2016)

Impact of Risk Management Measures on Project Success in IT Projects

AKINYEMI, Lateef Olayinka

lateef.akinyemi001@stud.fh-dortmund.de
University of Applied Sciences and Arts Dortmund
Faculty of Business Administration
Emil-Figge-Straße 44
D-44227 Dortmund

Abstract: *Many organizations apply IT to advance in the changing business environment to have an edge in the competitive market and to unify their business which in turn lead to different types of IT risks. This study evaluates the impact of risk management measures on project success in IT projects. This research focuses on IT risk management measures used for assessing and mitigating IT risks leading to successful IT projects by considering various approaches to IT risk management in literature. The aim of this study is to develop an effective IT project risk management (ITPRM) process that will serve as practical guidelines for IT project managers for managing IT risks identified within IT projects. The Correlation coefficient was used to confirm the hypotheses while t-test was used to test the significance of the hypotheses. The research findings reveal that there exists a strong impact of IT project risk management measures on IT project success. The findings also reveal that technology tools, multiple risk assessments, documented ITPRM Strategy, and Financial investment are the key success factors that contribute to the success of IT projects.*

Keywords: ITPRM, IT project, IT project risk, IT project success

1. Introduction

IT projects such as IT security, network, IT procurement, system integration, software development, etc., contribute to the smooth operations and management of any organization. Many organizations apply IT to advance in the changing business environment to have an edge in the competitive market and to unify their business and this has induced different types of IT risks. Different risks are involved while initiating software or IT projects (e.g. Budget overruns, time, massive rework, etc.). Barry W. Boehm [1] outlines the main reasons for implementing IT project risk management: (a) Preventing budget overruns and schedule slips, software project disasters, wrong functionality, reliability shortfalls and operational failures that can lead to abandoning of the IT project before or shortly after delivery. (b) Avoiding massive rework caused by unclear requirements, design or code, poor quality, etc. that can use up 50% - 60% of the total cost of IT project development.

Some of these reasons (i.e. unsatisfactory outcome) create a high-level checklist for determining and evaluating IT project risk items. IT Risk management is generally considered as a planned process for controlling IT risks which resulted in monitoring the success of IT project by analysing and making decisions on possible risks in IT projects. IT Risk management is becoming a more important process in managing IT projects due to the factors affecting IT project success. Deciding the time and budget limits and stating clear requirements occur at the initiation phase of the project when risk is at its highest [2] and setting realistic limits for time, budget and goals may not be possible, particularly in IT project. The traditional view of project success, delivering on time, within budget, and according to requirements, concentrates more on the interest of the vendor/supplier, and not on the customer [3]. The traditional definition of

project success is still very much accepted in reports on IT project success and its connection to risk management [4].

Project success cannot be completely measured correctly by comparing time and budget limits predicted and set at the initiating phase with actual values of the time and budget limits at the end of the project. From this research work, the conditions for IT project success can be grouped into three components: value delivery, management of IT risk and managing project relationships. Delivering value (e.g. functionality, reliability and operational) by avoiding schedule slips, budget overruns, managing scope/quality and understanding the business and organizational interest which requires managing IT project relationships and risks by ensuring stakeholders expectations are met regarding what, when, and how is delivered.

The IT projects failures occur far more often in that the societal and business costs of these failures are estimated in billions of dollars yearly [5]. The problem worsens as IT grows tremendously in large and small companies, non-profit and governmental organizations. IT project failures have endangered many organizations' prospects and this failure in the governmental organization can endanger the national security of that nation. However, the general problem was that large number of IT research have been carried out on IT risk management; yet, unsuccessful in terms of meeting the practical needs since most IT research focuses on discovering the IT risk factors affecting IT projects without drawing out the risk measures for controlling the risks and the aftereffects of the risks on the IT investment cost and value [6]. To determine how good IT projects are managed in relation to risk management, the following questions are stated: (a) Does the use of risk management measures influenced the IT project success? (b) Which measures of the IT project risk management can be ascertained as failure or success factors in IT projects? The general objective of this study is to develop an effective IT project risk management (ITPRM) process that will serve as practical guidelines for IT project managers for managing IT risks identified within IT projects.

2. Literature Review

Researchers have studied IT project success as a dependent variable, conceptualized as a multidimensional construct – system development management and IT project management. System development deals with various approaches and techniques for the improvement of IT projects that replace the old version of the business process. On the other hand, IT project management uses project management practices to improve IT project development.

2.1. Project Success in IT Projects

Agarwal & Rathod, [7]; Wright, [8]; Atkinson, et al., [9] evaluated IT project success/failure in three broad categories: (i) Time (tasks duration, project schedule, milestones, and deadlines); (ii) Cost (project cost, suppliers, external contract, or project's materials); (iii) Performance (scope, quality, standard, or specifications). Based on stakeholders' perspective, the IT project cannot be considered successful based on time, cost, and performance. The different views of what form a project success are due to different motivation and perspectives from senior management, IT project manager, software developers, and users [10, 11, 12, 13, 14, 15].
Prifling, [16] divided the definitions of IT project in literature into two viewpoints – Efficiency and Effectiveness. According to his research, success is defined from the efficiency viewpoint by measuring management of IT projects in terms of budget, time, and quality requirements. While effectiveness is based on the overall project deliverable and performance in line with the strategic objectives and future business performance. Standish report, [17] defines software project success in terms of cost, time, and product performance [17, 16].

Thomas & Fernandez, [18] concluded that few amounts of literature examined the definition of what comprises IT project success in practice. Therefore, many studies focused on examining the rate of IT project failure, causes and establishing tools and techniques to improve success in IT projects. From the above definitions, IT project success can be viewed from customers' and IT developers' perspectives where the customer views IT project success in terms of quality, acceptable functionality of project's product, schedule, and budget while the IT developer views success as customer satisfaction, meeting market demand on time, reusability, maintenance of product and lesson learnt. In IT projects, success can be the combination of systems success and project implementation success [19]. Systems success is further divided into technical development, deployment to the user and delivery of organization/business benefits or into four dimensions namely: development process success, use process success, product quality, and organizational/industry impacts [19]. According to DeLone & McLean, [20], systems success can be separated into six dimensions consisting of system quality, information quality, service quality, user, user satisfaction and net benefits. System quality as a measure of success measures functionality, reliability, data quality, integration, portability, ease-of-use, flexibility and importance [21, 22, 23, 24, 25]. System use was measured in terms of usage time, frequency of use, dependency and usage pattern [22, 26, 27, 28, 29, 30, 20, 31]. Multiple success dimensions of information quality include relevance, completeness, accuracy, timeliness, and consistency [21, 23, 24, 25]. The success measures for the net benefits include consumer impacts, work group impacts, inter-organizational impacts, industry impacts and societal impacts [32, 33, 34, 35, 36, 37, 38].

2.2. Risks Affecting IT Projects

Risk in IT projects is defined in terms of risk exposure that pose as a threat or as a probability weighted impact in achieving the expected outcomes of projects [39, 40]. This definition formed the fundamental concept of risk management. The concept of Risk Exposure (RE) otherwise known as risk impact is express mathematically as $\mathbf{RE = P \times I}$ where P denote probability of an unsatisfactory outcome and I denote the impact of loss if the outcome is unsatisfactory due to budget overruns, schedule slips, poor quality, wrong functionality, and reliability shortfalls [39].

Risk management and information technology researchers on IT project risks based their major focus of research on two main areas - risk factors and risk management, with the development of different models for making decisions based on probabilities of occurrence and expected utility [41]. Boehm, [39]; Charette, [40]; Powell & Klein, [42]; Heemstra & Kusters, [43]; Keil, et al., [44]; Barki, et al., [45]; Simister, [46] focused their investigations on models in risk management process – risk identification, assessment, response planning, and monitoring. The models developed by the researchers are based on potential risk with the discrete event, non-zero probability of occurrence and a measurable impact on the project which assumed that specific risks can be identified and measurable. In practice, evidence shows that project managers and IT project managers focus only on the impact of the risks ignoring the estimation of the probability of occurrence, likelihood, and control measures [47, 48, 49]. Unbalancing the impact and probability approach weaken the effectiveness of this approach of risk management.

The second area of focus by risk management researchers is the risk factors which is to develop checklists of risks to be considered during the planning phase and for managing IT projects. McFarlan [50], identified 54 risk factors, Boehm [39], developed a checklists of 10 risk factors, Schmidt, et al., [51], identified 53 risk factors, Addison & Vallah [52], reviewed 28 risk factors, Baccarini, et al., [53], identified 27 risk factors and the risk checklists are structured into various dimensional risks varying from three-dimensional to seven dimensional risk factors. In practice, the risk factor checklists serve as a tool for IT project managers but these checklists vary making it difficult to know the appropriate checklist to adopt for a given IT project [54].

Taylor, et al., [41] refine the 12-Dimension Radar Diagram (Risk Spider) in Wysocki [55] and the graphical models in Boehm and Turner [56] to develop a current version of Risk Spider

chart of 18 risk dimensions of IT project risk which was introduced into the risk reassessment process to bridge the gap between research and practice in IT project risk management. The current version of the risk spider chart categorised risks in 18 dimensions which includes criticality dimension (safety/mission criticality, external and internal visibility); uncertainty dimension (scope uncertainty, technology certainty, and change to business rules); complexity dimension (customization/configuration, data conversion complexity, application interface complexity, external project/process dependencies, and span of impact); size dimension (duration, cost estimate and team size); Project management maturity dimension; and stakeholder involvement dimension.

The development of the risk spider chart in the risk assessment process addressed the gap between research and practice in IT project risk management replacing the traditional probability-impact approach of assessing IT project risks. But the risk spider chart only serves as a tool in practice for IT project risk management under the risk assessment process without focusing more on risk mitigation methodology involving prioritization, evaluation, strategy, options, control implementation and control categories that are recommended from the risk assessment process. Identifying the IT project risks has been a great challenge for managers in the field of IT due to the numerous ways in which IT project risks are described and categorized [53]. Continuous changing of requirements by customer and poor production system performance were also rated high risks in IT projects due to lack of change management control process for quality and scope management. Other risks ranked in their survey include unrealistic expectations, incomplete requirements by client, diminished window of opportunity due to late delivery of software (due to rapid change in technology and dynamic markets), poor leadership, inadequate user documentation and lack of agreed user acceptance testing and signoff criteria due to communication gap on changes in scope and quality. The study provided valuable IT risk treatment strategies to manage the highest or medium risks in term of their likelihood and consequences by using a few project management processes such as communication management (managing stakeholders expectations and IT vendor relationships), scope/quality management (for defining IT project requirements, testing of vendors claims and acceptable functionality), and human resources management (staffing of experienced IT project manager, operational guidelines and personnel resources) under a categorized strategies of risk reduction and transfer. Still, the study provided no structural framework for IT risk management.

2.3. IT Project Risk Classification Framework

Many risks affecting the success of IT projects have heavily been identified by researchers in the areas of IT development and project management. Considering technology selection, consumers are faced with the difficulty of technology decisions due to many different types of information technologies and rapid change in technology [57]. According to Cochran [57], three high-level assessments - “standalone” product assessment, technical compatibility assessment, and technology survivability assessment should be considered before making technology decisions because practitioners make technology selection decisions based on the product and compatibility of the product with the existing technologies of the organization and the survival of the IT project’s product in the marketplace. Thorough understanding of these technology decisions helps to create better strategies assessment of IT risks and IT risk mitigation can be developed during the application of risk management when making decisions in IT projects. The IT risks identified in the literature are classified under the categories of environment risk, stakeholder management risk, requirement and schedule risk and project management risk [58].

2.4. Risk Management Strategies in IT projects

Alter [59] proposed risk management strategies for IT project risks: breaking down project into smaller manageable projects, creating simple solutions, development of satisfactory support, and meet user expectations. These strategies focused on technical risks, task risks, and

organisational risks without focusing on market risks that are important for IT project success. McFarlan [50] described two main strategies of risk management in IT projects – creating a project portfolio with different risks lists and using the project structure and technology as criteria for deciding which project risk management tools and techniques to use. McFarlan study focused on intra-organisational IT project risks leaving competitive risks that may arise from inter-organisational IT projects.

Alhawari, et al., [60], proposed a conceptual framework, Knowledge-Based Risk Management (KBRM) by using the knowledge management processes to improve the performance and increase the probability of success in information technology projects. The framework demonstrates the role of knowledge management processes in improving and assist the processes of risk identification, IT risk analysis, risk response planning, and execution which can be implemented to achieve IT project success. The risk management process in the proposed framework captured scope establishment, risk identification, and risk monitoring. The elements of knowledge management added to the risk management process includes – Knowledge-Based Risk Capture that forms the scope establishment that explains IT project targeted information system, identity, boundaries, environment, and its stakeholders' objectives. This clearly defines the scope of the IT project risk in terms of IT risk assessment. Knowledge-Based Risk Capture and Knowledge-Based Risk Discovery also form part of the risk identification process in discovering new IT risks.

Neo & Leong [61] classified risk management strategies into four categories – risk pre-emption strategy, risk reduction strategy, risk isolation strategy, and risk sharing strategy. The risk pre-emption strategy in IT projects secure an advantageous position over competitive actions that can hindered the success of the IT project and various tactics are used to prevent organisational risks [61, 62]. Risk reduction strategy reduces uncertainty in project with the increase of technical knowledge and information and the tactics adopted in this strategy include managing information search, expertise recruitment and project development. Risk isolation strategy is used in a situation where the IT risks cannot be reduced or pre-empted and the risk sharing strategy spread risk among key parties involved in the IT project. The tactics involved in this strategy include cooperating with other organisations, connecting to others systems, and co-opting key personnel [61].

2.5. Hypotheses

Based on the literature, the relevant hypotheses of this study are stated as follows:

(a) $\mathbf{H}_0$**:** There is no significant relationship between multiple IT risk assessments and IT project success.
$\mathbf{H}_1$ **:** There is a significant relationship between multiple IT risk assessments and IT project success.

(b) $\mathbf{H}_0$**:** There is no significant relationship between Risk control/mitigation methodology in Information Technology Project Risk Management (ITPRM) process and IT project success
$\mathbf{H}_1$ **:** There is a significant relationship between Risk control/mitigation methodology in Information Technology Project Risk Management (ITPRM) process and IT project success.

(c) $\mathbf{H}_0$**:** There is no significant relationship between investment in Information Technology Project Risk Management (ITPRM) and IT project success.
$\mathbf{H}_1$ **:** There is a significant relationship between investment in Information Technology Project Risk Management (ITPRM) and IT project success.

3. Research Methodology

The population of this research consists of small, medium and large organizations involving in IT projects. The target population in these organizations are the senior management/owners (who make decisions about the IT projects); Technical support personnel (computer specialists, data analysts, network, system, and application); IT system and application programmers; IT project managers/IT risk project managers; IT quality assurance personnel (who test and ensure the standard of the IT project); Information system auditors; IT consultants (who support customers in risk management); and Business or functional managers (who are accountable for the IT procurement process). The administration of this research was carried out using the research instrument, the questionnaire. The questionnaire consists of open-ended questions using the Likert scale (strongly agree = 5, agree = 4, undecided = 3, disagree = 2, strongly disagree = 1) divided into 2 sections, section A and section B. A total of 102 questionnaires were submitted out of the 150-distributed online. The responses collected was analyzed using correlation and t-test techniques.

Decision Rule

When $r \geq 0.70$ = very strong relationship,
$0.50 \leq r \leq 0.70 =$ strong relationships,
$0.10 \leq r \leq 0.50 =$ weak relationships.
The t-test is used to confirm or disproof the hypothesis postulated

Decision Rule:

1. When the tabulated t is greater than the calculated t, accept the null hypothesis (H_0) and reject the alternative hypothesis (H_1) i.e. $t_{tab} > t_{cal}$ = Accept H_0

2. When the tabulated t is less than the calculated t, reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1) i.e. $t_{tab} < t_{cal}$ = reject H_0

To find the critical value, the degree of freedom (df) is determined. The formula is n – 2. Since the number of variable options agreement is 5. That is df = n – 2 = 5 – 2 = 3.

4. Results

Table 1 shows the distribution of the respondents' personal characteristics – gender, educational qualification, years of IT project management experience, and project manager for an IT project. The data in table 1 shows that there are more male respondents 74(73%) than female respondents 28(27%). The distribution of the respondents by educational qualification in the table shows literacy level with MBA/M.Sc. 62(61%) as the highest, B.Sc./Diploma 31(30%), HND/Technical Certificate 1(1%), Ph.D. is 5(10%) and Prof. 3(3%). It is evident that educational level is high. This reveals adequate manpower and that the people are well educated in any standard both in theory and practical. Further examination of the table reveals that majority of the respondents 65(91%) have the experience of difference types of IT projects, thus, respondents have the requisite experience of difference types of IT projects to provide all necessary opinions regarding IT project risks.

From the calculation in table 2, the correlation coefficient is 0.8501. This shows that the relationship between multiple risk assessments and IT project success is not only positive, but very strong. The calculated t is 2.7960 while the tabulated t is 2.353. Since the table t is less than the calculated t, we

reject the null hypothesis and accept the alternative hypothesis. This confirms the statement that there is a significant relationship between multiple IT risk assessments and IT project success.

Table 1: Personal Respondents' Characteristics

	No	%
Gender of the Respondents		
Male	28	27
Female	74	73
Educational Qualification		
B.Sc./Diploma	31	30
HND/Technical Certificate	1	1
MBA/M.Sc.	62	61
Ph.D.	5	5
Prof.	3	3
IT Project Management Experience (years)		
0–1	3	4
2–5	27	38
6–10	23	32
11–15	15	21
16–20	4	6
Project Manager for an IT Project		
No	30	29
Yes	72	71

Source: author's field survey, 2016

In Table 3, the correlation coefficient is 0.9202. Therefore, it can be deduced that there is a positive and very strong relationship between risk control/mitigation methodology in ITPRM process and IT project success. Also, the calculated t is 4.0716 while the tabulated t is 2.353. Since the table t is less than the calculated t, we reject the null hypothesis and accept the alternative hypothesis. This confirms that there is a significant relationship between risk control/mitigation methodology in ITPRM process and IT project success. From the calculation in table 4, the correlation coefficient is 0.8447. Therefore, it can be deduced that there is a positive and very strong relationship between financial investment to support ITPRM and IT project success. Also, the calculated t is 2.7335 while the tabulated t is 2.353. Since the table t is less than the calculated t, we reject the null hypothesis and accept the alternative hypothesis. This confirms that there is a significant relationship between investment in Information Technology Project Risk Management (ITPRM) and IT project success.

Table 2: Correlation Coefficients for Hypothesis A

		There is a significant relationship between multiple IT risk assessments and IT project success
There is no significant relationship between multiple IT risk assessments and IT project success	Pearson Correlation (r)	0.8501
	t_{cal}	2.7960
	N	102

t_{tab} at 5% significant level = 2.353

Source: author's calculation based survey results

Table 3: Correlation Coefficients for Hypothesis B

		There is a significant relationship between Risk control/mitigation methodology in Information Technology Project Risk Management (ITPRM) process and IT project success.
There is no significant relationship between Risk control/mitigation methodology in Information Technology Project Risk Management (ITPRM) process and IT project success.	Pearson Correlation (r)	0.9202
	t_{cal}	4.0716
	N	102

t_{cal} at 5% significant level = 2.353

Source: author's calculation based survey results

Table 4: Correlation Coefficients for Hypothesis

		There is a significant relationship between investment in Information Technology Project Risk Management (ITPRM) and I.T project success
There is no significant relationship between investment in Information Technology Project Risk Management (ITPRM) and I.T project success	Pearson Correlation (r)	0.8447
	t_{cal}	2.7335
	N	102

t_{cal} at 5% significant level = 2.353

Source: author's calculation based survey results

The findings of this study reveal that there exists a strong impact of project risk management measures on IT project success. Based on the findings in this study, the following recommendations are made: (a) Investment in ITPRM should be spread across all IT staff through training and other forms of education, far beyond minimum in standard IT risk analysis techniques, in IT risk assessment, IT risk awareness, communication of IT risk analysis results, interpretation of IT risk assessment findings, reporting of ITPRM activities and action plan progress, identification of opportunities, implementation controls, and communication of lessons learned. Organizations should focus more on establishing effective and efficient ITPRM process to improve the maturity level in ITPRM process by continuous investments in ITPRM as the IT project risk profile continue to change due to pressure from the increase in emerging technologies. Concentration on investments in

ITPRM process will help to sustain its effectiveness, improve the maturity level and attain a high standardizes ITPRM process (b) Organizations should consider the existing ITPRM functions in terms of efficiency and effectiveness in relation to ITPRM standards (e.g., ISO 27005:2008, Risk IT Framework – ISACA, NIST-SP 800, COBIT 5, COSO, ISO 31000, OCTAVE, PCOI, ITILv3, etc.). In addition, more investments should be channel toward the advancement of ITPRM process when considering other standards to meet and exceed the growing expectations of customers and stakeholders (c) ITPRM process should be made dynamic due to new technologies and emerging IT project risks.

4.1. The Proposed Information Technology Project Risk Management (ITPRM)

The proposed Information Technology Project Risk Management (ITPRM) provides practical foundational guidelines for the development of an effective risk management for IT projects. The ITPRM process is divided into two sections. Section one is the Information Technology (IT) Risk Assessment Process and section two is the Information Technology (IT) Risk Mitigation.
The first section of the proposed ITPRM describes the primary component of IT risk assessment process and the output helps in defining IT risk assessment scope, IT project scope, and developing vulnerability list and plan controls as depicted in figure 1. The process starts with system/IT characterization, identify risk/threat, identify vulnerability, control analysis and finally, market forces/strategy.
The second section of the proposed ITPRM describes the primary component of IT risk mitigation process which involves prioritizing IT project risks, evaluation of the risks and implementing the control measures as recommended from the IT risk assessment process. This process reduces IT project risks to a level that can be considered satisfactory with little or no adverse effect on the overall goal or mission of the organization (see figure 2).

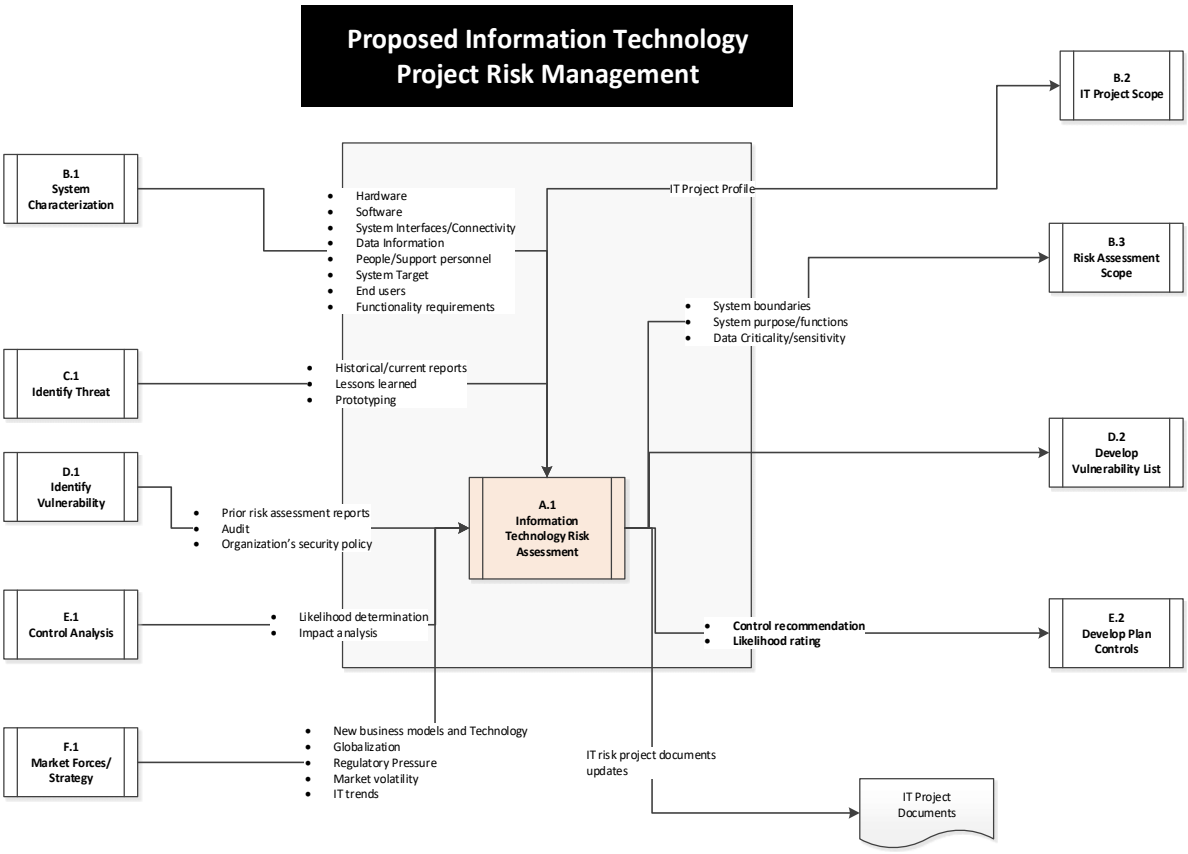

Figure 1: Proposed Information Technology (IT) Risk Assessment Data Flow Diagram
Source: Adopted from [63] [64]

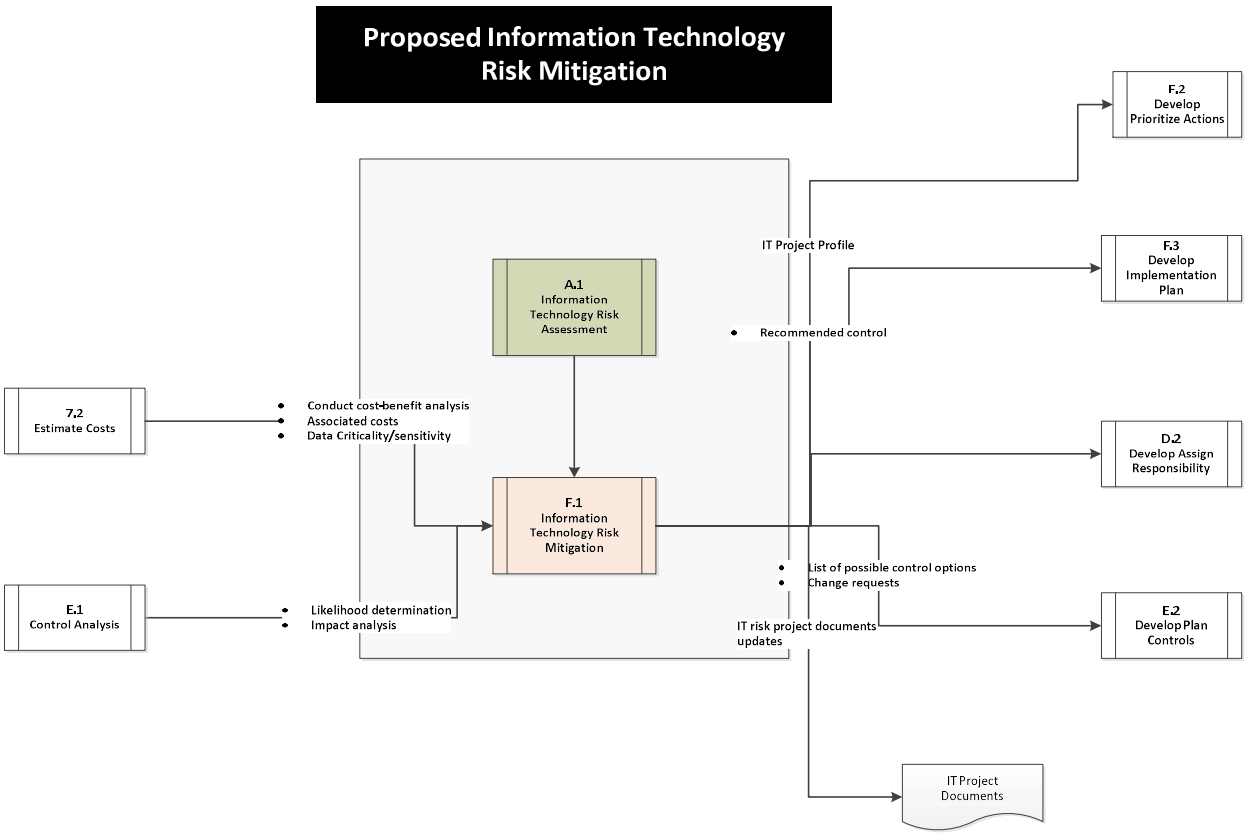

Figure 2: Proposed Information Technology (IT) Risk Mitigation Data Flow Diagram
Source: Adopted from [63] [64]

5. Conclusion

This research study investigated the impact of risk management measures on project success in IT projects. The problem studied in this research indicates the increase in IT project failure. Based on the findings, having a formal ITPRM does not does depend on the size of organizations. Emerging IT project risks created awareness for many organizations in the adoption of formal ITPRM on IT projects in defining and managing IT risk, establishing standard roles and responsibilities, strategies, policies and procedures, and charters.

Multiple IT risk assessments seems to be a driver for investment in IT project risk management, which focus on risk reporting and monitoring. Multiple IT risk assessments and financial investment in ITPRM clearly show that managing IT projects require continual development of ITPRM than the normal traditional projects since the outputs of IT projects are intangible and qualitative. Based on the test of the hypotheses, the strong correlation between multiple IT risk assessments and IT project success show that there is no permanent structure or organize ways to manage IT projects due to the different aspect of IT projects which calls for continual investment in IT project risk management and performing this, plays an essential role in achieving success in IT projects. The results of the investment in IT project risk management are well-defined roles and responsibilities of the IT risk function, clearly defined reporting, strategies, charters, policies and procedures.

Bibliography

[1] B. W. Boehm, Software Risk Management, NJ, USA: IEEE Press Piscataway, 1989.

[2] J. K. Pinto, Project Management: Achieving Competitive Advantage, 3rd ed., UpperSaddle River, NJ: Pearson - Prentice Hall, 2007.

[3] J. R. Turner and R. A. Cochrane, "Goals-and-Methods Matrix: Coping with Projects with ill Defined Goals and/or Methods of Achieving them," *International Journal of Project Management,* vol. 11, no. 2, pp. 93-102, 1993.

[4] The Standish Group International, "Standish Group," 1999. [Online]. Available: http://www.standishgroup.com/sample_research/index.php. [Accessed 5 January 2016].

[5] R. N. Charette, "W hy Software Fails," *IEEE Spectr,* vol. 42, no. 9, pp. 42-49, 2005.

[6] M. Benaroch, Y. Lichtenstein and K. and Robinson, "Real Options in Information Technology Risk Management: An Empirical Validation of Risk-Option Relationships," *MIS Quarterly,* vol. 30, no. 4, pp. 827-864, Dec. 2006.

[7] N. Agarwal and E. U. Rathod, "Defining Success for Software Projects: An Exploratory Revelation," *International Journal of Project Management ,* vol. 24, no. 4, pp. 358-370, 2006.

[8] J. N. Wright, "Time and Budget: The Twin Imperatives of a Project Sponsor," *International Journal of Project Management,* vol. 15, no. 3, pp. 181 -186, 1997.

[9] R. Atkinson, L. Crawford and S. Ward, "Fundamental Uncertainties in Projects and the Scope of Project Management," *International Journal of Project Management,* vol. 24, no. 8, pp. 687-698, 2006.

[10] J. Wateridge, "How Can IS/IT Projects Be Measured For Success?," *International Journal of Project Management,* vol. 16, no. 1, pp. 59-63, 1998.

[11] D. J. Procaccino, S. O. Verner and D. Marvin, "Case Study: Factors for Early Prediction of Software Development Success," *Journal of Information and Software Technology,* vol. 44, no. 1, pp. 53-62, 2002.

[12] J. M. Verner, S. Beecham and N. Cerpa, "Stakeholder Dissonance: Disagreements on Project Outcome and Its Impact on Team Motivation Across three Countries," Vancouver, BC, 2010.

[13] J. K. Pinto and S. J. Mantel, "The Causes of Project Failure," *IEEE Transactions of Engineering Management,* vol. 37, no. 4, pp. 269-276, 1990.

[14] S. M. Ghasabeh and K. K. Chabok, "Generic Project Success and Project Management Success Criteria and Factors. Literature Review and Survey," *WSEAS Transactions on business and economics,* vol. 6, no. 8, pp. 456-468, 2009.

[15] J. Wateridge, "IT projects: A Basis for Success," *International Journal of Project Management,* vol. 13, no. 3, pp. 169-172, 1995.

[16] M. Prifling, "The Organizational Culture's Influence on Risks in IT Projects: A Structuration Perspective," Lima, Peru, 2010.

[17] Standish report, "CHAOS Summary," 2009. [Online]. Available: http://www1.standishgroup.com/newsroom/chaos_2009.php. [Accessed 5 April 2016].

[18] G. Thomas and W. Fernandez, "Success in IT Projects: A Matter of Definition?," *International Journal of Project Management,* vol. 26, no. 7, pp. 733-742, 2008.

[19] G. Thomas and . W. Fernández, "Success in IT projects: A Matter of Definition?," *International Journal of Project Management,* vol. 26, no. 7, p. 733–742, 2008.

[20] W. H. DeLone and E. R. McLean, "The DeLone and McLean Model of Information Systems Success: A Ten-Year Update," *Journal ofManagement Information Systems,* vol. 19, no. 4, pp. 9-30, 2003.

[21] J. Etezadi-Amoli and A. F. Farhoomand, "A Structural Model of End user Computing Satisfaction and User Performance," *Information & Management,* vol. 30, no. 2, pp. 65 - 73, 1996.

[22] D. L. Goodhue and R. L. Thompson, "Task-Technology Fit and Individual Performance," *MIS Quarterly,* vol. 19, no. 2, pp. 213-233, 1995.

[23] P. B. Seddon and M. Y. Kiew, "A Partialtest and Developmentofthe DeLone and McLean Model of IS Success," in *Proceedings of the International Conference on Information Systems*, Atlanta, 1994.

[24] T. H. Teo and P. K. Wong, "An Empirical Study of the Performanceimpact of Computerization in the Retail Industry," *Omega—The InternationalJournal of Management Science,* vol. 26, no. 5, p. 611–621, 1998.

[25] B. H. Wixom and H. J. Watson, "An Empirical Investigation of the Factors Affecting Data Warehousing Success," *MIS Quarterly,* vol. 25, no. 1, pp. 17-41, 2001.

[26] T. Guimaraes and M. Igbaria, "Client/Server System Success: Exploring the Human Side," *Decision Sciences,* vol. 28, no. 4, pp. 851-875, 1997.

[27] M. Igbaria and M. Tan, "The Consequencesof the Information Technology Acceptance on Subsequent Individual Performance," *Information & Management,* vol. 32, no. 3, pp. 113-121, 1997.

[28] J. Teng and K. Calhoun, "Organizational Computing as a Facilitator of Operational and Managerial Decision Making: An Exploratory Study of Managers' Perceptions," *Decision Sciences,* vol. 27, no. 4, pp. 673-710, 1996.

[29] G. Torkzadeh and W. J. Doll, "The Development of a Tool for Measuring the Perceived Impact of Information Technology on Work," *Omega - The International Journal of Management Science,* vol. 27, no. 3, pp. 327-339, 1999.

[30] P. Weill and M. Vitale, "Assessing the Health of an Information System Portfolio: An Example from Process Engineering," *MIS Quarterly,* vol. 24, no. 4, pp. 601-624, 1999.

[31] K. Yuthas and S. T. Young, "Material Matters: Assessing the Effectiveness of Materials," *management IS. Information & Management,* vol. 30, no. 3, pp. 115-124, 1998.

[32] J. E. Bailey and S. W. Pearson, "Development of a Tool for Measuring and Analyzing Computer User Satisfaction," *Management Science,* vol. 29, no. 5, pp. 530-545, 1983.

[33] E. K. Clemons and M. C. Row, "Limits to Interfirm Coordination through Information Technology: Results of a field study in consumer goods packaging distribution," *Journal of Management Information Systems,* vol. 10, no. 1, pp. 73-95, 1993.

[34] E. K. Clemons, S. P. Reddi and M. C. Row, "The Impact of Information Technology on the Organization of Economic Activity: The "move to the middle" hypothesis," *Journal ofManage ment Information Systems,* vol. 10, no. 2, pp. 9-35, 1993.

[35] L. Hitt and E. Brynjolfsson, "The three faces of IT value: Theory and evidence," in *Proceedings of the International Conference on Information Systems*, Atlanta, 1994.

[36] M. Ishman, "Measuring Information System Success at the Individual Level in Cross-Cultural Environments," Hershey, 1998.

[37] B. L. Myers, L. A. Kappelman and V. R. Prybutok, "A Comprehensive Model for Assessing the Quality and Productivity of the Information Systems Function: Toward a Theory for Information Systems Assessment," in *Information Systems Success Measurement*, Hershey, 1998.

[38] P. B. Seddon, "A Respecification and Extension of the DeLone and McLean Model of IS Success," *Information Systems Research,* vol. 8, no. 3, pp. 240-253, 1997.

[39] B. W. Boehm, "Software Risk Management: Principles and Practices," *IEEE Software,* vol. 8, no. 1, pp. 32-41, 1991.

[40] R. N. Charette, "Large Scale Project Management is Risk Management," *IEEE Software ,* vol. 13, no. 4, p. 110–117, 1996.

[41] H. Taylor, E. Artman and J. P. Woelfer, "Information Technology Project Risk Management: Bridging the gap between research and practice," *Journal for Information Technology,* vol. 27, pp. 17-34, 2012.

[42] P. Powell and J. Klein, "Risk Management for Information Systems Development," *Journal of Information Technology,* vol. 11, no. 4, pp. 309-319, 1996.

[43] F. Heemstra and R. Kusters, "Dealing with Risk: A practical approach," *Jounrnal of Information Technology,* vol. 11, no. 4, pp. 333-346, 1996.

[44] M. Keil, P. Cule, K. Lyytinen and R. Schmidt, "A Framework for Identifying Software Project Risks," *Communications of the ACM,* vol. 41, no. 11, pp. 76-83, 1998.

[45] H. Barki, S. Rivard and J. Talbot, "An Integrative Contingency Model of Software Project Risk Management," *Journal of Management Information Systems,* vol. 17, no. 4, pp. 37-69, 2001.

[46] S. Simister, "Qualitative and Quantitative Risk Management," in *The Wiley Guide to Managing Projects*, P. Morris and J. Pinto, Eds., Hokoben, John Wiley & Sons, 2004, pp. 30-47.

[47] J. March and Z. Shapira, "Managerial Perspectives on Risk and Risk Taking," *Management Science,* vol. 33, no. 11, pp. 1404-1418, 1987.

[48] T. Moynihan, "How Experienced Project Managers Assess Risk," *IEEE Software,* vol. 14, no. 3, pp. 35-41, 1997.

[49] A. Pablo, "Managerial Risk Interpretations: Does industry make a difference?," *Journal of Managerial Psychology,* vol. 14, no. 2, pp. 92-107, 1999.

[50] F. McFarlan, "Portfolio Approach to Information Systems," *Harvard Business Review,* vol. 59, no. 5, pp. 142-150, 1981.

[51] R. Schmidt, K. Lyytinen, M. Keil and P. Cule, "Identifying Software Project Risks: An International Delphi Study," *Journal of Management Information Systems,* vol. 17, no. 4, pp. 5-36, 2001.

[52] T. Addison and S. Vallabh, "Controlling Software Project Risks: An Empirical Study of Method used by Experience Project Managers," South Africa, 2002.

[53] D. Baccarini, G. Salm and P. E. Love, "Management of Risks in Information Technology Projects," *Industrial Management & Data Systems,* vol. 104, no. 4, pp. 286-295, 2004.

[54] P. Bannerman, "Risk and Risk Management in Software Projects: A reassessment," *Journal of Systems and Software ,* vol. 81, no. 12, pp. 2118-2133, 2008.

[55] R. Wysocki, Building Effective Project Teams, New York: John Wiley & Sons, 2001.

[56] B. Boehm and R. Tuner, Balancing Agility and Discipline: A guide foe the perplexed, Boston: Addison-Wesley, 2004.

[57] J. Cochran, "A Comprehensive Model for Understanding Technology Selection Decisions of Interconnected Information," Claremont, Califonia, 2006.

[58] A. Sharma, "Shodhganga," 2011. [Online]. Available: http://hdl.handle.net/10603/2428. [Accessed 16 April 2016].

[59] S. Alter, "Implementation Risk Analysis," New York, 1979.

[60] S. Alhawari, L. Karadsheh, A. N. Talet and E. Mansour, "Knowledge-Based Risk Management framework for Information Technology," *International Journal of Information Management,* vol. 32, no. 1, pp. 50-65, 2012.

[61] B. S. Neo and K. S. Leong, "Managing Risks in Information Technology Projects: A Case Study of TradeNet," *Journal of Information Technology Management,* vol. 5, no. 3, pp. 29-45, 1994.

[62] E. K. Clemons, M. C. Row and R. Venkateswaran, "The Bell Canada CRISP Project: A Case Study of Migration of Information Systems Infrastructure for Strategic Positioning," *Office: Technology and People,* vol. 5, no. 4, 1989.

[63] Project Management Institute , A Guide to the Project Management Body of Knowledge, 5th ed., Pennsylvania: Project Management Institute, Inc, 2013.

[64] G. Stoneburner, A. Goguen and A. Feringa, "Risk Management Guide for Information Technology Systems," National Institute of Standards and Technology (NIST) Special Publication 800-30, Gaithersburg, 2002.

The Project Knowledge Management: a key factor in the integration of Sustainability in Project Management

Leticia Fuentes-Ardeo, Jose Ramon Otegi-Olaso, Maria Eugenia Aguilar-Fernandez

Lfuentes005@ikasle.ehu.eus, letitxu@gmail.com
PhD candidate
University of the Basque Country (UPV/EHU)
Alameda Urquijo, S/N, 48013, Bilbao

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Abstract
Integrating the sustainability dimension on the project management field is becoming more and more important. Until this moment, in the academic world,a lot work has been done regarding the integration from the theoretical point of view[1]-[4]. The authors consider that the integration could not be completely performed till the sustainability dimension can be measured and included as a key indicator considered in the project success.

Besides, while researching regarding the sustainability dimension, the authors have reached to the conclusion that this aspect is closely related with the knowledge dimension [5]. Knowledge is the most important resource needed for a project [6]. The existing literature review regarding the knowledge management that is involved in project management field is not sufficient; as the development of this research area has been started since the last 20 decades.

The first consideration regarding the relation between knowledge and project management was just oriented to lessons learned [7], but nowadays, the tendency is to consider the importance of the knowledge during all the project life cycle.

In this research, there are going to be considered two research fields: sustainability in project management and project knowledge management. The Sustainability Knowledge Model (SKM) for projects identifies the knowledge that is required for having integrated the sustainability in project management.

In this context, the research question of this study is: How the Model of Project Knowledge Management can contribute to the integration of Sustainability in Project Management.

The considerations explained in this contribution rose that the lack of knowledge management is one of the main reasons for project failure. Based on this idea, including sustainability aspects in the knowledge that is involved in project environment can be considered as a key factor to get the integration.

The Sustainability Knowledge Model for project that is proposed in this study aims to identify which knowledge is required in order to perform the integration of sustainability in project management.

The proposal pushes the idea of developing a specific knowledge area in project management books where the sustainability knowledge of the project is included. This is one of the steps of the Global-level macro-knowledge life-cycle of the Model of Project Knowledge Management [6]. Including these new concepts in the bodies of knowledge will directly contribute to a step forward in the integration of sustainability in project management.

1. References

[1] G. C. Tam. Managing project sustainability: A tool for project managers. *Handbook of Research on Sustainable Development and Economics* pp. 335. 2015.

[2] Pernille Eskerod and Martina Huemann. Sustainable development and project stakeholder management: What standards say. *International Journal of Managing Projects in Business 6(1),* pp. 36-50. 2013. . DOI: http://dx.doi.org/10.1108/17538371311291017.

[3] G. Silvius and R. Schipper. A maturity model for integrating sustainability in projects and project management. Presented at 24th World Congress of the International Project Management Association. 2010, .

[4] M. L. Martens and M. M. de Carvalho. An exploratory study of sustainability evaluation in project management. *Product: Management & Development 11(2),* pp. 111-117. 2013.

[5] A. L. Dahl. Achievements and gaps in indicators for sustainability. *Ecol. Ind. 17*pp. 14-19. 2012.

[6] S. Gasik. A model of project knowledge management. *Proj. Manage. J. 42(3),* pp. 23-44. 2011.

[7] T. Brady and A. Davies. Building project capabilities: From exploratory to exploitative learning. *Organ. Stud. 25(9),* pp. 1601-1621. 2004.

Strategic Postures for Sustainability in Projects of the Project Based Organization

Gilbert Silvius
mail@gilbertsilvius.nl
LOI University of Applied Sciences
Leiderdorp, the Netherlands

Ron Schipper
ron.schipper@aetsveld.nl
Van Aetsveld
Amersfoort, the Netherlands

Abstract: *Sustainability is one of the most important challenges of our time. How can we develop prosperity, without compromising the life of future generations? Companies are integrating sustainability in their strategies, processes and actions. In the implementation of strategies, projects play an essential role. Delivering business strategy through projects is even more eminent for the project based organization (PBO) that executes projects as its core business. For a PBO, there are multiple business and sustainability strategies to consider: the strategy of the 'client' that commissions the project, and the strategy of the PBO itself, as 'contractor' in the project. The PBO therefore is faced with the challenge to balance its commitment to sustainability between the strategy of the client organization and its own sustainability ambitions.*
This paper discusses the strategic postures a PBO can take on the consideration of sustainability in its projects, while aligning with both the strategy of the client organization and its own strategy. Based upon our analysis, we will develop four possible strategic postures on sustainability in the projects of a PBO that provide guidance for the consideration of sustainability in these projects.

Keywords: Sustainability, strategy, project, project management, project based organization

1. Introduction

Sustainability is one of the most important challenges of our time. How can we develop prosperity, without compromising the life of future generations? Industry leaders realize that 'greenwashing' of current business practices is not a solution. Integration of the principles of sustainability requires rethinking and redevelopment of business strategies, products/services, processes and resources [46]. This integration of sustainability into core business functions is considered one of the most important leadership challenge facing business today [5].
In the implementation of strategies, projects play an instrumental but essential role [38]. It is estimated that today, more than 20 % of global economic activity takes place as projects [53]. The integration of sustainability into business strategies therefore also requires the integration of sustainability in projects and project management. A growing number of publications address this integration [43; 1].
Delivering business strategy through projects is even more eminent for those organizations that execute projects as their core business. These organizations, characterized as "project based organizations" (PBOs) (Huemann, 2015) are executing projects as a way of delivering products and services to external clients. The PBO typology differs from the "project oriented organization" (POO), in which projects are primarily used an instrument to change the own organization.
For a PBO, integrating sustainability implies making the projects it performs more sustainable. Several studies on the integration of sustainability into project management focus on the

operationalizing the concepts of sustainability into sets of indicators that can be applied to the project's execution process and output, in order to assess the sustainability of the project (For example [4], [11], [23], [27] and [33]). These indicators normally follow a more generic framework of sustainability indicators, for example Global Reporting Initiative's sustainability reporting guidelines, in representing the "Triple Bottom Line" perspectives of social, environmental and economic performance [9]. However, specialists question whether a generic list of sustainability indicators is possible, or even desirable, given the wide variety of conditions and the differences in values in different contexts [18]. In line with Mettler and Rohner [35], Silvius and Schipper [44] therefore conclude that the assessment of sustainability in projects and/or project management should be configurable to the characteristics and context of the project at hand.

This context relates, amongst other factors, to the industry of the organization and the strategy of the organization. For a PBO, however, there are two contexts to consider: the industry and strategy of the 'client' that commissions the project, and the industry and strategy of the PBO itself, as 'contractor' in the project. The PBO therefore is faced with the challenge to balance its commitment to sustainability between the strategy of the client organization and its own sustainability ambitions. How can this balancing act be approached? Should the PBO follow the sustainability strategy of the client or should it stick to its own strategy and select the assignments and clients that fit that strategy?

This paper will discuss the question *What strategic postures a PBO can take on the consideration of sustainability in its projects, while aligning with both the strategy of the client organization and its own strategy?* We will develop four possible strategic postures on sustainability in the projects of a PBO that provide guidance for the consideration of sustainability in these projects.

The remainder of this paper is organized as follows. In the following section, we will discuss the concepts of the project based organization, the different strategic postures towards sustainability and the relationship between sustainability, project and project management. Based on the concepts found in the literature, the following section will develop a framework of four possible strategic postures for sustainability in the projects of the PBO. These four postures will be presented further and their implications for the PBO will be discussed.

2. Background

This paragraph present a brief discussion of the main concepts addressed in this chapter. First the model of the project based organization will be discussed, followed by the different strategic postures towards sustainability. The last section of this paragraph will discuss sustainability in the context of project and project management.

The project based organization

Companies and organizations in all types of industries are undertaking projects as a growing part of their business activities even when their core business processes are repetitive [24]. In order to identify the emerging role of projects in organizations, characterizations such as the project *led* organization [19], project *based* organization [54] and project *oriented* organization [15], started to get used. And although the exact meaning of these constructs has been subject to academic debate, for example by Sydow et al. [47], the discussion seems to have settled on the terms project based organization (PBO) and project oriented organization (POO). And although these labels are sometimes still used synonymously, the literature is now indicating a difference between the two typologies. As indicated in the introduction, a POO performs projects primarily for improving the performance of its own organization. In this typology, projects are temporary organizations, that realize changes of business processes, strategies, resources, products or services in the non-temporary 'permanent' part of the organization [46]. Projects are an organizational construct that

gather resources across organizational structures in order to make a non-routine 'unique' result. The core of the organization, however, is formed by the permanent organization that performs business processes in a repetitive way.
In a PBO, the core of the organization is organized in projects. These projects do not deliver change to the internal organization, but to a client organization that specifies the required deliverable. The effectuation of the change is normally not included in the scope of the project and left to the client organization. The PBO typology has its roots in the construction industry, but can also be recognized in other industries, such as event management, consulting, marketing communication and information technology.
Table 1 provides an overview of the characteristics of the PBO , compared to the POO typology.

	Project based organization (PBO)	**Project oriented organization (POO)**
Reason for projects	·Projects are performed per force because of the customized nature of the project	·Projects are a strategic choice ·Projects are one option for the organizational design
Relation	·Projects relate to production processes	·Projects relate to business processes
Type of projects	·Mainly external projects	·External (if adequate) and internal projects
Management logic	·Predominantly functional line organizations ·Projects are forced to fit functional logic, as disturbances are not allowed, large projects are turned into temporary functions	·Permanent and temporary organizations have different management logics ·Organization can deal with these contradictions
Understanding of project management	·Operational capability ·Project management as tools and control	·Operational and strategic capability ·Project management as leadership
Paradigm	·Prevailing mechanistic planning paradigm ·Project is considered as complex task or system	·Systemic-constructivist ·Project is considered as a temporary organization

Table 1. Comparison of the 'project based' and the 'project oriented' organization typologies [20:63]

The POO and PBO typologies help us to understand the different relationships between strategy and projects. Where a POO performs projects in order to realize its own goals and strategies, the PBO performs projects that relate to its client's goals and strategies, as well as its own goals. A frequently found situation is that a POO acts as a client of a PBO, for example in construction, consulting, information technology or event management projects. The POO in this situation outsources the realization of the project to a more specialized PBO.
The POO (client) and PBO (contractor) each value of the project from their own perspective [52]. For the PBO this confirms the earlier identified challenge of balancing the integration of sustainability in the project between the strategy of the client and its own ambitions.

Sustainability in the context of strategy

The BSR/GlobeScan study [5] is one of many studies that show that corporations are not blind for the societal issues that we are faced with. And although this may have been the case already in past decades, it is not too long ago that issues, such as poverty reduction, protection of the

environment and fair working conditions, were considered primarily the responsibility of governments and other regulatory bodies [51]. If a company operated within the boundaries of laws and regulations, it could expect societal acceptance. In fact, Friedman argued that a company's only social responsibility is to generate profits for its shareholders [14]. In today's society such a strategy would quite likely face criticism from societal organizations that scrutinize the behavior of larger organizations, thereby influencing public opinion. Examples of successful mobilization of public opinion are plentiful. For example the Brent Spar case of 1995, in which Greenpeace organized a high-profile media campaign around the planned sinking of the oil storage and tanker loading buoy Brent Spar, that successfully influenced Shell. Giving in to public pressure, Shell changed their plan to sink the Brent Spar and instead dismantled it on-shore.
Shell's behavior at the time of the Brent Spar case may be characterized as reactive to public opinion. Today, many organizations proactively accept some level of responsibility for sustainability as part of their 'license-to-operate' and integrate sustainability goals in their corporate strategy. Willard [56], depicts these different strategic postures as a growth model of 'sustainability stages' a company may develop on (Figure 1).

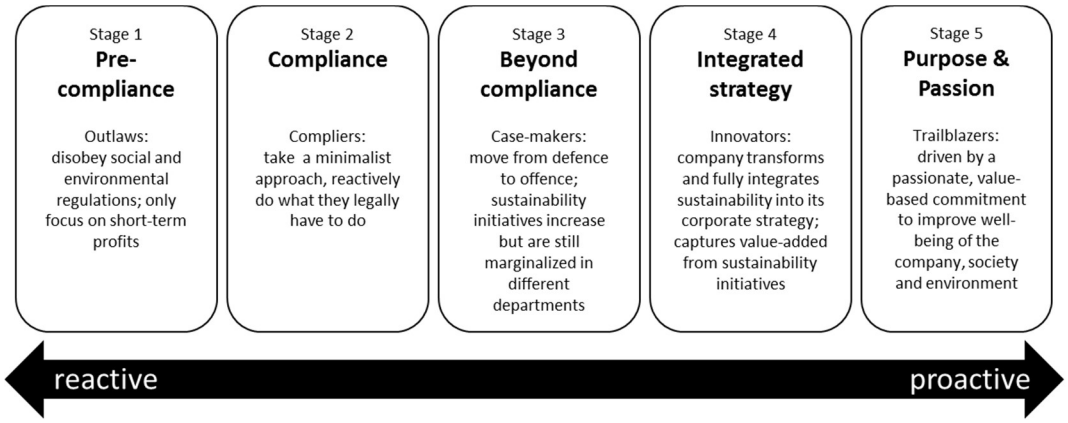


Figure 1. The stages of sustainability integration. (Adapted from [56])

The stages move from reactive to proactive and describe to what extent a company is committed to sustainability principles. The first stage is when companies fail even to comply with prevailing regulations. They are opportunistic and not engaged with the concept of sustainability . When a company complies with all environmental and social regulations it moves up to stage 2, 'compliance'. In stage 3 'beyond compliance' a company starts to not only react on regulations, but it starts introducing sustainability activities. Yet, these activities are not concerted but are carried out in different departments. Companies who understand the importance of sustainability and the value-added they can gain from sustainable activities e.g. energy-efficient production or eco-friendly products and integrate sustainability into their corporate strategy are in stage 4 'integrated strategy'. The highest stage 5 'purpose and passion' is attained when companies are not just driven by profits but also by a sense of responsibility to improve society and environment and contribute to a better world.
The stages of sustainability model illustrates how companies can move from a reactive approach to a proactive one. If we disregard the pre-compliance stage 1, stages 2 and 3 can be considered as reactive, whereas stages 4 and 5 are considered proactive. This distinction between approaches distinguishes companies that try to 'do no harm', by trying to minimize the negative effects of their business, from companies that try to proactively 'make a positive contribution', by integrating sustainability considerations in their core business strategies.
A similar dichotomy can be found with Baumgartner and Ebner [3]. In their study of the sustainability maturity of corporate strategies, they differentiate between introverted strategies

and extroverted strategies. Introverted strategies consider sustainability as an additional aspects of doing business and concentrate on a basic level of sustainability consideration such as conformity and compliance with sustainability-related rules and guidelines. These strategies could be characterized as 'risk avoidance' or 'defensive'. Extroverted strategies consider sustainability as an integrated part of the business and perhaps even as the reason for doing business. Within the extroverted strategies, a more conventional and a more transformative approach can be distinguished [3]. In the conventional extroverted strategy, the organization uses its sustainability as a differentiator in the marketplace. Given the 'competitive edge' that these organizations experience from proactively considering sustainability in their business and activities, it makes sense to engage more in sustainability that it is obliged to do by laws and regulations. In these organizations, the marketing of their sustainability efforts plays an important role. Organizations that adopt a transformative extroverted strategy, go beyond the 'competitive edge' perspective on sustainability. For these organizations, their activities are a driver for sustainability in society. Sustainability is integrated in all aspects of business and strategy, and gains therefore much higher credibility.

Tulder et al. [51] identify the basic attitude of an organization towards its societal role as one of the key variables in the classification of the strategic postures on sustainability. The reactive company sees sustainability as a liability to its business strategy and operations, where a proactive company takes responsibility for societal issues. Next to the basic attitude, Tulder et al. [51] recognize another meaning of the reactive-proactive dichotomy: the company's initial drive to consider sustainability. A reactive company acts upon pressure from, mostly external, stakeholders, whereas a proactive company makes the first moves based upon its own leadership or believes.

Based upon these two key variables, Tulder et al. [51] construct a framework that can be used to characterize the sustainability strategies of organizations and the transition from one strategy to another. Figure 2 shows this framework.

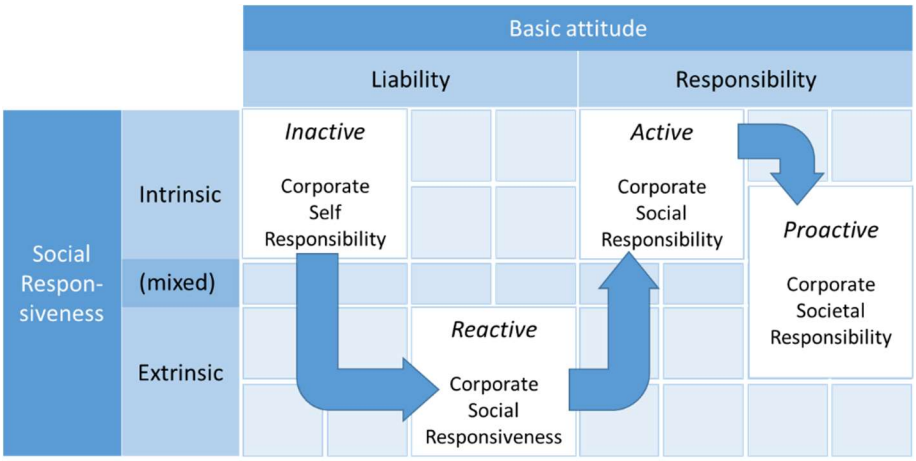


Figure 2. Development framework of sustainability strategies. [51]

Concluding this part of our literature review, we observe that consensus is emerging on a basic distinction between inactive/reactive strategies on sustainability, in which the organization views sustainability as a liability, and active/proactive strategies, in which the organization views sustainability as a responsibility.

Provide a normative opinion or judgment on which strategic posture should be considered 'right' or most fitting goes beyond the scope of this chapter. As we are aiming to provide direction for the strategic posture for the PBO, we need to understand how the strategy of the client context of

the PBO interacts with the strategy of the PBO itself. For this goal, the dichotomy of inactive/reactive strategies versus active/proactive strategies suffices.

Sustainability in the context of projects

The seminal Brundtland report of the UN World Commission on Development and Environment, linked sustainability to change, by stating "*In essence, sustainable development is a process of change*" [57]. Marcelino-Sádaba et al. [32] observe that "*projects are the ideal instrument for change*" and "*the necessary change that we require towards sustainability will be boosted by applying the project management discipline to sustainability*." [32]. This view elaborates on projects as temporary organizations [29; 55] that realize change in organizations or across organizational boundaries [46]. In according with this, Turner defines project management as "*the means by which the work of the resources assigned to the temporary organization is planned, managed and controlled to deliver the beneficial change*" [52: 29].

With the growing attention for sustainability, its concepts are also being related to project management (For example [27]; [7]; [31], [46], [33], [42]). Pasian and Silvius [37] identify sustainability as one of the evolving schools of thought in project management. They characterize the 'sustainability school of project management' as considering projects in a societal perspective, adopting a management *for* stakeholders approach and considering all aspects of the projects through the triple bottom-line perspectives of economic, environmental and social interests. criteria for the business case and project success. The following section discussed these three characteristics of sustainable project management further.

Projects in a societal perspective

As is suggested by Marcelino-Sádaba et al. [32], the sustainability school adopts a societal perspective on projects and considers projects as instruments to realize societal change. In their literature review on publications on sustainability in project management, Silvius and Schipper [43] therefore identify the 'recognition of the context of the project' as the starting point of considering sustainability in project management: "*Integrating the dimensions of sustainability in project management inevitably implies a broader consideration of the context of the project.*" [43:72].

Management for stakeholders

Several authors (For example [2], [10], [26]) recognize the need for a more proactive engagement of stakeholders as a consequence of integrating sustainability into project management. Eskerod and Huemann [10] conclude that the current standards of project management guide practitioners towards the recognition of a rather limited group of stakeholders and to "*selling the project to the most important stakeholders rather than involving them and their interests into the creation of project objectives*" [10:43]. In this approach, the 'management-of-stakeholders' approach, stakeholders are seen primarily as providers of resources that should be prevented from hindering the project. "*In contrast, the 'management-for-stakeholders' approach [12; 13] takes the point of departure that all stakeholders have the right and legitimacy to receive management attention [22]. Stakeholders are not means to specific aims in the organization but valuable in their own rights.*" [10:40]. Labelle and Leyrie [26] conclude that this implies that stakeholder communication becomes stakeholder participation. The information flow between project and stakeholders is no longer unidirectional but transformed into a dialogue that allowed participants to take part in developing the project [28].

Triple bottom-line criteria for all aspects of the project

Integrating sustainability in project management will influence the specifications and requirements of the project's deliverable or output, and the criteria for project success [8; 31]. For

example the inclusion of environmental or social aspects in the project's objective and intended output and outcome [46]. Integrating sustainability into project management suggests that the content, intended output/outcome and success criteria are based on a holistic view of the project [16] and developed together with a broad group of stakeholders [10].
Integrating sustainability also implies that the definition and perception of project success take into account the 'triple bottom line' of economic, social and environmental benefits as laid out in the business case, both in the short term as in the long term [43]. However, studies on sustainability in project management differ in their consideration of the different triple bottom line perspectives. Studies that focus on sustainable or 'green', construction projects and project management mostly discuss the combination of the economic and the environmental dimensions, whereas papers that focus on sustainable development projects tend to discuss mainly the social dimensions [43].
As noted earlier, several studies on the integration of sustainability into project management focus on operationalizing the Triple Bottom Line concept by developing sets of indicators on the different perspectives. This approach bears the risk of lacking the holistic approach of the integration of the economic, environmental and social perspectives. Martens and Carvalho [33] reported an empirical study on the consideration of Triple Bottom Line variables by project managers from diverse industries in Brazil. One of their conclusion was that the consideration of different sustainability aspects of the Triple Bottom Line is related to the strategy and context of the project. A universal set of sustainability indicators for projects may therefore be illusive.

Addressing this strategic context, Silvius and Schipper [44] develop a maturity model, SPM3, for the assessment of sustainability in project management with which the degree to which a project considers the different triple bottom line criteria can be assessed on an ordinal scale ranging from 'compliant' to 'purpose' (Table 2). In these maturity levels, the earlier found distinction between an inactive/reactive approach towards sustainability and an active/proactive approach can be recognized. Specific for the SPM3 model, however, is that the model considers how sustainability is approached on the level of a project, and not on the level of the organization or strategy of the organization.

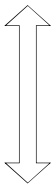
Approach	Maturity level	Description
'do no harm'  'positive contribution'	Level 1: Compliant	(This aspect of) Sustainability is considered minimalistic and implicit, and (only) with the intention to comply with laws and regulations.
	Level 2: Reactive	(This aspect of) Sustainability is considered explicitly, with the intention to reduce negative impacts of the project.
	Level 3: Proactive	(This aspect of) Sustainability is explicitly considered as one of the areas that the project contributes to.
	Level 4: Purpose	Making a contribution to (this aspect of) sustainability is one of the drivers behind the project and sustainability considerations are included in the justification of the project.

Table 2. The maturity levels of the SPM3 model [44]

For the measurement of the consideration of sustainability, the SPM3 maturity model defines 22 indicators, organized in the three triple bottom line perspectives [44]. During the maturity assessment, each indicator is assessed on the scale of the maturity levels of Table 2.
For each project a logical ambition should be that the project 'does no harm' and therefore addresses all sustainability criteria on at least the level 1 'compliant' level. For the more (pro)active levels of consideration, levels 3 and 4, addressing all criteria is not a realistic ambition for a project. Therefore the project needs to select on which aspects of sustainability it aims to make a more active contribution. Guidance for the selection of relevant criteria logically comes

from the (sustainability) strategy of the organization. However, for the PBO, a complicating factor is that there are multiple strategic project contexts to consider. Both the 'client' and the PBO itself, the 'supplier', provide relevant strategic contexts to consider in the project.

3. Four strategic postures for sustainability in project of the PBO

The basic strategic postures, inactive/reactive versus active/proactive, we derived in the preceding paragraph provides a foundation for the analysis of the possible strategic postures of the projects in a PBO. Earlier in this chapter we established that for the PBO two sustainability strategies provided a relevant context for the projects: the strategy of the client and the strategy of the PBO itself.
By using the two basic strategic postures for both organizations, we constructed the framework presented in Figure 3.

Figure 3. Four strategic postures for sustainability in projects of the PBO.

This framework now allows us to characterize four strategic contexts of the projects of the PBO:

1. An inactive/reactive sustainability strategy of the PBO with an inactive/reactive strategy of the client.
   We labelled the strategic posture of this situation Sustainability for compliancy.
2. An inactive/reactive sustainability strategy of the PBO with an active/proactive strategy of the client.
   We labelled this situation Sustainability on request.
3. An active/proactive sustainability strategy of the PBO with an active/proactive strategy of the client.
   We labelled this situation Sustainability as differentiator.
4. An active/proactive sustainability strategy of the PBO with an inactive/reactive strategy of the client.
   We labelled this situation Sustainability for value.

The following sections discuss the strategic postures of these four situations.

Sustainability for compliancy

The sustainability for compliancy posture is the most minimalistic of the four strategic postures. In this strategy, both the PBO and the client company have an inactive/reactive approach towards sustainability and therefore sustainability is addressed in projects only with the intention to comply with laws and regulations. In the absence of a more (pro)active sustainability strategy, the different triple bottom line sustainability criteria are addressed on a 'compliance' level.

Sustainability on request

In this strategic posture, the PBO has an inactive/reactive approach to sustainability and will only address those sustainability aspects of the project that the client, who has a more active approach to sustainability, requests in the project assignment. Figure 8 illustrates an example of the maturity assessment in this strategic posture. All indicators are considered on the level of compliancy, but towards some indicators a more proactive approach is taken. Which indicators are selected to be addressed more actively in the project is determined by the requirements that the client specifies. The client is in the lead, the PBO reacts and follows.

Sustainability as differentiator

In the sustainability as differentiator and sustainability for success strategic postures, the PBO takes a more (pro)active approach towards sustainability. The PBO has formulated strategic sustainability ambitions and logically aims to realize these through its core business: projects. The sustainability ambitions are therefore communicated and marketed to prospective clients. One reason for this is to allow clients to preselect themselves for the PBO in terms of strategic fit. Another reason is that by communicating its sustainability ambitions, the PBO aims to create a competitive advantage over competitive PBOs with clients that value sustainability.
This strategic posture bears the risk that the sustainability ambitions of the PBO and the client are not aligned. For the project this implies that it will probably have to address multiple criteria, some related to the sustainability strategy of the client and some related to the sustainability strategy of the PBO itself, parallel. In itself this may not be a problem, as the criteria logically not exclude other criteria, however, it may increase the complexity of the project.
Which indicators are selected to be addressed more actively in the project is in this posture a mixture of indicators derived from the sustainability strategy of the client and indicators that are provided by the PBO itself. These indicators may overlap, but they may also be completely different indicators.

Sustainability for value

Paying attention to sustainability aspects in projects may be perceived as costing time or money and therefore as not supportive of the value or success of a project. However, several studies, such as [50], [34] and [45], point out a positive relationship between addressing sustainability in the management of a project and the success of that project. For example by eliminating waste [30], reducing risks [45] and/or improved stakeholder relationships [10]. Therefore also without an explicit requirement of the client, the PBO may also address sustainability, simply because it expects sustainability delivers value.
In this strategic posture, it can be expected that the projects score overall better on the active consideration of sustainability aspects, with the highest level scores on a limited set of indicators that relate to the (sustainability) strategy of the PBO.

5. Implications

Our analysis of the four potential strategic postures of the projects of a PBO, showed that for three of the four postures, sustainability will be addressed on a level that goes beyond the level of being compliant with laws and regulations. This logically has implications for the way projects are managed and governed within the PBO. This paragraph highlights the implications for the PBO that aims to move towards a more sustainable management of their projects.

Adopt a sustainable project management process

Based on an analysis of the most used standards for project management, Silvius [39] concludes that on the logical areas of impact of sustainability in project management, the standards of project management processes (PMBOK Guide, PRINCE2 and ISO 21500) fail to refer convincingly to sustainability considerations. Enhancing the project management methodology that is used in the PBO with processes, templates and roles that explicitly address the sustainability aspects of a project therefore should be recommended. At this moment, only the ISO 21500 based PRiSM methodology [6] explicitly addresses sustainability and introduces a 'Sustainability Management Plan' [17; 40] as new element in the project management documentation.

Develop sustainability measurement and monitor systems

An important condition for the management of the sustainability aspects of a project is a practical tool or instrument to assess the sustainability of the project. And although numerous academic publications include assessments of sustainability impact, the instruments used for these assessments fail to address the specifics of sustainability in projects and project management. Sustainability in projects can be considered as sustainability of the project deliverable (the product that the project realizes) and the sustainability of the delivery of the project (the process of realizing the project) [44]. Gareis et al. [16] observe that the first perspective prevails in studies on sustainability in the business context and that, because of the temporary nature of projects, the second perspective, the sustainable management of projects, is still largely unexplored.
Specific project sustainability assessment instruments range from simple checklists, for example [25; 49], assessment methodologies, for example the Sustainable Footprint Methodology [36] and the Project Sustainability Impact Assessment [48], to maturity models, the earlier discussed SPM3 [44]. A PBO would be wise to develop or select an assessment instrument in order to be able to assess, measure, monitor and report the sustainability impacts of their projects.

Develop 'sustainable project management' competencies

Addressing sustainability in projects requires adequate competencies. The recently published IPMA Individual Competence Baseline version 4 [21], includes an explicit reference to sustainability in the competence "Identify, and ensure that the project complies with relevant sustainability principles and objectives". The description of this key competence states that the project manager should be able to "assess the impact of the project on the environment and society" and that he/she "researches, recommends and applies measures to limit or compensate negative consequences". Based upon our analysis of the strategic postures for projects in the PBO this competence makes sense, however, what 'sustainability competencies' does a project manager need to develop in order to fulfill the responsibility for sustainability that the ICB4 puts on him or her? And are these competencies today included in the development path of project managers in the PBO?
Drawing from the literature on 'Education for Sustainable Development', Silvius [41] derived five key competences for sustainability: systems thinking competences, anticipatory competences, normative competences, strategic competences and interpersonal competences. His specification of these key competences provide a foundation for answering the before mentioned questions and the development of specific training programs. However, his analysis also emphasized the importance of 'attitude' as the foundation on which skills and knowledge are developed. Integrating sustainability in project management therefore a 'mind shift' of the project manager. From executing 'ordered' projects, to accepting a professional responsibility for contributing to a better society [41].

Develop organizational maturity

The PBO also needs to develop an organizational competence on sustainability. In addition to the actions mentioned above on project management process, sustainability measurement instruments and individual competence development, the development of the organizational competence also requires sharing knowledge and experiences, developing good examples and best practices on sustainability in

projects, creating supporting structures, engaging stakeholders in the process and committing to ambitions and continuous improvement on the topic.

6. Conclusion

The PBO is an organizational typology that executes projects primarily for external clients. This complicates the alignment of projects and strategy, as two strategies come into play: the one of the PBO and the one of the client. Given this dualistic situation, this chapter set out to discuss what strategic postures a PBO can take on the consideration of sustainability in its projects, while aligning with both the strategy of the client organization and its own strategy. Based on our analysis of basic strategic postures, we concluded that consensus is emerging on a basic distinction between inactive/reactive strategies on sustainability, in which the organization views sustainability as a liability, and active/proactive strategies, in which the organization views sustainability as a responsibility. In the case of the PBO, this classification applies to both the strategy of the client as the strategy of the PBO itself, thereby creating four possible strategic contexts for the projects the PBO executes: (1) an inactive/reactive sustainability strategy of the PBO with an inactive/reactive strategy of the client, (2) an inactive/reactive sustainability strategy of the PBO with an active/proactive strategy of the client, (3) an active/proactive sustainability strategy of the PBO with an active/proactive strategy of the client and (4) an active/proactive sustainability strategy of the PBO with an inactive/reactive strategy of the client.
For each of the four situations we developed a fitting strategic posture and an expectation how the consideration of sustainability in projects for each of the strategic postures logically looks like.
The conclusion of our analysis of the four strategic postures is that in three of the four postures, sustainability needs to be considered beyond the level of compliancy. Only in the situation in which both the PBO and the client have an inactive/reactive approach to sustainability, can the consideration of sustainability be limited to being compliant. However, this situation is rapidly becoming outdated exception. As was indicated in the introduction of this chapter, businesses are integrating sustainability into their business strategies, products/services, processes and resources. And where a PBO, by the nature of its business, may be reactive to the requirements of its clients, it should be clear from our analysis that it does not suffice to take a reactive approach to sustainable project management. The PBO needs to develop competency in sustainable project management, in order to be competitive and to contribute to the strategy of its clients. This competency refers both to the individual competence of the project managers, as to the organizational competence in terms of project management processes, project management documentation, project reporting, supporting organizational structures and organizational learning and knowledge development.

7. References

[1] Aarseth, W., Ahola, T., Aaltonen, K., Økland, A. and Andersen, B. (2016), “Project sustainability strategies: A systematic literature review”, International Journal of Project Management, in press.

[2] AlWaer, H., Sibley, M. and Lewis, J. (2008), “Different Stakeholder Perceptions of Sustainability Assessment”, Architectural Science Review, 51(1), 48-59.

[3] Baumgartner, R.J. and Ebner, D. (2010), “Corporate Sustainability Strategies: Sustainability Profiles and Maturity Levels”, Sustainable Development, 18, 76–89.

[4] Bell, S and Morse, S. (2003), Measuring Sustainability Learning from doing, Earthscan, London.

[5] BSR/GlobeScan (2012), 2012 BSR/GlobeScan State of Sustainable Business Poll, retrieved from http://www.globescan.com/commentary-and-analysis/press-releases/press-releases-2012/244-new-

poll-of-business-leaders-highlights-sustainability-priorities-for-global-companies.html on January 8th, 2013.

[6] Carboni, J., González, M. and Hodgkinson, J. (2013), The GPM® Guide to Sustainability In Project Management, GPM Global.

[7] Edum-Fotwe, F.T. & Price, A.D.F. (2009), "A Social Ontology for Appraising Sustainability of Construction Projects and Developments.", International Journal of Project Management, 27 (4), 313-322.

[8] Eid, M. (2009), Sustainable Development & Project Management, Lambert Academic Publishing, Cologne.

[9] Elkington, J. (1997). Cannibals with Forks: the Triple Bottom Line of 21st Century Business. Oxford: Capstone Publishing Ltc.

[10] Eskerod, P. and Huemann, M. (2013), "Sustainable development and project stakeholder management: what standards say", International Journal of Managing Projects in Business, 6(1), 36 – 50.

[11] Fernández-Sánchez, G., & Rodríguez-López, F. (2010). A methodology to identify sustainability indicators in construction project management—Application to infrastructure projects in Spain. Ecological Indicators, 10, 1193–1201.

[12] Freeman, R.E., Harrison, J.S. and Wicks, A.C. (2007), Managing for Stakeholders: Survival, Reputation, and Success, Yale University Press, Yale.

[13] Freeman, R.E., Harrison, J.S., Wicks, A.C., Parmar, B.L. and De Colle, S. (2010), Stakeholder Theory: The State of the Art, Cambridge University Press, Cambridge.

[14] Friedman, M. (1970) "The Social Responsibility of Business is to Increase its Profits", The New York Times Magazine.

[15] Gareis, R. (1990), Handbook of Management by Projects, Mainz, Wien.

[16] Gareis, R., Huemann, M., Martinuzzi, R-A., with the assistance of Weninger, C. and Sedlacko, M. (2013), Project Management & Sustainable Development Principles, Project Management Institute, Newtown Square, PA USA.

[17] GPM Global. (2014), Sustainability Management Plan 1.2, GPM Global.

[18] Hardi, P. and Zdan, T. (Eds.) (1997). Assessing sustainable development: Principles in Practice, International Institute for Sustainable Development, retrieved from http://www.iisd.org/pdf/bellagio.pdf.

[19] Hobday, M. (2000), "The project-based organisation: An ideal form for managing complex products and systems?", Research Policy, 29, 871–893.

[20] Huemann, M. (2015). Human Resource Management in the project-oriented Organization. Gower Publishing, Farnham.

[21] International Project Management Association (2015), Individual Competence Baseline version 4, International Project Management Association, Nijkerk, the Netherlands.

[22] Julian, S.D., Ofori-Dankwa, J.C., and Justis, R.T. (2008), “Understanding strategic responses to interest group pressures”, Strategic Management Journal, 29, 963-84.

[23] Keeble, J.J., Topiol, S. and Berkeley, S. (2003), “Using Indicators to Measure Sustainability Performance at a Corporate and Project Level”, Journal of Business Ethics, 44(2-3), 149-158.

[24] Keegan, A. and Turner. J.R. (2002), “The management of innovation in project-based firms”. Long Range Planning, 35(4), 367–388.

[25] Knoepfel, H. (Ed.) (2010), Survival and Sustainability as Challenges for Projects, International Project Management Association, Zurich.

[26] Labelle, F. and Leyrie, C. (2013), “Stakepartner Management in Projects”, The Journal of Modern Project Management, May-August.

[27] Labuschagne, C. and Brent, A. C. (2006), “Social indicators for sustainable project and technology life cycle management in the process industry”, International Journal of Life Cycle Assessment, 11(1), 3-15.

[28] Libaert, T. (1998). “Faire accepter un projet: principes et méthodes.” Communication et langages, 117, 76-90.

[29] Lundin R.A. and Söderholm A. (1995), “A theory of the temporary organization”, Scandinavian Journal of Management, 11, 437–455.

[30] Ma, U. (2011), No Waste; Managing Sustainability in Construction, Gower Publishing, Farnham.

[31] Maltzman, R. and Shirley, D. (2011), Green Project Management, CRC press, Boca Raton, FL USA.

[32] Marcelino-Sádaba, S., Pérez-Ezcurdia, A., González-Jaen, L.F. (2015), “Using Project Management as a way to sustainability. From a comprehensive review to a framework definition”, Journal of Cleaner Production, 99, 1–16.

[33] Martens, M.L. and Carvalho, M.M. (2016). “Key factors of sustainability in project management context: A survey exploring the project managers' perspective”, International Journal of Project Management, in press.

[34] Martens, M.L. and Carvalho, M.M. (2017). “Sustainability and Success Variables in the Project Management Context: An Expert Panel”, Project Management Journal, 47(6), 24-43.

[35] Mettler, T. and Rohner, P. (2009), “Situational Maturity Models as Instrumental Artifacts for Organizational Design”, In Proceedings of the DESRIST'09.

[36] Oehlmann, I. (2011), The Sustainable Footprint Methodology, Lambert Academic Publishing, Cologne.

[37] Pasian, B. and Silvius, A.J.G. (2016), “A Review of Project Management Research in IRNOP and PMI Conferences from 2009 to 2014 to Identify Emerging Perspectives”, European Academy of Management (EURAM), Paris.

[38] Shenhar, A. and Patanakul, P. (2014). "Implementing Strategy through Projects" in J.R. Turner (Ed.), Handbook of Project Management, Gower publishing, 35-47.

[39] Silvius, A.J.G. (2015a), “Considering Sustainability in Project Management Processes”, in: Thomas, K.D. (Ed.), Handbook of Research on Sustainable Development and Economics, IGI Global Publishing.

[40] Silvius, A.J.G. (2015b), Model Project SMP, retrieved from http://www.slideshare.net/GilbertSilvius/model-project-smp

[41] Silvius, A.J.G. (2016), “Sustainability as a competence of Project Managers”, PM World Journal, V(IX), 1-13.

[42] Silvius, A.J.G., Kampinga, M., Paniagua, S. and Mooi, H. (2017) “Considering Sustainability in Project Management Decision Making; An investigation using Q-methodology”, International Journal of Project Management, In press.

[43] Silvius, A.J.G. and Schipper, R. (2014), “Sustainability in Project Management: A literature review and impact analysis”, Social Business, 4(1).

[44] Silvius, A.J.G. and Schipper, R. (2015), “Developing a Maturity Model for Assessing Sustainable Project Management”, Journal of Modern Project Management, 3(1), 16-27.

[45] Silvius, A.J.G. and Schipper, R. (2016), “Exploring the relationship between sustainability and project success - Conceptual model and expected relationships”, International Journal of Information Systems and Project Management, 4(3), 5-22.

[46] Silvius A.J.G., Schipper, R., Planko, J., van den Brink, J. and Köhler, A. (2012), Sustainability in Project Management, Gower Publishing, Farnham.

[47] Sydow J., Lindkvist L. and DeFillippi R. (2004), “Editorial: project organizations, embeddedness and repositories of knowledge”, Organization Studies, 25(9), 1475–1489.

[48] Tam, G.C.K. (2017), Managerial Strategies an Green Solutions for Project Sustainability, IGI Global Publishing.

[49] Taylor, T. (2008), A sustainability checklist for managers of projects, retrieved from http://www.pmforum.org/library/papers/2008/PDFs/Taylor-1-08.pdf.

[50] Tiron-Tudor, A. and Ioana-Maria, D., “Project Success by Integrating Sustainability in Project Management”, in Silvius A.J.G. and Tharp, J. (Eds.), Sustainability Integration for Effective Project Management, IGI Global Publishing, 2013.

[51] Tulder, R. van, Tilburg, R. van, Francken, M. and da Rosa, A. (2014). Managing the Transition to a Sustainable Enterprise: Lessons from Frontrunner Companies, Earthscan by Routledge.

[52] Turner, R.J. (2014). "Projects and Their Management" in J.R. Turner (Ed.), Handbook of Project Management, Gower publishing, 19-34.

[53] Turner, J.R., Anbari, F., and Bredillet, C. (2013). “Perspectives on research in project management: the nine schools”, Global Business Perspectives, 1(1), 3-28.

[54] Turner R and Keegan A. (1999), “The versatile project-based organization: governance and operational control”, European Management Journal, 17(3), 296–309.

[55] Turner, J.R. and Müller, R. (2003), “On the nature of the project as a temporary organization”, International Journal of Project Management, 21(3), 1–8.

[56] Willard, B. (2005), The next sustainability wave: building boardroom buy-in, New Society Publishers, Gabriola Island.

[57] World Commission on Environment and Development (1987). Our Common Future, Oxford University Press, Oxford.

Sustainability in the Educational Process through Sustainable Software

P. Arras[1], P. Shynkarenko[2], G. Tabunshchyk [3]

[1] Dr. ing., International Relations Officer, KU Leuven – faculty of engineering technology, J. De Nayerlaan 5, Sint-Katelijne Waver, Belgium, peter.arras@kuleuven.be, iiw.kuleuven.be

[2],Master Student of Software Tools Department, Zaporizhzhya National Technical University, Zhukovskogo, 64, Zaporizhzhya, Ukraine, Polina Shynkarenko, polyashinkarenko@gmail.com

[3] Prof. of Software Tools Department, Zaporizhzhya National Technical University, Zhukovskogo, 64, Zaporizhzhya, Ukraine, galina.tabunshchik@gmail.com

Abstract: *In this paper the question of sustainability of software which is used for teaching engineering disciplines is discussed. A case study for the reengineering of software for the determination and optimization of cutting conditions is presented by the authors.*

Keywords: engineering, software sustainability, re-engineering, COPTURN

1. Introduction

Educating engineers and technicians relies on technical solutions. Technology in society is in a constant evolution and the educational environment is expected to keep up with all these trends and (r)evolutions to teach their students the best and newest technologies.
On top, the digital teaching aids – as all related to computers – even change quicker, driven not only by new techniques, but also the fast obsoleteness of hardware (and software).
Conflicting with this evolution is the lack of resources for schools and universities to acquire all the newest tools.
Sustainability is a widely used term and refers to the capacity of something to last for a long time, in other words the capacity to support, maintain or endure.
To reach sustainability in the global world we need good education to prepare all children for a world which is durable. The ideas of endless grow in consumption and unlimited natural resources has been countered by the reality of limits in the production of fuels, food, fresh water and other natural resources.
"Industrial and economic constraints, catastrophic environmental pollution in many regions and disastrous water, land and air quality are forcing engineers to think differently. In addition, engineers have to take into account the ever-increasing complexity of interaction between technology and human beings. In the techno-centric 21st century, engineers are challenged by the uncertainties associated with the impacts of their designs on their respective societies." [1]
The paradox that teaching engineers on the one hand is going for newer, faster, better, more productive systems and on the other hand going for more sustainable, people- and earth friendly techniques brings also responsibilities towards the way we use systems in education itself.
So sustainability in education covers a lot of different issues.
One can consider the sustainability of the knowledge transfer to students, the durability of buildings or equipment, the ability to stimulate a sustainable (lifelong learning) attitude in students and staff.
More and more knowledge transfer to students is supported by software-tools. Building expertise in a tool and creating the necessary didactics for using it requires (a lot of) time. Unfortunately however, due to the ever continuing change of computers, OS, programming languages, the specialist dedicated software tools very often outdate and become obsolete.

The term "Sustainable Software" can be investigated in two ways [2]: how to achieve sustainable code or how software can support to reach the sustainable goals. This paper deals with both dimensions and considers sustainable software development for educating engineers: first a

definition of sustainability in software development, next we look at a case of the updating of an expertise system COPTURN (Cutting Optimization Program - Turning) for the determination of optimal cutting parameters for the turning process.

2. Sustainability in Software Development

If to look at sustainability from the point of code it means that "the software you use today will be available - and continue to be improved and supported - in the future" which can be achieved by different approaches [3]. Even from this point of view, sustainability has many dimensions that relate organization to information systems and to software engineering [3]. Also sustainability in development also should be considered separately as it is about efficiency and balancing the needs on the short and long term [4].
Software architectures play a major role in large-scale systems' sustainability (that is, economical longevity), vastly influencing maintenance and evolution costs. It's thus desirable to measure the sustainability of a software architecture to determine refactoring actions and avoid poor evolution decisions [5]. There are several areas in which software sustainability needs to be applied: software systems, software products, Web applications, data centers, etc. Which have different architecture and for sustainability assessment more convenient to use integrated approach which concider as requirements as architectural design as source code.
Despite all efforts technologies are changing very dynamically and it is difficult to foreseen all. But re-engineering of the existing software can allow to reach sustainable goals as in research as in education.
So we suggest for development process to consider from the point of view of future re-engineering, which can highly improve its long-term sustainability. Software re-engineering process is following the typical software lifecycle but it involve software transformation at different level of abstraction. One of the main differences is that instead of requirements of the stakeholders analysis the re-engineering process starts from the source code analysis of an existing software.
There are numerous of object-oriented re-engineering patterns which input parameters can be considered as quality metrics for long term sustainability assessment.
Following case study is an example of well created software inheritance for sustainable educational and research goals.

3. Case study

The existing program named COPTURN is a software package for the determination and optimization of cutting conditions and the calculation of cutting times and cutting costs. This system – originally dating back to the 1970's with a major upgrade near 1998 – is reengineered, rewritten in another programming language and optimized with a new user interface. The system – in comparison to some commercial software – is open for students to research and work upon, and IP in it is also owned by the university itself. So after years of losing functionality due to outdated (software) technology, a complete makeover was decided.

The existing solution had a number of problems.

1) The key issue is its being outdated with respect to compatibility with new operating systems and platforms. Behavior of the program cannot be predicted, what makes it unsustainable.
2) There is provided a set of catalogues, which contain static data about lathes and their characteristics, frequently used tools and materials [6]. These catalogues with static data are ordinary sequential text-files, which can be modified by an editor, but the program itself doesn't provide any interface to manage this information. Data is arranged line by line, separated with spaces in each line. The meaning of each value is described in the

header of the file. Thus, with this implementation it is difficult to add or update any information.

3) The program contains menu items to create a new project, save it or open existing, make and print a report. However, after creating and saving a project, buttons for some of these operations remain inactive.
4) The program has only two auxiliary drawings that would explain the physical meaning of the entered values. However, they describe only a small part of required items. These images are insufficient and require redesign with respect to the colors and description.
5) The program doesn't provide any help or guide to a user, "Help" menu item displays window with information about program.

The above-mentioned issues became crucial and a new solution has been developed. The new software system for the determination of economic optimum machining conditions was designed and built with the use of the technology and strategy of COPTURN. It is based on the minimum cost criteria as a main concept and relies on fundamental cutting laws, terms and constraining factors (restrictions imposed by the machine, workpiece material, workpiece geometry and fixture, etc.) [7]. The new program uses the scenarios and static data of the COPTURN software, that have been updated and re-engineered.
The component diagram (fig. 3.1) explains the concepts of the new software and gives an overview of its architecture.

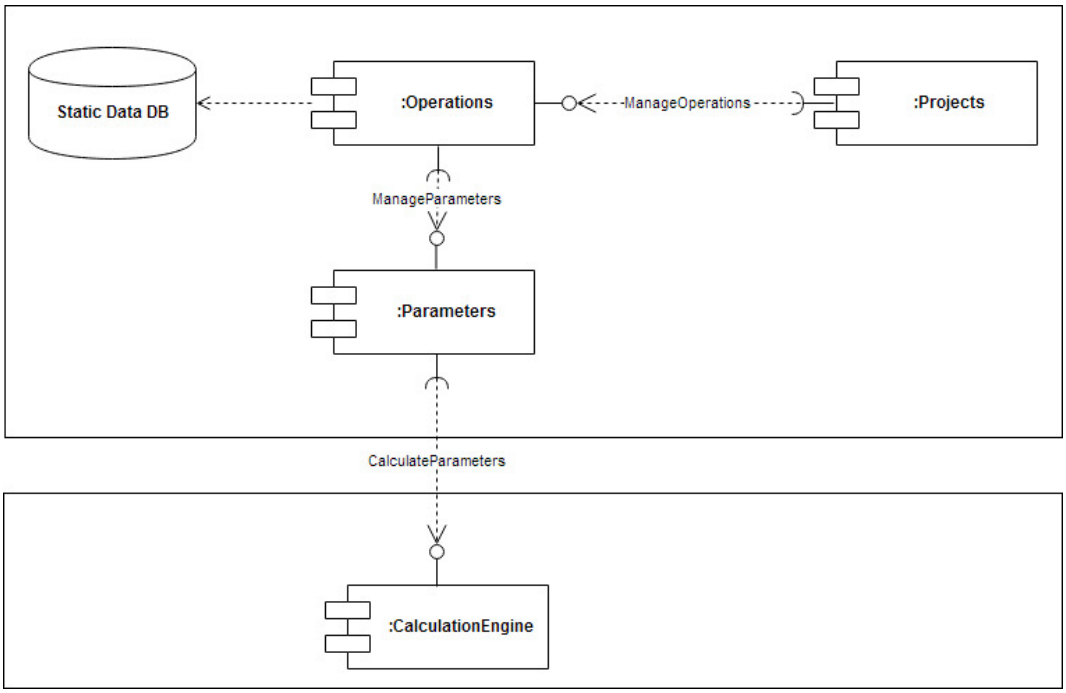


Fig. 3.1 – UML Component Diagram

The new program allows to create and manage a project that includes a set of operations that can be performed on a workpiece. The provided GUI interface allows a user to input the required values, choose an equipment (loaded from a DB file) and make all necessary settings in order to get a result that represents optimal cutting values provided that a cost of the machining is minimal. Static data was converted to a single JSON file used as a database to reduce platform and software dependency and make it compatible and general-purpose. The new software loads data from this file and displays to a user. The SQL scheme is represented on fig. 3.2.

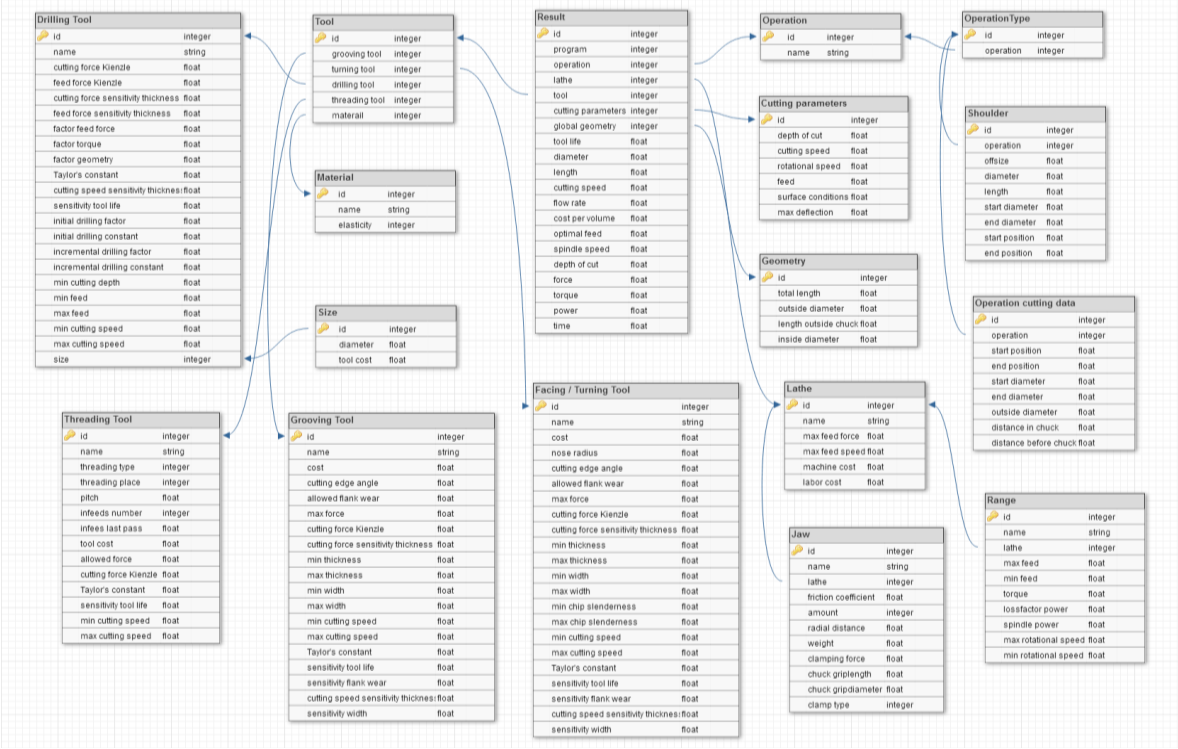


Fig. 3.2 – SQL representation

Also, the software provides an interface that allows to manage information stored in the DB, i.e. add new objects, remove or edit existing. The appearance of the new program was improved to make it more modern and user-friendly. There were implemented new images that describe all operations and provide a guidance for users with respect to the physical meaning of the imposed values. A "Help" section was added as well.

The new implementation is a Python desktop application, based on PyQt5 – a Python binding of the cross-platform application framework Qt [8]. Its GUI was built with the use of QtDesigner application. The resulting Qt forms were used to generate the UI code with the help of PyQt5's pyuic5 utility. The standard appearance of Qt forms was changed and stylized by setting a designed style sheet and QtAwesome library. The process of development was performed in PyCharm IDE. CXFreeze is a library that allows to "freeze" Python scripts into executable files under any platform Python works on itself [9].

Within the software sustainability concept, the functionality-centric approach was implemented. In order to reproduce the operation of the old software system, the migration process has been made. This approach means re-coding the software to run it on new hardware or perform with new and reliable software. It also gives an excellent opportunity to enhance the old program's performance by solving issues and adding new features. The code was completely rewritten to another programming language with the use of modern technologies, that keeps a code up to date with the latest changes that the program relies on. This migration is in fact a development of new software, but constrained by the old architecture. Migrating the software that completely produces a new code package that reliably recreates the work of the old software is required to make the program stay in use over a long period of time [3].

(The work was done in the frame work of international students and teachers exchange in Erasmus + KA1.)

4. Results and Conclusion

Sustainability in technology in education covers many areas. The use of educational software for teaching (LMS, MOOCs..) is one aspect and has been researched a lot.
The sustainability however of technological software systems used in teaching is an area which is mostly forgotten or put aside as an equipment and investment thing.

The reengineering and improving sustainability of the expert software system (COPTURN) turned out to be a tough task: the interaction of the users of the system (technologists) and the software engineers which made the conversion let to new insights on how sustainability was conceived by both sides.

The new platform strategy put forward in the case study will be used to convert other software systems to make them more sustainable suited for this typical field of study. The new system is open source to the students allowing them to integrate new modules and to research on knowledge in the expertise system and as such converted the old closed (and obsolete) system to a modern software tool, ready to meet and cope with future technology challenges.

5. References

[1] M. Sotoudeh, Technical Education for Sustainability. An analysis of needs in the 21th Century, Frankfurt am Main: Peter Lang Internationaler Verlag der Wissenschaften, 2009.

[2] B. Penzenstadler, A. Raturi, D. Richardson, C. Calero and H. Femmer, Systematic Mapping Study on Software Engineering for Sustainability (SE4S), French Universitat Politècnica de Catalunya.

[3] "Approaches to software sustainability," Software Sustainability Institute, [Online]. Available: https://www.software.ac.uk/resources/approaches-software-sustainability. [Accessed 28 04 2017].

[4] C. Calero and M. Piattini, "Part 1. Introduction to Green in Software Engineering," in *Green in Software Engineering*, Springer International Publishing, 2015, pp. 3-27.

[5] H. Koziolek, D. Domis, T. Goldsmith and P. Vorst , "Measuring Architecture Sustainability," in *IEEE Software*, IEEE, 2013, pp. 54-62.

[6] G. Selleslagh, Manual Cutting Optimization Program - Turning (COPTURN), Leuven: Heverlee.

[7] J.-P. Kruth, Productietechnieken en -systemen, Leuven: Acco, 2010.

[8] "PyQt5 Reference Guide," Riverbank Computing Limited, [Online]. Available: http://pyqt.sourceforge.net/Docs/PyQt5/. [Accessed 28 04 2017].

[9] A. Tuininga, "Welcome to cx_Freeze's documentation," [Online]. Available: https://cx-freeze.readthedocs.io/en/latest/. [Accessed 28 04 2017].

THE BLENDED MENTAL SPACE AS ONE OF THE FACTORS FOR SUSTAINABILITY AND SUCCESS IN THE PROJECT IMPLEMENTATION PROCESS

Olena Verenych

Email: verenych@ukr.net
Affiliation: associate professor of KNUBA

Victoria Bushyeva

Email: verenych@ukr.net
Affiliation: lecturer of KNUBA
University: Kyiv National University of Construction and Architecture of Ukraine (KNUBA)
Address: #31, Povitroflotskiy Avenue, Kyiv, Ukraine

Abstract: *A sustainability during a project implementation process is one of the main factors of the project success. If we have sustainability, it will lead to the project success. The sustainability can be defined as a well-done planned project, sustainability movable context, harmonious project team, and stakeholders work, and also an unambiguous understanding all of the project documents by all participants in the project process. Our paper primary focus will be on the unambiguous understanding.*

In our practice, we often find that unambiguous understanding is incomplete or non-existent. This is a typical situation for countries in which the project approach is just have been introduced or exists in the state of development. The unambiguous understanding appears when all of the participants of the project-oriented process join in a single project mental space.

Such single project mental space come to effect as a result of the participants working together and represents the mental space that includes knowledge, skills, and practices of all participants in the project-oriented process [1]. We will refer to this space as a Blended Mental Space (hereinafter – the BMS).

Keywords: project, blended mental space, stakeholders, project manager, movable space

1. Introduction

The BMS is a space that exists temporarily during project life cycle. It is necessary to create an environment (space) of joint action and understanding of the process of the project implementation by all participants of the project-oriented process at various stages of the project lifecycle. All participants involved in the project execution must understand unambiguously in any given moment to understand the processes, goals, and tasks, which are taking place at this point in time, and know the approaches and methods used to achieve them.

Based on the above, the aim of the BMS is the creation and functioning of a mental space in the process of the project implementation.

According to the 1-st definition in the small academic dictionary [2], the concept of "function" is an occurrence that depends on the other and changing with the changing another occurrence.

Based on this definition, we can analyze the BMS function. The birth of the project idea can be considered as the project's beginning and an appearance of the desire for the project implementation. Each idea is unique. This uniqueness can be:

- absolute. For example, a project of the construction of a the new safe confinement over the collapsed reactor as a result of the man-made disaster at the Chernobyl nuclear power plant (Ukraine) [3];
- or relative. That mean, that in that generally a project can be attributed to a group of similar projects, it implementation takes into account certain features. For example, the project to create a Cadastre system in Ukraine [4]. The unique character of the project appeared in the implementation conditions (during that time a lot of legislative collisions happened because of in a turbulent political continuum), scale (it was one of the largest infrastructure projects in Ukraine) and a the project product (it was unique for Ukraine).

Each project has its own lifecycle, although its phases will be the same for all projects. The duration and the complexity of the life cycle's each phase will be the uniqueness of the project life cycle. The formation of unambiguous understanding of the processes that occurs in each phase of the life cycle is carried out in the BMS. This is possible only in the mental space, which provides all participants of the project-oriented process with opportunities for interaction and communication in order to develop a common understanding during the implementation of the process.

Based on above, the BMS's function is the interaction and communication support of all participants in the project process throughout the project lifecycle.

The interaction and communication in the BMS can be provided using the next facilities] (following communication prospects, channels):

- Negotiations;
- Meetings;
- Conferences;
- Discussions;
- Various reports;
- Integrated information system of a project;
- Workshops and training;
- News releases;
- Informational management systems.

Each approach can be adopted for the use in different situation, but mechanics of their use will follow common principles.

The functioning of the BMS is based on an the understanding of the structure of a given space, i.e. on the understanding all of the of connections between parts of the space. To achieve an understanding, to understand the big picture, we will examine, we will research the BMS and try to understand what the BMS elements consist and what kind of links, transformations, and transitions between these elements exists in throughout the different phases of the project lifecycle.

Because the BMS is a mental space, knowledge will be the main elements of it. But apart from knowledge, according to P2M, any project should create value, i.e. benefits that will create the project product, when all the requirements of the project mission will be satisfied [5]. In addition, practices and skills will be the elements of the BMS too. Nevertheless, knowledge, skills, practices and values are not individual elements. The BMS consists of the accumulated knowledge, skills, practice, and set of values.

Thus, elements of the BMS will be the sets of knowledge, skills, practices and values [5], which will be transformed and changed during the project implementation. The sets of knowledge, skills, practices and values of the BMS (are) consists of elements that belongs to of the project manager's, project's, movable context's and stakeholders' mental spaces. Nevertheless, as was shown in [7,8], such the space is based not on the absorption of other mental spaces, but on the union of their elements, which can be original or changed both at the entrance to the BMS or in the process of its existence.

The space itself creates new elements (for example, the project manager gets new knowledge and the movable context gets new values) and transforms existing elements that are

already included (for example, the customer upgrades his/her level of competence in the implementation of the project, or the project manager improves his/her practice in contracts administration. Because of the nature of the BMS is transitory and exists only during project implementation, upon completion of the project all the BMS elements returns to the project manager's, stakeholders', movable context's and project's mental spaces in the original or transformed form upon completing the project. In the future, they can be used to create and operate other blended mental spaces for other projects.

The BMS includes the project manager's mental space, it would be logical to see a set of skills among the BMS elements, since it is one of the sets of the project manager's mental space [7]. Nevertheless, skills are utilized by a personal way of doing things on based on the acquired knowledge and experiences [9]. Working outside of the BMS will require utilizing only personal knowledge, experience and resources. A person can transfer to another person knowledge and experiences, but the skills are acquired individually. Based on this conclusion we can exclude skills from the BMS.

Thus, the BMS structure will be consist of three sets:

- knowledge;
- practices;
- values.

Each set will be considered and studied on the different phases of the project lifecycle.

2. Study of the BMS elements on the different project lifecycle

The Initiation phase. During the initiation phase, the project idea, with the help of the project manager's knowledge, is transformed into a project; the result through understanding by the customers certain nuances of the idea and success criteria. The project manager transforms and formalizes the stakeholders' knowledge using his/her professional knowledge. On top of that, the project manager forms the BMS's knowledge set. At the same time, the stakeholders' mental space of the knowledge set is changing by addition adding knowledge about the project process. In fact, several knowledge transformations takes place during the initiation phase [10]: tacit knowledge into tacit knowledge (socialization) and tacit knowledge to explicit knowledge (externalization). The project manager always make agrees with the stakeholders (the customer) unambiguously understanding the obtained transformed and formalized knowledge.

The project documents are the interaction results of the knowledge sets of the project manager and stakeholders in the BMS. The project documents are explicit knowledge, which are describing certain future activities in the frame of the project implementation (practical actions). The knowledge formalization is carried out using the appropriate project manager's practices and skills. Therefore, the practices and skills sets of the project manager aren't included in the BMS, but they act directly on it. The project documents and information about the project will be the result of this activity.

Inasmuch as any project should create a value, the project values, the project manager values, and the stakeholders' values will be already formed during the phase. These values may remain unchanged until the project closing or may vary dependability on the project progress: decrease or increase.

The above information can be presented schematically (Fig. 1).

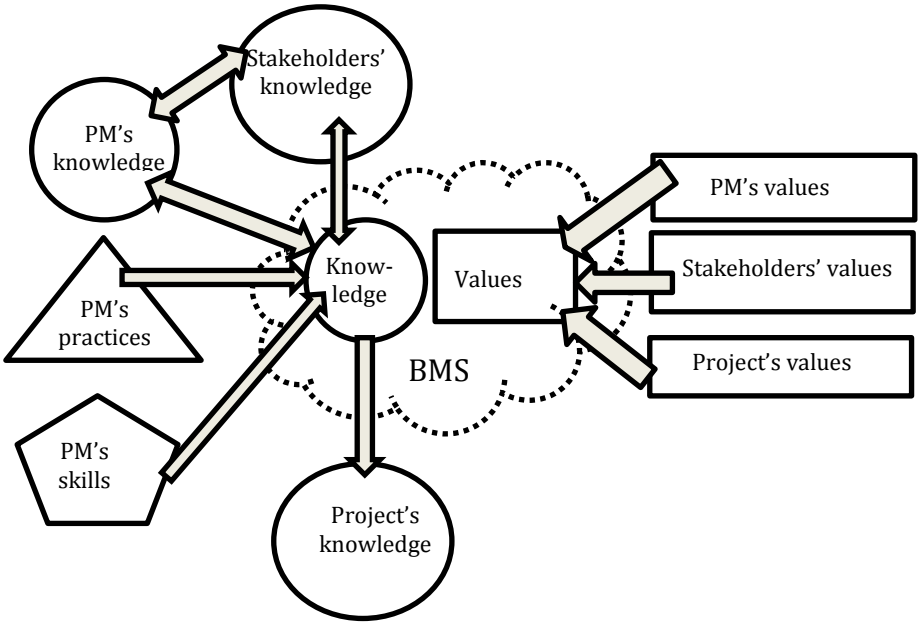


Fig. 1. Schematic presentation of different sets influence on the BMS's sets during the initiation phase [own source].

The arrows point out on the influence directions on the fig. 1.

The planning phase. The phase is one of the most basic and complex, as it is necessary to plan the entire project in detail. It is important to conduct a comprehensive project analysis, concerning the project product creation, to analyze and classify all existing possible technologies and methods for the project product creating, to identify and classify stakeholders, to describe uncertainties and to analyze risks based on uncertainties, etc.

The project manager uses his/her professional knowledge to transform and formalize the stakeholders' knowledge about the project. The number of stakeholders can expand. Such expansion is possible due to the analysis of stakeholders and their classification taking into account their interest and influence on the project. Here the project manager uses not only professional knowledge but also individual ones.

The increasing number of stakeholders occurs due to the necessity of involvement of highly specialized specialists necessary for the analysis of the project product technical aspects, the involvement of the customer's specialists to assess the future project organizational structure (functional, matrix, project), risk management specialists for risk assessment and analysis, etc. Investors for the future project, stakeholders from the government and international organizations can be identified as the stakeholders.

At this phase, the project manager works closely with a part of the stakeholders, formalizing their knowledge. Nevertheless, some stakeholders, who can have an impact on the project, are, but the project manager can't work closely with them. For example, it is necessary to take into account the demographic and ecological situation in the region, when a project of the construction of a nuclear power plant is considered. In this case, residents of the region, where construction is planned, will be valued the same as stakeholders. The residents may not take part in a protest if the project manager informs them about advantages of the plant construction and planned the environmental renovation. The expanding the labor market due to the construction and operation of the plant may be one of the advantages. If the project manager doesn't give consideration enough the residents can organize protests. The protests may have a serious negative impact on the future project, until the closure of the project in the phase. Thus, the project manager may not work closely with the residents, but they may have an impact on the project. The changing influence depends on the project manager's professional actions and knowledge.

The movable context's knowledge is also included in the knowledge set of the BMS. The movable context doesn't participate in the project directly, but has an influence on it and directly

interacts with its individual parts. In the article [11] it was analyzed and shown that in general about 200 elements of the movable context can have an impact on the project.

The knowledge set of the project's mental space will also include into the knowledge set of the BMS. The transformed and formalized during the initiation phase project's knowledge will be fully utilized in the phase.

All knowledge, which is included in the knowledge set of the BMS, will be transformed into the knowledge, practices and skills sets elements of the project manager's mental space into explicit knowledge. Such transformations will be made in accordance with one of the project management methodologies or internal standards of the customer's organization for project management if any. Part of the explicit knowledge will be included in the knowledge set of the project's mental space in the documents forms, some of them will expand the knowledge set of the BMS, and some will form the practices set of the BMS and the practices set of the project's mental space.

The practices set of the project can also be expanded by adding the accumulated previous experience in implementing similar projects (if it exists in the organization and it is accepted to formalize). All sets, which are included in the project manager's, stakeholders' and the project's mental spaces, will be transformed.

The values can remain unchanged, as in the initiation phase. New values can be formed depending on the complexity, scale, and significance of the project:

- product (new technologies, new materials that will be used for the project product),
- process (new design, new business processes that will be developed for the project product creation);
- development (new problem solutions that will be used for the project planning) [5].

The values of the project manager, stakeholders, and movable context will influence on new values formation and will transform the project values.

The above information can be presented schematically (Fig. 2).

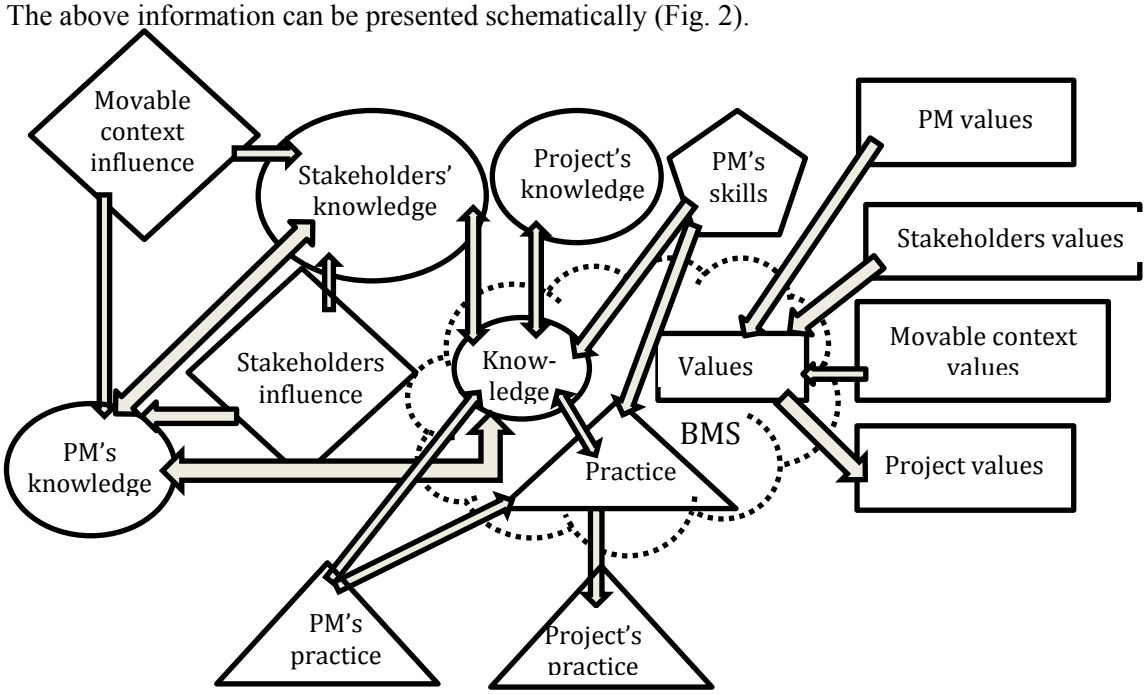


Fig. 2. Schematic presentation of different sets influence on the BMS's sets during the initiation phase [own source]

The arrows point out on the influence directions on the fig. 2.

The implementation phase. Implementation all approved plans and the design solutions take place in the implementation phase.

The project manager's, stakeholders' (through contractors), and the movable context's (the state context, the industry context, and the organizational context sets) mental spaces will be influenced on the BMS in the frame of the phase.

The knowledge set of the BMS will not change significantly at the phase, inasmuch as the main approaches and solutions to achieve the project objectives were evaluated at the previous phase. However, the knowledge set the project's mental space will expand its.

Herewith, the knowledge set of the BMS will carry out the knowledge transformation from explicit knowledge to explicit knowledge (combination) and from explicit knowledge to tacit knowledge [10]. The state context, the industry context, and the organizational context sets of the movable context's mental space will influence on the knowledge set of the BMS. Organizational culture, workflow management, report presentation, internal or external communications, and approaches to negotiation and conflict resolution reflect this influence.

The results of the interaction of the knowledge sets of the project manager, stakeholders, and the BMS are represented in the reports forms, signed and executed contracts.

The knowledge set of the project is fully included into the knowledge set of the BMS. The knowledge set of the project includes all approaches to project implementation describing.

The values set of the BMS will change a little bit. In general, it will be due to obtained new skills as the project's implementation result. Therefore, the values set of the BMS will have an impact on the values sets of the project manager and stakeholders, but it will not change.

The practices set will be expanded through obtained new practices in the transformation process of knowledge from explicit knowledge to tacit knowledge (a real experience expansion) [10]. The practices set of the BMS will expand due to the project's and movable context's knowledge transformation to practice with help of the professional knowledge, the explicit practice and skills of the project manager, and the knowledge, which relating to the project, stakeholders.

The above-described process can be presented schematically (Fig. 3).

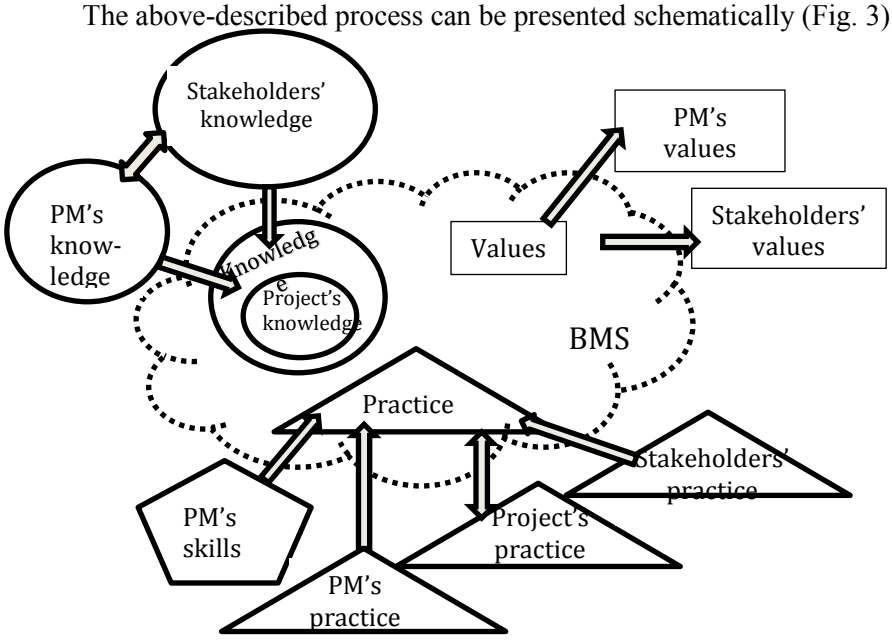


Fig. 3. Schematic presentation of different sets influence on the BMS's sets during the implementation phase [own source]

The arrows point out on the influence directions on the fig. 3.

The Monitoring and Control phase. Comparing the planned and actual indicators of the project implementation takes place on the monitoring and control phase. In the frame of the phase, possible alternatives are evaluated and the project manager offers corrective activities to eliminate unwanted deviations if it's necessary.

Considering the BMS at this phase, it can be argued that the professional knowledge, the explicit practices, and skills sets of the project manager's mental space will be influenced by it. The project manager is responsible for the project implementation monitoring. His/her knowledge of methods and techniques of analyzing project implementation allows achieving the project objectives in time with an approved budget and the given quality. The knowledge set of the BMS will be expanded due to supplementing the professional knowledge, practices, and skills of the project manager in the aspect of project control implementation.

The values set of the BMS will not change, inasmuch as monitoring and control don't change the values. The phase is a transition tacit knowledge in tacit knowledge according to the Spiral of Organizational Knowledge [10]. In practice, this is a spread of intellectual models and technical skills [10], which is reflected in the application of knowledge and skills to the project monitor.

The above-described process can be showed schematically (Fig. 4)

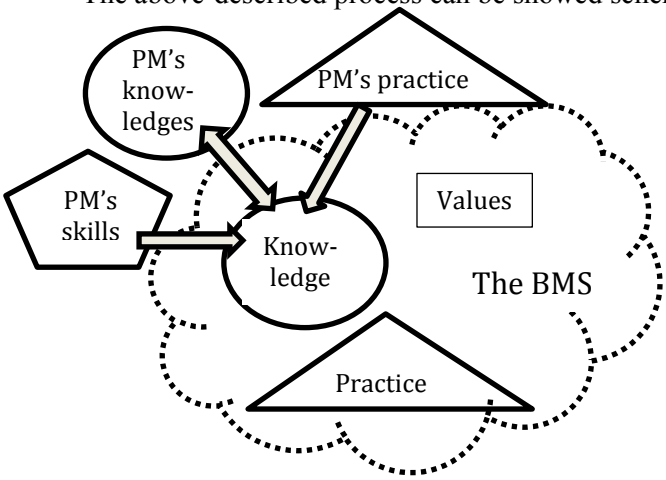


Fig. 4. Schematic presentation of different sets influence on the BMS's sets during the monitoring and control phase [own source]

The arrows point out on the influence directions on the fig. 4.

The Closing phase. The project tasks are being finished and the project is being closed officially at the closing stage. The project history is being learned in the project-oriented companies. The project history is accumulated in the knowledge base. In fact, the knowledge transformation from tacit to explicit (concepts are being included in the knowledge system) takes place [10]. The acquired knowledge, practices and values will be transferred from the BMS to the project manager's, stakeholders', and the project's mental spaces, expanding them. Results of these transferring will be presented in the reports forms, different approaches analysis, descriptions the used technologies and methods in the project, methodologies and technologies implementation, etc. In the future, obtained during the project the knowledge, practices, and skills will be applied to other projects implementation.

3. Results and Conclusion

Successful projects implementation requires an unambiguous understanding of the project process by all its participants. The project doesn't exist separately from the movable context, the stakeholders, and the project managers. From its initiations to closing, it is necessary to unite the opinions, approaches, principles of implementation and evaluation of the project. Such a unity can exist in a blended mental space, which is formed from the moment of the project idea to its closing.

Researching of the space allows us to understand the complex structure of interaction between the mental spaces of the project manager, stakeholders, the movable context and the project. Understanding the structure will allow considering the approaches in a future for its

building. And it also allows developing management methods for its control that will help the project manager in successfully implement projects.

4. References

[1] Bushuyev, S., Verenych, O., Bushuyev, D., Jaroshenko, R.: Formal model of project or program mental space. The scientific journal "Radio Electronics, Computer Science, Control", No. 1(40), pp. 153-160 (in Russian) (2017)
[2] Evgenieva, A.P.: The Small Academic Dictionary. The Russian Language institute of the Science Academy of USSR, Moscow, Russia (1984)
[3] Chernobyl NPP: Chernobyl nuclear power plant; URL Document: http://chnpp.gov.ua/en/home, last visited Jun 13, (2017)
[4] World Bank: Report No: ICR2767: Implementation completion and results report on a loan to Ukraine for a Rural Land Titling and Cadastre Development Project; URL Document: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/11/06/000442464_20131106103928/Rendered/PDF/ICR27670P035770C0disclosed011040130.pdf, last visited Jun 13, (2017)
[5] Tanaka, H.: Presentation for SKEMA Business School: Service Science: Theories, Practical Applications and a Recent Ph.D. Research Case. Lille, France (2016)
[6] Verenych, O.: Conceptual model of mental space formation. Management of Development of Complex Systems. Kyiv, Ukraine: 23, 39 - 43. (2015)
[7] Verenych, O.: Formalized model of project manager/project team mental space. Management of Development of Complex Systems, Issue 24, pp. 23 – 29.(2015)
[8] Verenych, O.: Formalized model of stakeholders mental space. Management of Development of Complex Systems, Issue 26, pp. 58 – 66. (2016)
[9] Psychology dictionary (2017). URL Document: http://psihotesti.ru/gloss/tag/umenie/, , last visited Jun 13, (2017)
[10] Nonaka, I. & Takeuchi, H.: The knowledge – creating company. How Japanese companies create the dynamics of innovation. Oxford University Press, New York, NY.(1995)
[11] Verenych, O.: Development and implementation of formalized model of mental space of project or program environmental. Eastern-European journal of Enterprise Technologies, Vol. 2, No. 4(80), pp. 21-31. DOI: 10.15587/1729-4061.2016.65635 (2016)

"Project Management Office (PMO): An Operating Model For Public Enterprises in Cameroon to achieve Sustainability and Corporate Social Responsibility

Ekomenzoge Metuge

E-mail: ekomenzoge@yahoo.co.uk or eekomenzoge001@ikasle.ehu.eus

PhD Candidate in Project Management

University of the Basque Country (UPV/EHU) Bilbao Spain

Key words: Cameroon, Project management office, PMO, Enterprise project management office (EPMO), Sustainability, Electricity company of Cameroon (ENEO), Cameroon Development Cooperation (CDC), Brasseries du Cameroun, PRINCE2, PMBOK®

Abstract

After the introduction and implementation of a project management office PMO in 2015 in three companies in Cameroon, Brasseries du Cameroun [01]; (ENEO) Electricity company of Cameroon [02]; Cameroon Development Corporation [03]; two years later early 2017, I went to examine how specifically the implemented PMO role on sustainability and corporate social responsibility within the three companies and how these companies are unrolling to new innovative practise.

In the wake of increasing Regional integration and globalization (Trans-Pacific Partnership (TPP), or the Trans Pacific Partnership Agreement (TPPA); (Brazil, Russia, India, China and South Africa) BRICS; organisations within these states or regions are becoming increasingly conscious not only of what they buy, but also how the goods and services they are providing is produced with sound project management methodology, [04]. Consequently, countless companies and organisations are doing everything within their power to build trust and credibility with the general public to earn more profit through best practise. One of those ways is through emphasizing their social corporate responsibilities [05]. Essentially, social responsibility refers to "the attempt of a business to balance its commitments to groups and individuals in its environment, including customers, other businesses, employees, investors, and local communities [05]. There are various general approaches to social responsibilities and can be divided into four basic stances: Obstructionist, Defensive, Accommodative, and Proactive [06].

How then can organisations and companies in Cameroon develop prosperity without compromising the operations and future of their companies?

The PMO as a heavyweight methodology and its rules and roles in organisations, can better examine and put in place ways for helping to support the concepts of sustainability and corporate social responsibility during its projects and programmes.

1.0 Introduction

The concept of corporate social responsibility [07] means that organizations have moral, ethical, and philanthropic responsibilities in addition to their responsibilities to earn a fair return for investors (ROI) and comply with the law. A traditional view of the corporation suggests that its primary, if not sole, responsibility is for its owners, or stockholders. However, CSR requires organizations to adopt a broader view of its responsibilities that includes not only stockholders, but many other constituencies as well, including employees, suppliers, customers, the local community, local, state, and governments, environmental groups, and other special interest groups.

The highest degree of sustainable corporate social responsibility that any enterprise, company or organisation can exhibit is the proactive stance. [08]. A proactive stance, as opposed to a reactive one, involves acting in advance of a future situation rather than simply responding to a situation that has already happened. Ultimately, a proactive organization "actively provides and tries to figure out how to help instead of being reactive". But to better understand what part sustainability and corporate social responsibility play in most companies; “Policy for Sustainability and Corporate Social Responsibility within organisations have to be well managed.

According to the World Commission on Environment and Development (1987) “sustainability requires also a social and an environmental perspective, next to the economical perspective, on development and performance”. In his book ”Cannibals with Forks [09]: the Triple Bottom Line of 21st Century Business”, John Elkington identifies this as the ‘triple bottom line’ or ‘Triple-P (People, Planet, Profit)’ concept: Sustainability is about the balance or harmony between economic sustainability, social sustainability and environmental sustainability [10]. How then can enterprises or organisations or companies in Cameroon achieve this corporate sustainability? It is difficult for Cameroon to achieve this because of deep rooted mismanagement, and corruption within the government and government owned enterprises.

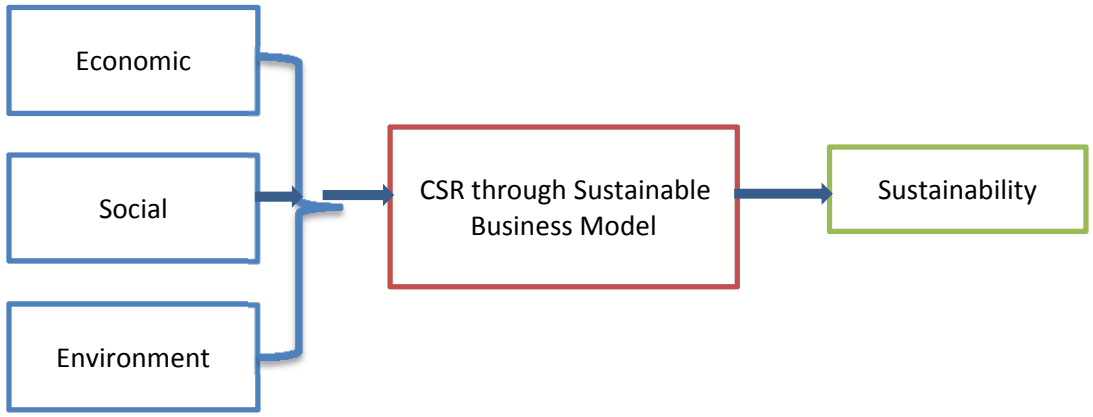
Accorded to Helton, Jordan (2011) [11], a study demonstrated on corruption and bribery in Cameroon, bribery was once a shameful deed, especially in the Anglophone Region of Cameroon, but it appears to have become a legitimate way of conducting business. Police checkpoints, Tax collection “Inland Revenue”, Electricity connection and distribution, Contracting and Procurement, Recruitments into Public enterprises, etc. To paraphrase Helton, Jordan 2011, the grossly mismanaged Cameroon ship Yard (Chanter Naval) has gone into crises so many times and the Cameroon Airlines, Cameroon Bank and even the Chad-Cameroon oil pipeline to the Atlantic Ocean. All these are as a result of fundamental solid mismanagement methodology and lack of the application of sustainability.

Sustainability is centred on the integration of the Economical; Environmental and Social aspects. This is referred to as the triple bottom or three-P concept as stated by Elkington (1997) [10] as the ‘three pillars’ of sustainability: Social, Environmental and Economical (illustrated in Figure 1). These three

pillars are interrelated and therefore may influence each other in multiple ways for which the PMO can better handle to make projects and programmes produce best results. Although these interrelations are acknowledged, we should as well note that some regional differences do exist with regards to each pillar. In (West) Europe and America, sustainability is mainly about environmental concerns, while in Africa the social concern seems to be prevailing. This same applies to companies and their products or services, Judy N. Muthuri (2012) [12]. According to the Africa Progress Panels (2010) [13], it is not the volume of economic activity that determines development, but it is based on how business enterprise activities affect people, economy, and the environment. According to Davis (1973 [14]) there is a flexible approach to corporate social responsibility practices. Davis states (1973 [14]), business enterprises are all holding social contracts with society and their existence depends solely on legitimacy within society; if a business enterprise fails to interact with society, then it fails to exist. In line with the above, Carroll (1979 [15]) developed a CSR model called the 'pyramid of CSR'. The model was later modified by Carroll (1991 [16], 1994 [17], 1998 [18], 1999 [19], 2000 [20], 2004 [21]) to clarify two competing themes; corporate citizenship and stakeholders. In his original work, Carroll says CSR is categorized into four parts: Economic, legal, ethical and discretional responsibilities; and then defined CSR as "the conduct of a business so that it is economically profitable, law abiding, ethical and socially supportive".

However, Viser et al., (2010 [22]), reviewing Carroll's CSR pyramid model, contend that Carroll's CSR Pyramid model does not fit into the African context for which this research knows that Cameroon falls in, where there is cultural relativism, a poorly developed legal framework, and a prevalence of poverty. Carroll's model fails to include an environmental dimension that can help to address inherent risks from unsustainable business practices across the Africa and the world; it fails to provide a specific direction on how business enterprises should implement the environmental dimension of CSR. From the analysis of what and how sustainability is been applied by companies to achieve their objectives and keep them running, an examination of the PMO model process are analysed for which the three companies mention here in this research have functioned so far to add that aspect of sustainability to enhance social, economic and the environment.

Figure 1: The Triple-P concept of sustainability



Source: Dyllick and Hockerts (2002), identify three key concepts of sustainability

One of the objectives of the PMO implementation is to help these companies aspire to achieve sustainable development, i.e. to strike a good balance between financial results, value creation and corporate social responsibility. The value created will be of benefit to owners, stakeholders and society-at-large. Its policy for sustainability and corporate social responsibility is intended to describe its ambitions and its most important target areas. PMO for these companies' policies provide the framework for its work with sustainability and corporate social responsibility.

Coming back after two years to check and analysis the role played by PMO in the enhancing sustainability and corporate social responsibility, I began by examining each of the component that is keeping these companies surviving after the implementation of the PMO.

2.0 Strategy

For the pass years, enterprises and companies in Cameroon have been trying to engage themselves in making the most advanced and technologically demanding solutions for its works, stakeholders and customers. This requires a unique culture with a strong set of value of commitments. To be able to develop throughout their production lifecycle, an enterprise must have long-term perspectives, unique competences and the ability to reach out for continuous renewal. This aspiration to innovation combined with ambitious and demanding goals is and has always been one of the operation companies in Cameroon most important attributes. Some important initiatives for achieving the objectives include:

2.1. Markets

Markets are characterised by stringent requirements for performance, quality and operational reliability. Eighty per cent of, "Cameroon Development Corporation (CDC)" operating revenues are earned outside Cameroon, while "Electricity producing company of Cameroon (ENEO)" and Brasseries du Cameroun (Cameroon Brewery Company)" earn almost all their revenues in Cameroon. With the implementation of a PMO, these companies are now striving to develop a marketing system to help meet customers' needs in an efficient manner. Customer proximity and cooperation on the development of optimal solutions are crucial. Strategic alliance-building is a prerequisite for success in several of their product areas.

2.2. Concentration on the business areas

The business areas are continuously reviewed to identify activities which do not occupy a natural place there, or which might better be developed under the auspices of other industrial constellations. The companies are now using the PMO enterprise system to consider these areas thoroughly in an effort to conserve assets insofar as possible.

These areas are PMO concentration on their business are as shown on the figure below.

Figure 2. Align PMO with Business Needs

Source: Adopted from IMPACT 2015

2.3. Acquisitions

Acquisitions are a key part of the corporate growth strategy in core areas. The goal of acquisitions is to exploit common technologies and achieve market synergies. Other motives include a desire to supplement the range of products, and to gain access to new markets or specialised technology with new products. The desire for constant improvement in their company's strategic market position plays a key role in its acquisition strategy.

2.4. Expertise

Knowledge and expertise are these three companies' most important competitive parameters. Opportunities for human resources development are crucial to positive performance trends, making them a high priority. It is important to offer attractive, challenging jobs. Leadership development programmes are conducted systematically. At this time, all these companies are motivating their staff and stakeholders into project management activities and short training programmes making them to have gotten project team members with the PMI certifications.

2.5. Corporate Social Responsibility and Ethics

The PMO has helped to institute a corporate Code of Ethics, an environmental policy and a policy for corporate social responsibility. These are basic elements in the efforts to achieve a corporate culture that supports profitable, sustainable development.

2.2.6. Technology

Product development and it costs are equal or equivalent to approximately 15 per cent of these three companies operating revenues each year. A high level of activity in this field is a prerequisite for profitable organic growth. Product development may be funded by customers and/or equity-financed. The needs of the market invariably determine each of them their direction, ambitions and solutions for product development. Their products are largely based on the following core competencies: software development services, research and development, Innovations, and much more of training need analysis to be able to identify weakness.

2.7 Financial strategy

These companies management attaches importance to having the financial wherewithal needed to ensure its freedom of action. Their growth are funded mainly by earnings and the freeing up of previously embezzled funds from some top management. External funding is always based on a long-term perspective that is commensurate with the company's business strategy and funding´s from government. These companies financial policy are now aiming primarily at increasing predictability and reducing risk.

After the implementation and now operating the project management office, these companies Sustainability and Corporate Social Responsibility Policy are now intended to promote their group's long-term business goals. At the same time, the company's goals must be compatible with sustainable development.

These three companies operations are not perceived as entailing particularly great challenges as regards environmental pollution. Notwithstanding, they are now always striving to improve and develop their business activities, not least in this area. They maintain a proactive attitude to sustainable development and business opportunities. The strategic and business decisions taken within these companies are to be considered from the perspective of sustainability as below divided into three main areas of Economic, Society and Environment as shown in figure 1.

3.0 Economic

3.1 UN initiative Global Compact

National companies as well as international companies doing business in Cameroon have all endorse the United Nations initiative Global Compact and are working systematically to comply with the initiative's basic principles within the areas of human rights, workers' rights, environment and anti-corruption. Similarly, these companies are now striving to comply with the intentions laid down in the ILO conventions guidelines.

3.2. Sustainable solutions – existing products

As regards existing markets and products, priority is being given to improving and developing solutions that are contributing to a sustainable future. Market needs, business attractiveness, and proximity to the existing platform of expertise are being normative.

3.3. Sustainable solutions – new products and new business

These three companies are actively considering new market opportunities that open up in response to the global challenges facing the world today. This paves the way for entirely new products and business segments. These companies are developing a good number of technological points of departure in several important disciplines that may contribute to such new solutions.

Brasseries du Cameroun has introduced new products into the market (new beers are brewed and quality enhancement on other products like 33 Export beer and Beaufort beer.
For ENEO, customers can now do online payment without going to do payment in ENEO offices and also made ways for online customer's service. For CDC, this agro company that concentrated in Rubber, Tea and Palm production has now added Banana production (Delmote Banana) and also extended and cultivated new estates in Manyu in the South West Region and Donga and Mantung in the North West Region of Cameroon.

3.4. Anti-corruption

Corruption undermines all sorts of business activities and free competition, and it is prohibited by law in all the countries and also in Cameroon. Corruption is destructive and for Cameroon, corruption has become part of the business game for which you have to pay 10% of the cost or contract for the services to be done. Formally, for a costumer to be supplied electricity, he/she has to bribe 10% of the cost for connection. For Brasseries du Cameroun, corruption is higher during Christmas period when they have to supply retailers and wholesalers. You need to bribe 10% of what you have to buy. This is mostly noted in rural areas. Corruption in Cameroon is rooted from the French way of life. This has now cross over to the English speaking part of Cameroon. In 2003, Cameroon was among the first ten most corrupt countries in the world "transparency international, 2003". Another form of corruption that is still eating up these companies is favouritism and tribalism in employment especially with the two companies located in the Francophone region of Cameroon, (Brasseries du Cameroun and ENEO) based their employment not on competency but on relationship with the top executives. Theoretically these companies are opposed to all forms of corruption but practically, its still part of business as usual.

4.0 Society

4.1 Human rights

With the functioning of their PMO´s, all these companies operations strive to comply with the UN's Universal Declaration of Human Rights, the UN's Convention on the Rights of the Child and the ILO conventions. These companies now have routines for analysis, verification; reporting and follow up of possible violations of human rights linked to their operations, as well as in respect of business partners in the event of any violation of human rights related activities.

4.2 Workers' rights

With the implementation and functional PMO, employees are treated with respect and given orderly working conditions. All employees are given equal opportunities. The only issue still with these companies is lack of recognise freedom of association and the right to collective bargaining. Trade unions are still been controlled by the government as they would want to make sure they appoint trade union leaders that will represent their interest. In cases of conflict with local legislation, these workers are not protected. Wages are as a minimum not enough to live on. Forced labour, child labour are strictly forbidden. Health and safety are now high-priority areas for each of the three companies.

4.3. Local engagement

Through social investments, these companies are making positive contributions to the development of the local communities in which they operate. The Cameroon Development Cooperation (CDC) for example is helping to engage local people in community works and also employ the local population in some unskilled positions. CDC is also providing accommodations to most of its staff.

The establishment of a functional football school by Brasseries du Cameroun to train young Cameroonian at their earliest age. Promote music concert tours to raise money to help community development and sponsor kids in need.

ENEO is still trying to come up with local programmes to engage the community

4.4. Cooperation with Stakeholders

These selected companies cooperate with their both internal and external stakeholders, including non-government organisations (NGOs), to increase the transparency of their work with sustainability and corporate social responsibility. This has also enhances their expertise and the quality of their own work. Now these companies are publishing their annual income and expenditure in newspapers and on their websites for the public and other stakeholders to know their quality of work done.

5.0 Climate and the environment

A functioning PMO is acting responsible with a view to the footprint left by its activities on the climate and the environment. Their operations and their products development are approached from a

'green' perspective. In recent years, waste management has become a major environmental issue for these companies and the public. Indeed, poorly managed waste is likely to harm human, animal and environmental health.

With this in mind, these three companies now focus inter alia on:

a. Reducing own direct and indirect emissions of greenhouse gases (GHGs)
b. Making more efficient use of resources in general, not least by reducing consumption through the more efficient use of energy, water and materials
c. Increasing the efficiency of waste management is now a core in these companies
d. Viewing product development in a life-cycle perspective
e. Suppliers: In collaboration with their suppliers, these companies are striving to ensure that operations are conducted in compliance with internationally recognised principles for business ethics and corporate social responsibility.

In selecting suppliers, these selected companies still practise bribery and corruption for which only individuals or sub-contractures that pay in 10% are awarded the contract to supply. The suppliers' don´t work with human rights and workers' rights and anti-corruption, and the supplier's don´t work in the area of climate and the environment.

6.0 Monitoring and follow up Reporting

The three companies' sustainability and corporate social responsibility are being planned in a professional manner and integrated into their business strategy by their PMO´s. These efforts are part of business planning and their regular monitoring and follow-up routines. This is further developed systematically, and linked to reporting and measurement criteria associated with sustainability and corporate social responsibility. At the moment their external reporting are surely adhering to the principles of the Global Reporting Initiative (GRI).

7.0 Factors that are hindering the support of CSR within these companies in Cameroon

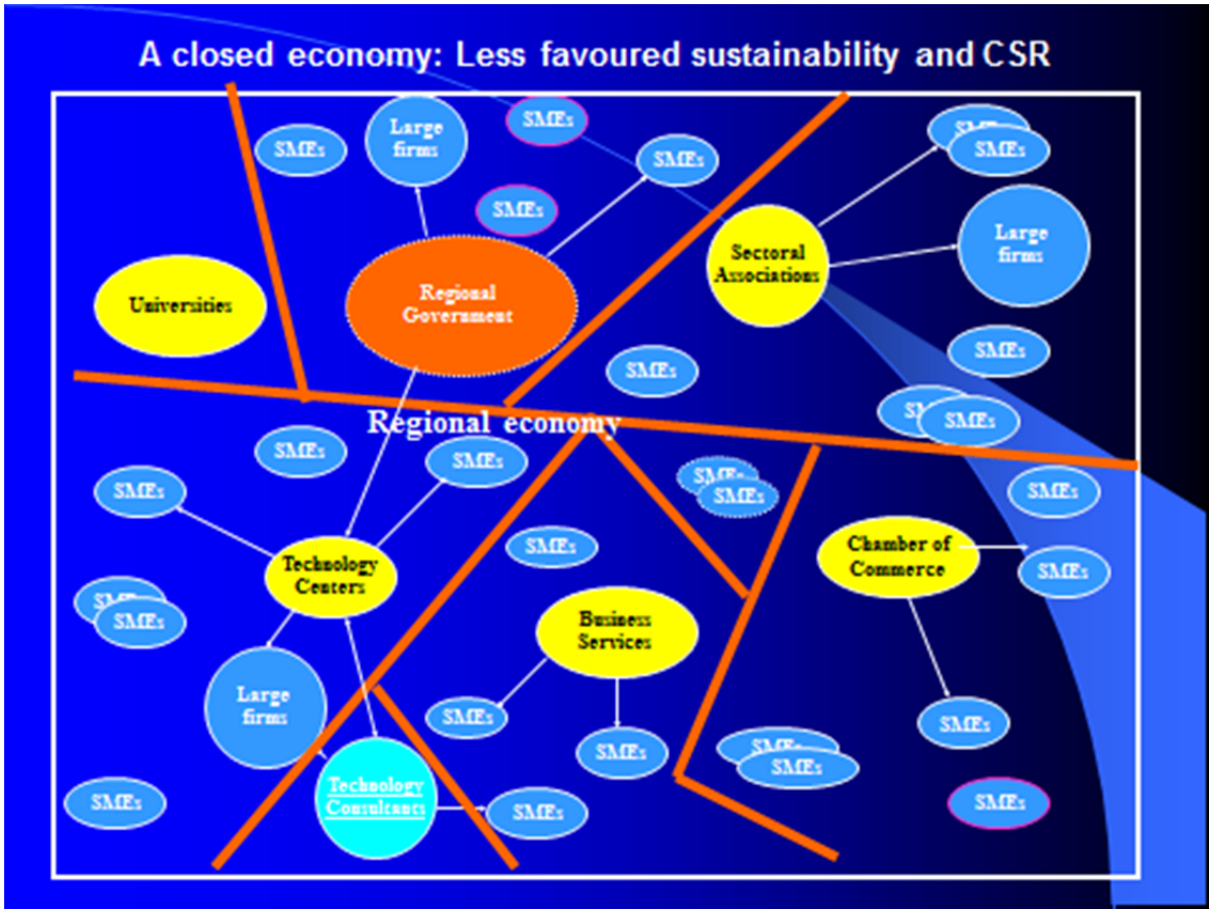
- Companies specific internal challenges: e.g. lack of resources; low executive management commitment and support; limited technical knowhow
- External resource challenges: i.e. clear gaps in social provision – companies embrace neo-governmental role
- Regulatory challenges: i.e. lack of, weak, or unenforceable regulation; lack of governmental capacity; no explicit governmental incentives for CSR
- Lack of cohesive social movement to advance civil regulation – (social issues mobilization)

Before the introduction and application of the PMO methodology, the business environment in Cameroon has been much closed to itself. Hardly had any of these been networking with others for innovations and project organisational exchange knowledge management. There is lack of enterprise

risk sharing and none of these works in close collaboration with technological firms or universities for innovations and trainings. The (figure 3) below, ”Close business enterprise environment” shows how independently these firms or enterprises operate; an enterprise operating in the South West Region dose not consult for information from a chamber of commerce in the Littoral Region.

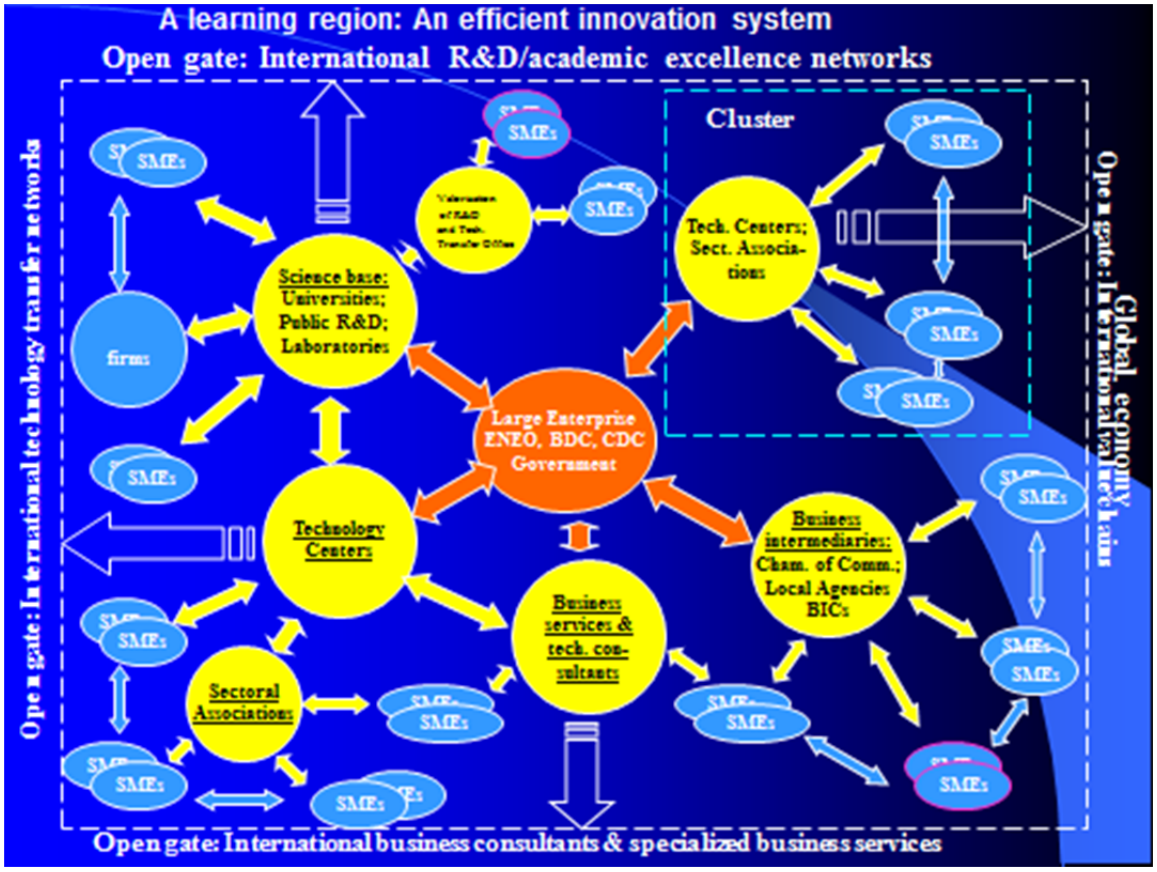
With the present situation working with the PMO methodology, these enterprise or organisations are now trying to open up doors for networking and exchange of information between them and the universities, chambers of commerce, and other big and small medium size enterprises. Figure 4 below shows us how this is supposed to be now and in the near future.

Figure 3: Close business enterprise environment



Source: Created by author

Figure 4: Open business enterprise environment



Source: Created by author

References:

[01] Brasseries du Cameroun : http://www.lesbrasseriesducameroun.com/

[02] ENEO Electricity company of Cameroon : https://eneocameroon.cm/index.php/en/

[03] Cameroon Development Corporation: http://cdc-cameroon.net/new2014/

[04] Enevoldson. N. (2013). What Is Social Responsibility? Available at: <http://www.imasocialentrepreneur.com/social-responsibility/> Last accessed 01 May 2017

[05] Ebert & Griffin, (2007, p. 43-46), Approaches to Social Responsibility; Business Essentials

[06] Amanda R. Dollak. (2008). How Should American Businesses Approach Social Responsibility?. Available: <http://voices.yahoo.com/how-american-businesses-approach-social-responsibility-2131442.html?cat=3> Last accessed 03 May 2017

[07] Carroll, A.B., and A.K. Buchholtz. Business and Society: Ethics and Stakeholder Management. 5th ed. Australia: Thomson South-Western, 2003.

[08] Ricky W.Griffin. (2012). Management. Available ; <http://books.google.com.my/books?id=ht6ca2s4NNMC&pg=PA106&lpg=PA106&dq=accommodative+stance&source=bl&ots=RxKd_ciDP&sig=oMuAFbzJineNqRNKeSARewHL3Ak&hl=en&sa=X&ei=fYZ_UZvkOcHTrQe_vYHQCw&ved=0CDUQ6AEwA>. Last accessed 03 May 2017

[09] Cannibals with forks (1997). The triple bottom line of 21st century business

[10] John Elkington, Cannibals With Forks: The Triple. Bottom Line of 21st Century Business. Capstone,. Oxford, 1997, 402 pp

[11] Helton, Jordan. "Cameroon: $62m in funds lost, report says." Gobal Post. 11 11, 2011. http://www.globalpost.com/dispatches/globalpost-blogs/africa-emerges/cameroon-62m-funds-lost-report-says (accessed 05 May 2017).

[12] Judy N. Muthuri (2012). Corporate Social Responsibility in Africa: Definition, Issues and Processes

[13] Economic Commission for Africa /AfDB/AUC. Assessing Progress in Africa toward the Millennium Development Goals: Analysis of the Common African Position on the Post-2015 Development Agenda, MDG Report; Economic Commission for Africa: Addis Ababa, Ethiopia, 2014.

[14] Davis, K. Case for and against business assumption of social responsibilities. Acad. Manag. J. 1973, 16, 312–322.

[15] Carroll, A.B. A three-dimensional conceptual model of corporate social performance. Acad. Manag. Rev. 1979, 4, 497–506

[16] Carroll, A.B. The Pyramid of Corporate Social Responsibility: Toward the Moral Management of Organizational Stakeholders. Bus. Horiz. 1991, 34, 39–48.

[17] Carroll, A.B. Social issues in management research: Experts' views, analysis and commentary. Bus. Soc. 1994, 33, 5–29.

[18] Carroll, A.B. The Four Faces of Corporate Citizenship. Bus. Soc. Rev. 1998, 100, 1–7.

[19] Carroll, A.B. Corporate social responsibility. Bus. Soc. 1999, 38, 268–295.

[20] Carroll, A.B. Ethical Challenges for Business in the New Millennium: Corporate Social Responsibility and Models of Management Morality. Bus. Ethics Q. 2000, 10, 33–42.

[21] Carroll, A.B. Managing Ethically With Global Stakeholders: A Present and Future Challenge. Acad. Manag. Exec. 2004, 18, 114–120.

[22] Visser, W.; Dirk, M.; Pohl, M.; Tohurst, N. The A to Z of Corporate Social Responsibility; ICCA Publication, John Willey & Sons Ltd.: West Sussex, UK, 2010.

Field report: Entrepreneurship in the Medtech sector

Alexandru Sereseanu

sereseanu@devicemaster.eu
DeviceMaster GmbH
Hofsteder Str. 91, 44809 Bochum, Germany

Sascha Richter

richter@devicemaster.eu
DeviceMaster GmbH
Baldenaustr. 10, Rastatt, Germany

Abstract: *This paper aims at providing a reference case for those interested in establishing a project-oriented company operating from the Rhein-Ruhr area in the highly regulated field of medical devices design, manufacturing and marketing. The present case study features an ongoing personal effort to establish an up-stream service supplier for the medical technology sector.*

Keywords: medtech, medical devices, entrepreneur, market approval, regulatory affairs

1. Introduction

The target audience for this paper is students and young potential entrepreneurs who might be presently thinking about establishing a spin-off company and taking their academic research to market.

The present paper is structured as a field report. It showcases the authors ongoing effort to register a company in the Rhein-Ruhr area using local and federal resources and guidance. It also provides a rough sketch for the overall business plan of the company which is supposed to be used to secure outside financing for future expansion. Finally, some of the planned steps to design a regulatory compliant project management process for the acquisition and execution of industry-specific projects will be highlighted.

2. Company registration process

The company registration process in Germany is fairly straightforward and requires the involvement of a manageable number of actors:

- A notary to charter the future company and to initiate the registration process with the chamber of commerce once they receive confirmation of subscribed capital from a bank.
- A commercial bank to host the companys business account.
- The local municipality to license and register the company for
- The local branch of the internal revenue service to register the company and issue VAT Identification Numbers

One of the main and possibly most time-consuming steps in the registration process is drafting the company charter. German legislation requires only few elements for a charter: Company name, corporate structure, jurisdiction, purpose, owners and registered capital. However, depending on the purpose of the company, configuration of the entrepreneurial team, company

equity and planned executive decisions some additional negotiation and drafting efforts might be required to achieve an agreeable wording.

Based on the charter and indication of the capital to be registered, a commercial bank can open up a business account for the future company and the equity holders can wire in their shares.

Upon confirmation of successful wire transfers, the notary can initiate the registration of the company with the chamber of commerce.

Finally, the newly registered company needs to be licensed by town hall and receive its VAT ID in order to be able to assume opperations.

The entire process might take up to 2 months, but can be streamlined considerably if all stakeholders are engaged early and the registration steps are well prepared in advance. Based on own experience, the overall expenses for a company registration might be as high as 600-800 EUR.

3. Overall business plan

Team: Our current team is made up of two entrepreneurs who have been working together for some years on common projects as business consultants. There is one technical executive who specializes in regulatory affairs and quality management and an economic executive expert project manager.

Vision&Mission: Our common vision is to jointly make a successful transition from business consultants to an established supplier of services for the medtech sector. We aim to help device manufacturers maintain and update technical documentation files for their outdated products. Based on our expertise we can also assist development departments in streamlining the transfer of knowledge and application of lessons learned to new products for worldwide marketing.

Core added value for our customers:

- Achieving and maintaining regulatory conformity for marketed medical devices
- Consistently meeting regulatory requirements in key markets: EU, USA, CA
- Out-sourcing complex services which do not count towards our customers bottom line
- Organizations can redirect internal resources towards their core business
- Clients can focus on marketing current products
- Professional project & Program Management
- Project organization embedded in our customer’s management system

Planned services:

- “Legacy” services (for old medical devices)
    - Market vigilance
    - Risk management
    - Clinical evaluations
    - Updating technical documentation
    - Program management for multiprojects
- Market approval (for new medical devices)
    - Regulatory affairs
    - Establishing technical documentation
    - Business coaching
    - Requirements Engineering
    - Usability Engineering

4. Entrepreneurial support networks

Very useful local guidance on establishing a business and developing a good business plan can be achieved by joining a business plan contest, such as the “Senkrechtstrater”[1] in Bochum or the “start2grow”[2] in Dortmund, staged regularly by the local entrepreneurial support networks mostly sponsored by local authorities. They generally help entrepreneurial teams to develop their business ideas and structure them in a business plan which they can use to raise capital. They also provide coaching and mentoring services for questions ranging from patent registration to merger negotiations.

Great support for start-ups is also provided by the local chambers of commerce. Along regular services provided to paying members they can also provide sector-specific or country-specific knowledge for export-oriented entrepreneurs. For instance, the Dortmund chamber of commerce[3] specializes in IT services, while the IHK Bochum[4] supports the sprawling local healthcare business cluster. This sort of knowledge is great

Another great resource for entrepreneurs with a frugal budget might be a local co-working initiative such as the “Workinn”[5] in Dortmund. Start-ups can time-share office space and facility services in office buildings. They can also have the opportunity to register their company at that address and rent a PO box there for mail traffic.

5. Tips and pitfalls

Corporate structure: the appropriate form for the future business should be well thought out! For technology oriented companies there are only few options available: some sort of limited liability company or incorporated. Many might be tempted to opt for the mini limited company (Unternehmergesellschaft) due to the seemingly high entry barriers for the regular “Gesellschaft mit beschränkter Haftung”. However, notaries and financial advisors are likely to point out that only half of the minimum required company equity of 25000 EUR needs to be wired in on a fresh company registration. The might also advise that the full LTD form is more appealing to venture capitalists and investment bankers in case of a capital raising pitch.

Fundraising: There are many local, regional, federal, European and sectorial development programmes available to be tapped for additional capital or business loans. However, those who might want to access such funds should know that their management is a long term full time commitment and have resources in place accordingly. Another point is that funding claims take a long time to process so a company needs to have own financial resources in place in order to bridge the long reimbursement periods. Finally, they also need to remember that any personnel expansion related to a program financing is required to be sustainable even some years after the funding period expires.

Operating in the MedTech sector: Many of the ideas and research projects undertaken in universities around Europe feature products oriented towards the booming health-care sector. Some of these might be devices or apps which would be classified for market approval as medical devices. The MedTech sector - Medical devices design, development, manufacturing and marketing - is a highly regulated sector with additional rules for both manufacturer and manufactured product throughout its entire lifecycle. Product life-cycles and time-to-market values can be extremely long in this business sector. Financing to bridge the break-even point can be challenging to secure, and market vigilance measures have to be kept up even long after devices are no longer being actively marketed.

6. Results and Conclusion

Generally, companies are fairly easy to establish and to operate in the Rhein-Ruhr area, with a good support network to boost their market survival chances. The is also an impressive array of specialized support for business aiming to operate in the MedTech sector ranging from knowledge support for market research to specialized venture capital offers. However, those interested in operating a business in this sector should not forget the special rules and processes involved.
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7. References

[1] “Senkrechtstarter – der Gründungswettbewerb BOCHUM”: https://www.senkrechtstarter.de/

[2] “start2grow”: http://www.wirtschaftsfoerderung-dortmund.de/gruendung/start2grow/index.html

[3] „IHK zu Dortmund“: https://www.dortmund.ihk24.de/

[4] „IHK Mittleres Ruhrgebiet“: http://www.bochum.ihk.de/startseite.html

[5] „WORKINN – Das flexible Büro”: https://www.workinn.de/

Multi-Agent System to the rescue!
Approach to support production planning

Andreas J. Wojtok[1], David Grimm[2], Martin Hirsch[3*]

[1]andreas.wojtok@fh-dortmund.de, [2]david.grimm@fh-dortmund.de, [3]martin.hirsch@fh-dortmund.de
IDiAL Institute,
Fachhochschule Dortmund,
Otto-Hahn-Straße 23, 44227 Dortmund

**Computer Science Department,*
Fachhochschule Dortmund,
Emil-Figge-Straße 42, 44227 Dortmund

Abstract: *Small and medium-sized enterprises have an incomplete overview of their production process. In this paper, an approach based on multi-agent systems will be introduced to solve this problem.*

Keywords: multi-agent system, production planning, small and medium-sized enterprises, sme

1. Introduction

A lot of small and medium-sized enterprises (SME) have an incomplete overview of their production process. It is common that they don't get any progress feedback on current jobs. Therefore, they can't provide accurate delivery dates or improve their current production planning.
Additionally, SMEs don't measure data like energy consumption, heat development, or noise level during the production process. Based on that data they would gain the opportunity to improve their production planning or predict imminent events.
In this paper we present an approach, which is a combination of software and hardware, to solve the described problems.

2. Approach

A solution for the described problems would be:

- offer the possibility to provide needed feedback in the production process
- continuously measure data like energy consumption, heat development, or noise level during the production process. The measured data has to be accessible to gain insights.
- create an expert system to digitalize the employee's knowledge which is used to customize the soft- ware for the production process.

In our approach, we are using the construct of multi-agent systems. Therefore, we are delivering a short introduction on multi-agent systems.

Multi-Agent Systems An agent is a computer system which is capable of reacting autonomously in a dynamic and unpredictable environment. Every agent has a specific goal and is capable of communicating with other agents [1] [2] [3] [4]. A multi-agent system is a combination of several agents. These agents exchange their goals to enforce a collective and beneficial cooperation [5]. The coordination and negotiation between these agents is the essential part because you have to make sure that all agents pursue a common goal even though their own goals can be different [4]. "MAS are able to utilize other agents for cooperative distributed problem solving when individual agents don't wish to or can't perform tasks within certain constraints or don't have the competency to perform tasks by themselves." [6]

So, how do multi-agent systems fit into the approach to solve the described problems? The goal of every agent is the delivery more insight in the production process.
To provide such insight we created a software concept with five components, see Figure 1. To

digitalize the knowledge of employees in a production process, those components are connected through a rule-based expert-system. Rules can be defined, based on events and actions. For example, an event could be the measurement of data from a sensor. The according action to this event could be writing those data to the Production-Planning-System. Most of the measured data is not relevant for the Production- Planning-System, therefore the rule can be enriched with a condition to write only relevant values into the Production-Planning-System.

Measured data should also be stored locally on the agent giving the possibility to analyze the data and provide insight to adjust the current rules.
Besides measuring data, the agents will also provide feedback on the job progress. Providing the feedback could be either a manual or an automatic process. If employees are involved an interface will be provided to interact with. If the use case is an automatic one, with machines involved that provide an interface to get the current state, the feedback could be provided automatically.

Because a single agent is not capable of collecting all necessary feedback and data of the whole production process, it is necessary to create a system of several agents to gain the best insight. Therefore, it is necessary to use a multi-agent system to solve the described problems.

Software The software is divided into five parts, see Figure 1:

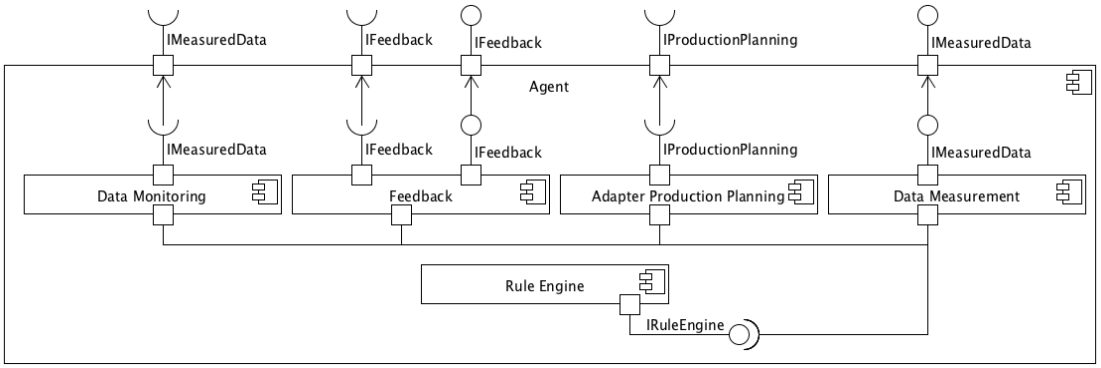


Figure 1: System overview Software

The **Data Measurement** component is in charge of collecting measurable data like energy consumption, heat development, or noise level during the production process. Additionally, an interface is provided to receive sensor data from external devices. After measuring data, the *'dataMeasured'* event is fired.

The **Adapter Production Planning** component handles the communication to the Production-Planning- System. The agent receives data, like current jobs from the Production-Planning-System and delivers needed feedback and measured data. This part of the software is customized for the Production-Planning- System that is used. Possible events are: *'jobAssigned'* if a new job is assigned to the machine, *'jobChanged'* if an assigned job has changed, *'jobCanceled'* if an assigned job got canceled.
The component offers the following actions: *'writeData'* write data to the Production-Planning-System, *'deliverFeedback'* deliver feedback to the Production-Planning-System.

The **Feedback** component offers the possibility to deliver manual and automatic feedback. The component is able to consume interfaces provided from machines, but is also able to deliver an interface for a manual feedback process. The feedback component fires the event *'feedbackReceived'* every time feedback is received. The action *'showInformation'* can be

executed within a manual feedback process, where an employee, to receive information, is involved.

The **Data Monitoring** component processes the measured data and displays this data to gain the best insight. In addition, this component is capable of collecting the measured data from other agents for better insight. The event *'storeCapacityReached'* is fired if the agent is running out of disk space. The component offers the following actions: *'storeDataLocally'* this action will store the measured data on the agent, *'storeDataRemotely'* this action will store the measured data on a remote location, *'exportData'* this action will export the stored measured data to a remote location, *'wipeData'* this action will wipe the local measured data on the agent.

The **Rule Engine** component is in charge of listening to all events and fire the according actions based on the given rules.

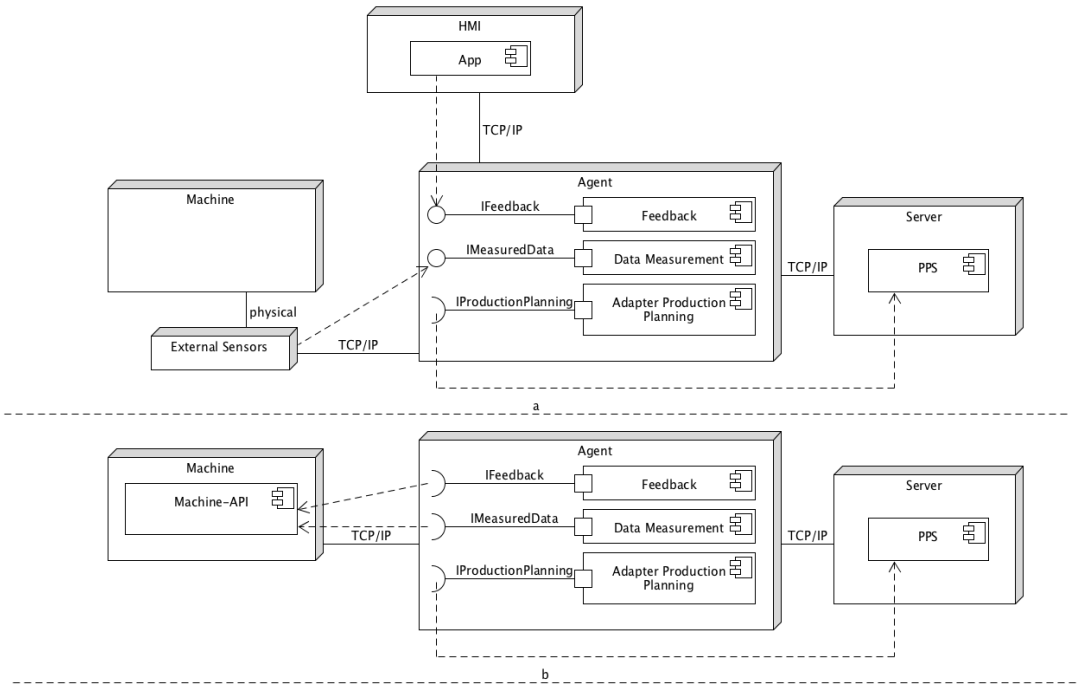


Figure 2: System overview Hardware

Hardware The hardware solution has two manifestations, see figure 2. In figure 2a a solution for a manual feedback process is shown. Using an application installed on an HMI the employee can provide feedback to the agent. Furthermore, external sensors are attached to the machine and continuously send their measured data to the agent. In figure 2b a solution for an automatic feedback process is shown. The machine provides an interface which is used by the agent to get feedback on the current job and continuously measured data.

3. Results and Conclusion

With the provided approach, it is possible for SMEs to solve their problem that they have an incomplete overview of their production process. With the progress feedback and the measured data like energy consumption, heat development, or noise level, it is possible for those enterprises to use this data to improve the production planning. An improved production planning leads to a faster production process, an ideal resource usage, cost reduction, meeting delivery dates, and more pleased customers. The introduced approach will be evaluated in context of the project inMachine [7].

4. References

[1] J. Rosenschein, Rational Interaction: Cooperation among Intelligent Agents. PhD thesis, Stanford University, 1985.

[2] M.WooldridgeandN.Jennings,IntelligentAgents:TheoryandPractice.No.10inTheKnowledge Engineering Review, 1995.

[3] T. Finin, Y. Labrou, and J. Mayfield, "KQML as an agent communication language," tech. rep., Computer Science and Electrical Engineering University of Maryland Baltimore County Baltimore MD USA, Sept. 1995.

[4] M.Luck,P.McBurney,O.Shehory,andS.Willmott,AgentTechnology:ComputingasInteraction-ARoadmap for Agent Based Computing. AgentLink III, Sept. 2005.

[5] D. J. Veit, Matchmaking in Electronic Markets: An Agent-Based Approach towards Matchmaking in Electronic Negotiations. Springer, Dec. 2003. Google-Books-ID: 7tZtCQAAQBAJ.

[6] ACM, ACM Trans. Auton. Adapt. Syst., November 2007, vol. 2. New York, NY, USA: ACM, 2007. Issue 4.

[7] inMachine.de, "inMachine Project Website", https://inmachine.de/, May2017.

Cognitive readiness of project teams

Chinwi Mgbere

cmgbere@nu.edu.kz
Facility Construction Directorate, Private Entity,
Nazarbayev University
Astana, Kazakhstan

Abstract: Challenges encountered in today's project environment include rapid decision making by project teams. These decisions interact with the complex, dynamic and sometimes ambiguous project environment. Attempts to implement projects of high complexity successfully often stretch the knowledge, skills, and attitudes of team members beyond capacity. High workload burden team members over an extended period. Other stressors such as acceleration of schedule required by the client also affect team performance. Such situations may stretch the cognitive capacities of team members and negatively impact team performance. This paper describes the application of the knowledge of human behaviour provided by the advances in cognitive psychology (Etter et al., 2000; Morrison & Fletcher, 2001; Fletcher, 2004) to a real-world project like the construction of the Nazarbayev University project. Since people, so do project decision makers and stakeholders, learn by observing and imitating, self-efficacy in decision making and overall project performance may be enhanced by influencing stakeholders through positive reinforcement, given that the project manager's (agent of change) cognitive potential is positive. The resulting network of decision makers is more likely to make fast and efficient decisions in project situations.

Keywords: Competence, emotional intelligence, cognitive readiness, self-efficacy, decision making

1. Introduction

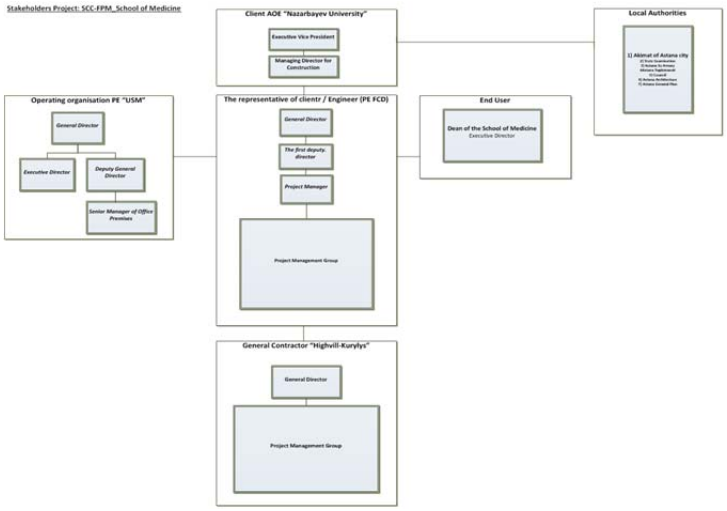
Project challenges require project teams to make rapid decisions. These decisions interact with the complex, dynamic and sometimes ambiguous project environment and affect the overall project outcome. In 2010, Nazarbayev University (NU) opened as part of an initiative to create a world class University - a quantum leap of the educational system in Kazakhstan. A collaborative effort started with some of the leading top 100 universities from around the globe. An innovative approach to collaboration, coordination, information sharing and decision making is required to excel under such conditions, which enhance the decision-making process of project team members and stakeholders and the value of their decisions. The NU project environment is characterised by ever changing stakeholders with new players coming to play during project implementation and exerting diverse influences: cultural - with international General Contractors, workforce from countries across Europe and Asia with their own beliefs and values; changing end-user requirements; governmental; political and technological. To enhance effective decision-making, all levels of the leadership echelon (top, middle and low) in the organisation has to demonstrate the required level of competence and cognitive readiness in executing their roles. Situational leadership and self-managed teams are critical to successful implementation of this model. This paper uncovers factors (barriers) that influence the attitude of project team members and make them shy away from decision making in challenging project situations, perceived as threats and factors (cognitive enablers) that enhance cognitive readiness.

2. Cognitive readiness

Cognitive readiness is the possession of psychological (mental) and sociological (social) knowledge, skills, and attitudes that individuals and team members need to sustain high performance and mental well-being in the dynamic, complex, and unpredictable project environments (Strater et al. 2012). This concept also relates to the "capability to adapt to and quickly address with manageable stress new, unpredictable, unforeseen changes, acting dynamically and proactively with self-efficacy sensations" (Archibald et al., 2013). A project team may achieve such performance after working together for a relatively extended period. In a highly dynamic environment where the consequences of poor team performance can be detrimental, applying the knowledge of human behaviour provided by the advances in cognitive psychology (Etter et al., 2000; Morrison & Fletcher, 2001; Fletcher, 2004) in a real-world project, like the NU project enhance project performance. To expose factors that affect the high performance of project teams, we use an interdisciplinary approach based on facts, methods, theories, and rules of inference discovered in the field of cognitive psychology and tools, crucial for behavioural science. This paper defines factors that promote coordination and information sharing in project teams for effective decision making by major project stakeholders. A team with the adequate level of collaboration and information sharing is the backbone for efficient (informed) decision making, which in turn enhances the teams' cognitive readiness that support high performance.

The Private Entity – Facility Construction Directorate (FCD) in the role of project manager and Client representative implements NU campus construction project. FCD Tasks include pre-project, project and post-project activities such as business case development, feasibility studies, design, construction, and transition to operations. There are at least five key stakeholders involved in FCDs' projects. When multiple teams are involved in projects, there is usually a tendency for the teams to work in silos, instead of working cross - functionally, cohesively. This cause conflicts in the integration of functions and lead to the decreased output and team performance. Team performance depends on factors such as team satisfaction, project efficiency, goal achievement and many other factors.

Fig.1. The NU project Stakeholders



Questions linked to the primary goal of FCD to organise the initiation, planning and implementation and hand over of NU projects include:

- How long will it take to implement the project?
- How much will it cost?
- Will the built facility be fit for purpose?
- Will the end result meet the major stakeholders' expectation?

Characteristics of project teams include:

- Distinctive roles and duties;
- Standard procedures;
- Knowledge and skills;
- Team building;
- Team members come together in their numbers to deliver on a complex project without prior experience of working together

Standardized procedures have a down side –

- It is slow in reacting to change and adapting to new conditions. Because all procedures are specified in detail, changes in operation require reengineering the workflow, rewriting procedures.
- Team members' intelligence, initiative, and ingenuity are underutilised.

The objective of a high-performance project team would be Stakeholder satisfaction that generates repeat business, even if that meant occasional deviation from standard routines (alter normal procedures and allocated duties).

There is no "one best way" to implement a project. Project teams (through the project charter) receive a shared understanding of the project objectives, the direction for their work and a diverse set of tools to use in pursuing the project's objectives. Beyond that, project teams are on their own.

Sometimes team members may not know exactly how long it is going to complete a task. Even so, stakeholders should be told the truth, and the whole truth, about the status of the project. It is an essential part of the work of the project manager/team members to decide to do just that. If they do not have the information, then it is their job to resolve to seek it out and pass it along. When there is a problem, decide to explain to stakeholders honestly what the problem is and what they are doing to take care of it. The IPMA Individual Competence Baseline (ICB4) underlines this approach with its methods, tools and techniques - the application of Knowledge, Skills and Abilities to achieve the desired attitude that supports right decisions for project results.

By the existing practice (business as usual), organisations operate as silos with strict boundaries that only allow for one point of contact at the very top of the chain of command, which creates a profound bottleneck in the decision-making process of the project team. To excel under such conditions - enhance the decision-making process of project teams, an innovative approach that promotes collaboration, coordination and information sharing is required. The premise of this paper is a study of the factors that support and enhance competence development of decision makers through positive influencing based on collaboration, coordination and information sharing among a network of teams. Leaders of organisational silos are the key points of responsibility in project implementation, charged with the responsibility of delivering value to major project stakeholders. In the process of implementing leadership roles, leaders do not have a primary influence on schedule, time and cost. A leader only controls his project manager. The problem is that critical encounters between project managers (team members) and uncertainty occur during the process of project implementation during the day to day project situations. Worse, project leaders are not available on the ground to address this situation as they arise because they have other administrative responsibility. So there is no realistic way a responsible project leader can monitor and manage what counts – for example, team members' encounters with project situations.

It is time to rethink the design, manning and management of complex project teams. This problem uncovers factors like:

- Barriers and enablers that promote Collaboration and Information Sharing in Project Teams and how this impact team performance.
- Influences of adverse attitude by project team members that makes them shy away from decision making in challenging project situations, perceived as threats.
- How cognitive learning and influencing can enhance stakeholder decision making competence and behaviour in projects.

3. Competency-based approach to managing projects

With increasing complexity and scope of knowledge about deliverables (products and services) created in projects, of importance is not only the value of knowledge and experience but also the competence of projects managers. The labour market is gradually becoming a market of competence, and competency management will play an increasingly important role in human resource management within the organisation especially for innovative projects.
Two concepts form the basis of Competence approach:

- authority - the area of activity or function, performed by employee;
- competence - the characteristic of potential capabilities of employee to successfully work within the specific competences.

At the NU project with all its challenges and uncertainty, FCD faced the task of unlocking the potential of individuals engaged in the projects to the fullest, which is key for quick and appropriate decision-making through all phases of project implementation. Coupled with this challenge is the availability of project managers in the labour market of Kazakhstan. Competence management is a critical component of the FCD organisational management system.
The following principles form the basis of its development and implementation:

- competences are delineated (the principle of independence of the components of an effective model);
- FCD's core business competences are covered (the principle of completeness);
- authority is defined, regularly reviewed to reflect the current challenges facing FCD (the principle of realism);
- all competences are decomposed to the desired level of detail (the principle of differentiation);
- all competences have indicators that enable the assessment of competence of managers (the principle of measurability).

These principles are achievable following the implementation of FCD's organisational management system based on global best practice - the IPMA "Individual Competence Baseline for Project, Programme & Portfolio Management" Version 4.0 (ICB4).

Competence areas

ICB4 covers three areas of competence. These areas apply equally to all three domains (project, programme and portfolio management):

- People competences: these consist of the personal and interpersonal competences required to successfully participate in or lead a project, programme or portfolio
- Practice competences: these are the specific methods, tools and techniques used in projects, programmes or portfolios to realise their success
- Perspective competences: under this heading come the methods, tools and techniques through which individuals interact with the environment, as well as the rationale that leads people, organisations and societies to start and support projects, programmes and portfolios.

Competence structure of the ICB4 in the project environment is broken down into 29 competence elements with one to many key competence indicators each.

- Perspective competences (5 elements)
- People competences (10 elements)
- Practice competences (14 elements)

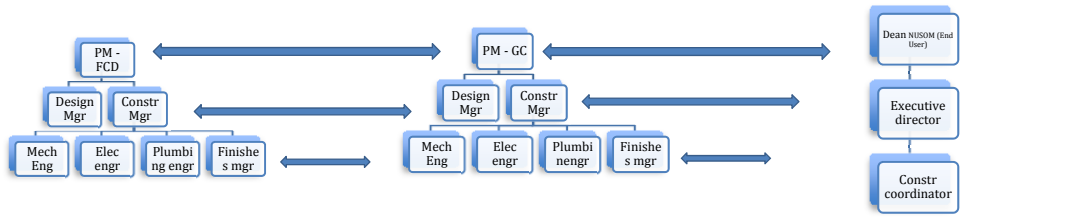
The framework of the ICB4 is the bases of the FCD corporate project management control system and Human Resource competence development system. The success of the competence-based approach in FCD largely depends on the ability of managers to adapt it to FCDs' processes, strategies and culture. In accordance with the scope of competences for a manager FCD constructed a path for career development with the following roles:

- IPMA-D - Assistant project manager/ project management associate
- IPMA-C – Project Manager
- IPMA-B - Senior Project Manager
- IPMA-A – Project director

Quality and speed of decision making

Recent trends (such as the push for sustainability, the increased desire for stakeholder engagement, globalization) have influenced the environment under which decision makers work. Consequently, the models of how decisions are formed and made should adapt to that change. Decision-making problems are studied in terms of three major components: decision makers, decision tools, and techniques for selecting the best alternative. In terms of decision makers, a shift was detected from an assumption of individual decision makers to a hierarchical structure, and, more recently, to a network of decision makers [1]. Figure 2. Decision criteria have evolved from focusing on the technical and objective to soft and subjective aspects of projects. A general migration from models with pure deterministic nature to (fundamentally) probabilistic models with stochastic approaches is detected. The complexity of engineering problems has resulted in a shift from judgmental to rational selection techniques. Interest in softer and subjective issues (such as sustainability) and the increasing number of (diversified) stakeholders have promoted the application of emergent-based selection methods, particularly in infrastructure projects. [2]

Fig. 2. Network of decision makers



Since projects like the NU construction project reflect a network of interacting stakeholders, the responsibility for decision making must be borne by a network of decision makers (rather than an individual or hierarchy). The scale of this network is huge, with as much as five to seven stakeholder organisations involved. Official decision makers (such as the owner, funding agencies, and city and government agencies) have traditionally been members of this network. Similarly, technical staffs have been at the forefront of the decision-making network (architects, engineers, construction and project managers, and operators). Today, in the age of media and the web, knowledge-enabled non-traditional decision makers like customers

and end users should play a more active role beyond discussing already-designed projects. This complex network of decision makers is more likely to make fast and efficient decisions in project situations given that the agent of change (the project manager) has a positive cognitive potential to influence this network of stakeholders, enhance their competence and cognitive potential and so lead to their likeliness to make fast and efficient decisions in project situations. This requires a considerable shift in the mind-set of traditional decision makers: from customer and end users as a source of feedback on predetermined alternatives offered by professionals to them as the idea generator, and decision maker. As a result, the future network of decision makers in projects can be considered as a heterogeneous mix of professionals (technical and official decision makers) and non-technical end users.

Social Cognitive Theory

Social Cognitive Theory (SCT) (Bandura, A. Social Cognitive Theory. In Vasta, R., editor. Annals of Child Development. Vol. 6. 1989. p. 1-60.) is a learning theory stating that people learn by observing and imitating others and by positive reinforcement. SCT posits that behavioural change is affected not only by personal factors and internal dispositions but also by environmental influences. Therefore, behavioural change is a complex process influenced by internal and external factors. According to the social cognitive theory (SCT), self-efficacy is the most important characteristic that changes human behaviour. Self-efficacy is the strength of one's belief in his willingness and ability to complete tasks and reach goals.

Individuals with high self-efficacy have a high expectation that the outcomes or consequences of the tasks they perform must be useful, valuable and beneficial to them, and they believe that they can exhibit such behaviour. Other people around who may have a positive or negative attitude towards a particular behaviour of an individual influence his Self-efficacy. The broader environmental impact such as from mass media and campaigns is another factor. According to SCT, people learn positive behaviours which they believe is beneficial to them by observing the benefits of other people exhibiting the same behaviours.[3]

To produce a successful project, every individual in the team should have a sense of essential principles that he/she could immediately apply at decision-making. The process might be flexible and sometimes even creative.

Cognitive readiness

"Cognitive readiness has been defined as the "mental preparation (including skills, knowledge, abilities, motivations, and personal dispositions) an individual needs to establish and sustain competent performance in the complex and unpredictable environment of modern operations"[4]

Cognitive readiness is the ability to "accomplish a mission by making and implementing decisions in a timely, efficient, and effective manner, often with very limited information in a constantly changing, complex, and dangerous environment"[5]

Besides the definition of cognitive readiness presented previously, it must be noted that the concept also relates to the "capability to adapt to and quickly address with manageable stress new, unpredictable, unforeseen changes, acting dynamically and proactively with self-efficacy sensations" (Archibald et al., 2013). The characteristics of a competent cognitive ready team include:

- Distinct but complementary roles coupled with the necessary skills and talents aligned with and committed to a common purpose.
- Team members are so devoted to their purpose that they will do all that is humanly possible to surmount any barrier hindering the achievement of project goals.
- Consistent and reliable performance demonstrating adaptive competence and accomplishing results.
- Interchangeable roles within realistic boundaries to better serve project goals. Leadership within the team is not dependent on a single individual but may be taken

up by various team members, according to the current needs within realistic limits of scope and authority.
- Proactive in managing the tasks assigned
- Empathetic to the problems of other team members.
- Demonstration of positive attitude coupled with job satisfaction
- Robust methods for resolving conflicts ensuring progression and achieving goals.
- The sense of focus and intense energy based on own consciousness and shared norms and values.
- Accountability in relation to actions based on high levels of mutual trust.

Identification of the Cognitive barriers:

The cognitive model helps to eliminate Organizational constraint which prevents individuals from the timely mannered decision making and consequently, prevents the organisation from the continuous throughput increase.

Cognitive enablers include leadership, **emotional intelligence**, metacognition strategy, lateral thinking, cognitive appraisal, cognitive adaptability, metacognition, resilience, agency, **self-efficacy**, and automaticity of action or Heuristics in judgement and decision making, communication strategy, arousal, assertiveness.

Cognitive barriers include: the student syndrome; Parkinson's law; burnout syndrome; internal conflicts that can lead to crises, drastic commitment reduction; overloading stress; multitasking stress (many tasks simultaneously); competence borderline syndrome or cognitive balance; the skill syndrome; cognitive lock; haste; over commitment to bureaucratic goals; denial; fear of satisfying; perfection is the enemy of good.

Cognitive modeling

A key approach used to improve the implementation of NU projects is the continuous learning from experience, gained during project implementation. At FCD failures are recorded to learn from them to achieve success in future projects. Not only were the situations that led to failure, but their causes. The use of cognitive models for project analysis, formation, accumulation and updating the bases of formalised methodologies for their use by FCD in future projects provided methods and tools of application and best practices in project management. An essential resource gained during the implementation of NU projects is information and knowledge. This resource is used to develop integrated solutions for analysing the complex project management systems we have. In particular, this resource is used in cognitive structuring processes and decisions making based on cognitive modelling.

Cognitive modelling is one of the classes of simulation modelling based on the creation and study of cognitive maps of investigated systems. For these purposes, we use the device of targeted, functional and balanced graphs. It allows working with both qualitative and quantitative data types, and it is convenient for use in the study of development and functioning of socioeconomic systems.

Cognitive models of projects are project models with built-in mechanisms of analysis, selection, and the formalisation of lessons learned and best practices for their further use. Furthermore the gained experience is introduced in the relevant knowledge base, new projects models created and monitored taking into account the accumulated knowledge bases [6]

At FCD we use the following operations on applying lessons learned and accumulated experiences in projects:

- create a new project based on the methodology describing a standard project model and standard organisational model (characteristics), implemented in a particular area of activity;

- update the project management methodology with necessary changes to the base methodology;
- transfer the experience of successful actions from previous project experience;
- transfer best practices in project database through a monitoring system;
- transfer from projects into the database lessons learnt concerning the project completion
- adjust the basic methodology based on the lessons of other projects;
- Transfer or apply best practices in the new project as the base methodology or modify existing base methodology.

In FCD these operations are implemented following procedures, which are part of the project management control system. At project initiation, the project management plan (PMP) jointly developed with the participation of the project management office reflect practices that ensure the transfer and application of best practices in project management.

Challenging project parameters identified (factors considered) within the FCD cognitive model for the NU projects include:

- delayed execution / late completion of projects. Snag list with more than 100 items
- inadequate quality of work leading to rework
- stakeholders (Keeping our promise on stakeholders' expectations)
- exceeded project budget

Cognitive model of the current status of a project is a model description of weakly structured systems, consisting of a directed balanced graph, where:

- nodes of the graph correspond to the base factors of the system in terms of which the processes in the system are described;
- factors determine the direct interaction between the system.

The influence of factors may be reinforcing (positive), weak (negative) or changing (alternating sign). The cognitive map shows the mutual influence of factors on each other. Cognitive maps modelling is a tool for constructing situational models for decision-making.

These unique situational models expose the failure of basic project parameters. Areas of Weakness of this approach include:

- subjective measurement of the mutual influence of the factors, shaping the considered current state of the project, and
- Possible low competence and lack of experience of the project management expert who built the cognitive map.

Building a cognitive map is a way to create an «image» of the system (or changes occurring in it). This image, been built, is representative of the system.

A cognitive map shows the current state of the project and accumulates the views of experts, many of which have never communicated with each other. We take into account the opinion of each participant in the process of creating the map.

In cognitive models of knowledge accumulation in projects the use of cognitive maps, based on the relationship between the stakeholders of the project and the interaction of these stakeholders, depending on their competences. The incompetence of a stakeholder in project management can cause significant problems at all project phases of initialization, planning, project execution, and completion. The cognitive model determines the mutual influence of stakeholders. The information and experience owned by each stakeholder determine its behaviour during the project execution.

We create the cognitive maps of the following processes:

- project start-up,
- change management,
- Project implementation and

- Project monitoring.

These processes determine the dynamics of both project implementation and changing values of projects parameters. To limit the negative impact of typical problems we model processes to expose the causes of problems and create scenarios of behaviour in different situations. In future situations we use these scenarios.

The elements of the cognitive model are project stakeholders, displayed as nodes in the graph, and the lines of their mutual influence represented as arcs. Also indicated in the cognitive model are the corresponding potentials (magnitude of influence) of each stakeholder, defined by competence elements.

The cognitive capacity (potential) is determined, in accordance with the elements of competence, represented in IPMA ICB 4

The value of cognitive capacity (potential) is determined by expert evaluation and ranges from -1 to +1. The value of the cognitive potential of each stakeholder is determined for each group of competence element, and then a weighted average of the overall capacity of the concerned party is calculated.

The central project stakeholder is the Project management team (FCD) assessed by groups of competence elements. It is much easier to identify cognitive potential if the entire team consists of certified project managers. In this case, one can accept that the cognitive capacity (potential) varies from 0 to 1.

This model is designed for change management within the initialization and implementation phases of the project. During the initialization phase, it is important to determine the cognitive potentials of stakeholders to evaluate mutual influence before implementation of the project: whether one party will dictate to the other party, or they will together positively impact the project. At this phase, we notice the alignment of stakeholder potential towards reducing their mutual negative influence. Alignment of cognitive capacities leads to elevation of the competence of the stakeholder, whose cognitive potential does not allow for effective interaction with other parties.

Models developed within the framework of the theory of fuzzy sets belong to the logico-linguistic class and are characterised by:

- use of qualitative, not quantitative variables (sometimes called linguistic. That is, their values are not numbers, but words expressed in natural language);
- linguistic relationships between variables, not mathematical equations;
- performance requirements described solely by qualitative criteria.

At the strategic (conceptual) level of management logico-linguistic models are usually applied, and solutions developed in projects and programs.

Cognitive structuring of knowledge about the object and its external environment are based on cognitive analysis and modelling. The object and the external environment are described as a fuzzy set.

Stages of cognitive maps modelling:

1) Cognitive structuring: Analyse problem situation. Determine central factors (in this case, stakeholders) impacting the situation. Define the structure of the relationship between them;
2) Structural analysis of the cognitive map: Analyse the direction and strength of mutual influence of the factors. Select target and control agents. Study management decision for consistency and coherence with the objectives of the organisation (project);

3) Scenario modelling: model scenarios of the project (both in unmanaged and managed regime);
4) Evaluation of modelling results: this stage is quite controversial, because been evaluated is the efficiency of decisions-making (which, in essence, is subjectivity square: subjective evaluation of a subjective action);
5) System (project) monitoring is implemented at the last stage of modelling. If required appropriate corrections to the cognitive map are made.

The information is structured in order to determine the set of stakeholders of the project $S=\{s_1, s_2,\ldots, s_n\}$ (***S*** — Stakeholder), as well as the set of causal relationships between them $I=\{I_1, I_2, \ldots, I_n\}$ (***I*** — Influence), which determine the effectiveness of the project implementation. Accordingly, these causal relationships are defined in the context of impact on effective implementation of the project.

The competence of each stakeholder is determined in accordance with the cause-effect relationships between project stakeholders. This competence is called cognitive potential. The definition of cognitive potentials, based on the standards of determining competence enables more precise formalization of those areas where a stakeholder has a negative impact on project implementation, and enables accurate development of principles to enhance its competence and ways to overcome the project challenges slowing down its implementation.

When defining the cognitive potentials of stakeholders in the project, an expert, the project management office or management of an organization may choose only those elements of competence, which have a direct impact on the Project and of relevance at that stage of the project (see Table 1). Then one needs to rank these elements and identify cognitive potentials of each stakeholder. The value of cognitive potential of a stakeholder, can range from -1 to +1, ie, $C_s=\{-1;+1\}$.

A negative value of cognitive potential means that a stakeholder negatively affects the project at a given time, the positive – stakeholder affects positively. A value of zero potential shows, that the competence of stakeholder is adequate.

At the nodes of a cognitive map project stakeholders that exert only indirect influence on the project situation are also shown.

Formulate a tendency:

- figure out what direction and intensiveness of influence the stakeholders have on each other.
- Determine cause-effect relationship that is the nature (positive or negative) of relationship between the parties, the degree of influence of one stakeholder on another (on the graph show the weight of the corresponding arc between the vertices of the graph).
- The values of the variables are defined linguistically and to each linguistic variable a number between -1 and +1 is assigned (Table 2, The value of linguistic variables).

TABLE I STAGES OF THE PROJECT AND RELEVANT COMPETENCE ELEMENTS

Phase	Subject groups	ISO21500 correspondence	ICB Competence elements	
01_Initialing	Integration	4.3.2 Develop project charter	Practice 01:	Project design
			Practice 02:	Requirements and objectives
	Resource	4.3.15 Establish project team	Practice 05:	Organisation and information
			Practice 08:	Resources
	Stakeholder	4.3.9 Identify stakeholders	Practice 12:	Stakeholders
02_Planning	Communication	4.3.38 Plan communications	Practice 05:	Organisation and information
			Practice 12:	Stakeholders
	Cost	4.3.25 Estimate costs	Practice 07:	Finances
		4.3.26 Develop budget	Practice 07:	Finances
	Integration	4.3.3 Develop project plans	Practice 10:	Plan and control
	Procurement	4.3.35 Plan procurements	Practice 09:	Procurement
	Quality	4.3.32 Plan quality	Practice 06:	Quality
	Resource	4.3.16 Estimate resources	Practice 08:	Resources
		4.3.17 Define project organisation	Practice 05:	Organisation and information
	Risk	4.3.28 Identify risks	Practice 11:	Risk and opportunity
		4.3.29 Assess risks	Practice 11:	Risk and opportunity
	Scope	4.3.11 Define scope	Practice 03:	Scope
		4.3.12 Create work breakdown structure	Practice 03:	Scope
		4.3.13 Define activities	Practice 03:	Scope
	Time	4.3.21 Sequence activities	Practice 04:	Time
		4.3.22 Estimate activity durations	Practice 04:	Time
		4.3.23 Develop schedule	Practice 04:	Time
03_Implementing	Communication	4.3.39 Distribute information	Practice 05:	Organisation and information
			Practice 12:	Stakeholders
	Integration	4.3.4 Direct project work	Practice 10:	Plan and control
	Procurement	4.3.36 Select suppliers	Practice 09:	Procurement
	Quality	4.3.33 Perform quality assurance	Practice 06:	Quality
	Resource	4.3.18 Develop project team	Practice 08:	Resources
	Risk	4.3.30 Treat risks	Practice 11:	Risk and opportunity
	Stakeholder	4.3.10 Manage stakeholders	Practice 12:	Stakeholders
04_Controling	Communication	4.3.40 Manage communications	Practice 05:	Organisation and information
			Practice 12:	Stakeholders
	Cost	4.3.27 Control costs	Practice 07:	Finances
	Integration	4.3.5 Control project work	Practice 10:	Plan and control
		4.3.6 Control changes	Practice 10:	Plan and control
	Procurement	4.3.37 Administer procurements	Practice 09:	Procurement
	Quality	4.3.34 Perform quality control	Practice 06:	Quality
	Resource	4.3.19 Control resources	Practice 08:	Resources
		4.3.20 Manage project team	People 03:	Personal communication
			People 04:	Relations and engagement
			People 05:	Leadership
			People 06:	Teamwork
			People 07:	Conflict and crisis
			People 10:	Results orientation
	Risk	4.3.31 Control risks	Practice 11:	Risk and opportunity
	Scope	4.3.14 Control scope	Practice 03:	Scope
	Time	4.3.24 Control schedule	Practice 04:	Time
05_Closing	Integration	4.3.7 Close project phase or project	Practice 10:	Plan and control
		4.3.8 Collect lessons learned	Practice 01:	Project design

TABLE II THE VALUE OF LINGUISTIC VARIABLES

Linguistic value of the variable "cognitive capacity" ("potential")	Linguistic value of a variable, which characterizes the relationship between stakeholders	Numerical values of the variables (Cognitive capacities and connections)
None	No influence	0
Soft	Mildly enhances (weakens)	0,1-0,3 (-0,1; -1,3)
Average	moderately enhances (weakens)	0,4-0,6 (-0,4; -0,6)
High/Low	Strongly enhances (weakens)	0,7-1,0 (-0,7; -1,0)

The stakeholders, causal relationships between them and the relevant variables are determined by results of interviews, expert survey or analysis, conducted by the project management office of FCD. See appendix.

Cognitive map is a weighted graph $\boldsymbol{G = (S, I)}$, where $\boldsymbol{S}$ (Stakeholder) - node (stakeholders of the project), $\boldsymbol{I}$ (Influence) - the set of arcs represent the direct influence of stakeholders on each other.

Each arc connecting the stakeholder $\boldsymbol{s_i}$ with stakeholder $\boldsymbol{s_j}$, has a weight $\boldsymbol{a_{ij}}$, which reflects the nature and degree of influence of a stakeholder $\boldsymbol{s_i}$ on stakeholder $\boldsymbol{s_j}$. If $\boldsymbol{a_{ij}}$ is a positive value, then with the change of cognitive potential $\boldsymbol{s_i}$, the value of $\boldsymbol{s_j}$ will change in the same direction, if $\boldsymbol{a_{ij}}$ is a negative value, then change in the value of $\boldsymbol{s_i}$, will change $\boldsymbol{s_j}$ in the opposite direction. The module value $\boldsymbol{a_{ij}}$ characterizes the degree of influence.

The matrix $\boldsymbol{A_n}$ is associated with the graph $\boldsymbol{G}$. The element $\boldsymbol{a_{ij}}$ of matrix $\boldsymbol{A_n}$, which lies at the intersection of the $\boldsymbol{i}$-th row and $\boldsymbol{j}$-th column characterizes the influence of a stakeholder $\boldsymbol{s_i}$, on stakeholder $\boldsymbol{s_j}$.

$$An = \begin{bmatrix} a11 & a12 & \dots & a1j \\ a21 & a22 & \dots & a2j \\ \dots & \dots & \dots & \dots \\ ai1 & ai2 & \dots & aij \end{bmatrix}$$

The rows in the matrix determine the influence of a stakeholder on other stakeholders or the weight of the arcs emanating from the corresponding node-weighted graph.

Figure 3 shows an example of cognitive map describing current status of the project and defining innovative principles for its development. All key stakeholders of the project are listed here. This card is developed to order to conceive a solution to stakeholder management during the implementation stage of the NU School of Medicine project (NUSOM). The set of cognitive maps generated during the process of execution of project situations, decisions and actions, create the basis of FCDs' best practice and lessons and is used in future projects.

Fig. 3. Situational cognitive map of NUSOM project during implementation stage

At this stage subset of target $Y=\{y_1,y_2,\ldots,y_k\}$ and managing $U=\{u_1,u_2,\ldots,u_p\}$ stakeholders, as well as the vector of initial values of the cognitive potentials of $S(0)=(s^0_1, s^0_2,\ldots, s^0_n)$ stakeholders are determined. According to Fig. 3.3. this vector is represented as $S(0)=(0,7; 0,4; 0,1; 0; 0,1; 0,2;)$.

Managing stakeholders are those stakeholders who, in their turn, would be influenced by the project team to implement the project efficiently, given the project constraints. Target stakeholders are those who, to a greater extent, characterise the state of the controlled object and its purpose, whose change of cognitive potential values is undesirable. In this case, managing cognitive potentials are cognitive potentials of customer and the client, and target cognitive potentials - the project team (FCD).

4. Results and Conclusion

- An interorganizational networked-based arrangement is a new paradigm (measure) introduced to facilitate innovation development and diffusion within projects. Taking advantage of innovation by involving nodes from the lower levels of the network of project decision makers (such as site workers and end users) in decision making improves the process of innovation in projects. Extending such networks to include the nontechnical and external stakeholders and end users of the built facility can expedite the process of innovation projects even more. This is particularly true in the context of sustainable development. Open involvement of end users in the NU projects has been an effective means for meeting and exceeding the expectation of the major stakeholders. A good example is the NUSOM project.
- Challenges: The heterogeneity of decision-maker networks and the lack of structured input will result in chaotic discussions (Taylor and Bernstein 2009). However, it may present a promising approach to harvest the collective intelligence of the increasingly complex networks of decision makers. The objective here is not only the optimisation of a decision. Beyond searching for solution mechanisms, the actual need is to understand the dynamics of innovation that will take place in such networks (Taylor and Levitt, 2007). The goal is to empower key stakeholders to make value creating decisions through democratising innovation. The role of technical decision makers will change from the vertex at the top of the hierarchy pyramid, which controls the decision process, into a leading or facilitating node among others within the network of decision makers. The final decision will emerge from the self-stabilizing mechanisms of decision-making networks as well as distilling order, agreement, and innovation from chaotic discussions.
- Adverse attitude is attributable to the behavioural competence level of individuals. This is evident in the NU projects. Upon cognitive modelling of the existing cognitive potential stakeholders and their influencing weight, FCD implemented stakeholder management measures, like meetings, seminars and training in project management, to enhance their competence. In other words, after taking a snap shot of cognitive potential and influence of decision makers, a strategy is put in place for change management (competence enhancement)
- FCD implemented Oracle Primavera P6 Enterprise Project Portfolio Management solution, a web based repository and document/information management and communication system (corporate project management control system). This system effectively provided stakeholders with on time information needed for timely decision making.
- The NU projects are implemented in an environment of multiple decision makers, whose level of competence in managing projects vary. Through interaction between stakeholders during implementation, they influence each other. The NUSOM project benefited from this intercommunication through the exchange of knowledge and motivators, given a competent project manager with high cognitive potential is

involved. This led to a better attitude and efficient decision making among the decision makers at the top level, middle level and low level.

5. References

[1] N.B. Mazdak and E. El-Diraby Tamer, "Synthesis of Decision-Making Research in Construction", Journal of Construction, vol 141, no. 9, September 2015. [Online]. Available: ASCELibrary, http://ascelibrary.org [Accessed August 01, 2017].

[2] N.B. Mazdak and E.E. Tamer, "Synthesis of Decision-Making Research in Construction", Journal of Construction Engineering and Management, vol.141, no.9, September 2015.

[3] H.Yoon and G. Tourassi, "Analysis of online social networks to understand information sharing behaviors through social cognitive theory", Author manuscript, Annu ORNL Biomed Sci Eng Cent Conf., 2014

[4] J.E. Morrison and J.D. Fletcher, "Cognitive Readiness", Institute for Defense Alnalyses, IDA Paper P-3735, 2002

[5] S.M. Fiore, K.G. Ross and F.Jentsch, "A Team Cognitive Readiness Framework for Small-Unit Training", *Journal of Cognitive Engineering and Decision Making*, Vol… DOI: 10.1177/1555343412449626, 2012

[6] N.Y. Azarov, F.A. Yaroshenko and S.D. Bushuyev, *Innovative principles for managing development programs* . Kyiv: Summit-Book, 2012 , p.576.

Risk management modeling in multi project environment

Myroslava Kotlyarchuk

myroslava.kotlyarchuk@gmail.com
Lviv Polytechnic National University

Nataliia Kozak

KozakNatalia11@gmail.com
Lviv Polytechnic National University

Mariia-Antoniia Moisa

antonia.moysa@gmail.com
Lviv Polytechnic National University

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1. Introduction

An integral part of decision making process is uncertainty, which may cause the risk during the decision making. The risks affecting the quality of decision making can occur at any stage of the decision making process: an incomplete or uncertain information about the problem; an ambiguity of conditions, requirements and criteria; an unclear understanding of the goal; the inability to accurately take into account the reaction of the environment to the performed actions, etc. That is why the passive risk evaluation and the consequences of it are not expedient, when the active targeted risk management with an aim to minimize uncertainties and random factors influence on the quality of the decision is suitable.

Risk is a daily reality on all the projects, and continuous risk management should become just a regular thing. Management should be permanent and convenient, not imposed or forgotten. However, continuous risk management is not the same for all projects. It needs to be adjusted to be effective. Adjustments are used when organizations apply processes and selected methods and tools, which are the most suitable for their project management practices and their organizational culture. Abidance by principles of continuous risk management is the way to successful adjustment.

Risk management is described as a set of methods and techniques for the analysis and neutralization of the risk factors incorporated in planning, monitoring and adjusted action system, which give the opportunity to predict to some extent the occurrence of risk events and to take action so as to exclude or reduce the negative consequences of occurrence of such events [1,2].

2. Analysis of the recent research on the topic

The risk management process usually precedes the planning (the decision making process about the risk management application and planning for a particular project), which involves making decisions about the organization and staffing of risk management procedures, methodology and data sources to identify the risks, as well as the time interval to analyze the situation.

It is important to plan the risk management in accordance with both the risk level and type and the importance of project realization for the organization. The systematic approach to risk perception and awareness facilitates the planning of the effective risk management. The management strategy is developed in relation to each particular risk, the sphere of its influence is specified, the appropriate threshold levels of risk are defined and taken, and the strategic objectives are developed. The roles and the responsibilities of all the project members as well as the cooperation between the departments involved are defined. Time limits are set and the methodologies for estimating and managing risks of particular types are suggested. Methodology in its turn includes estimation models and criteria, which are to be constantly reviewed. Existing approaches to the classification of risks are accepted or the new ones are developed. Report formats as well as the accounting principles and the principles of documentation are suggested. Business meetings, interviews and control measures are planned, questionnaires and fill-in forms are prepared, information is collected from the other organizations, management meetings and discussions are scheduled.

Risk management process may be defined as a sequence of the following procedures [3]: risk identification, risk analysis, risk response, risk monitoring and control. All the components (procedures) of the risk management process interact with each other as well as with other procedures. Each procedure is executed at least once within a particular project. Even though all the procedures listed are considered to be discrete elements possessing certain features, they may, in fact, overlap and interact.

3. Effective management of the project risks

Suppose N number of projects Pr1, Pr2, …, PrN forming a multi-project environment are to be carried out. Certain constraints have been imposed on the multi-project environment in question – only a limited amount of C resources is available.

Each project is characterized by its minimum duration ti (the project can't be completed any earlier regardless of how many resources are used). This duration can be calculated using the critical path method. Ti is the maximum project duration. In case the project is finished earlier than planned (ti<t<Ti), organization makes a profit. If the project exceeds its maximum duration, the fine is imposed for missing the deadlines.

We shall call h a function representing the dependence between the duration and the resource usage C:

$$C_i=h_i(t)$$

We shall speak of a risk free multi-project environment a, if

$$\sum_{i=1}^{N} h_i(T_i) \le C \qquad (1),$$

that is when all the projects are finished meeting the deadlines.

If the condition (1) is not satisfied, the lack of resources and therefore the existence of possible risks within the multi-project environment become evident. In the following case the resources are to be allocated between the projects in the way which enables to maximize the difference between the profits for finishing the projects earlier than planned and the fines for exceeding the time limits.

The following functions should be introduced:

Profit, f

$$f_i = \begin{cases} \hat{f}_i(t), t_i \le t \le T_i \\ 0, t > T_i \end{cases} \qquad (2)$$

Fine, g

$$g_i = \begin{cases} 0, t_i \le t \le T_i \\ \hat{g}_i(t), t > T_i \end{cases} \qquad (3)$$

Thus the objective of project management in the multi-project environment may be defined as follows:

$$u = \sum_{i=1}^{N} (f_i - g_i) \to \max \qquad (4)$$

Formulas (1)-(4) set the model of effective project risk management in a multi-project enviroment.

Task 4 answer depends directly on functions $\hat{f}_i(t)$ and $\hat{g}_i(t)$ form. These functions can have both tabular and analytical form. Since these functions are specific to each project, the most effective method of solving the problem (4) is tabulation of resources allocation between projects. Project execution time can be defined as $t = h_i^{-1}(C_i)$.

Function h_i^{-1} can be different for every single project. It is mainly inversely proportional relationship $t = \frac{W}{C}$ (W – any constant) or linear relationship with negative gradient of a line $t = -aC + b$. Type of functions is given by experts based on historical data, experience and intuition. For simulation modeling we consider the following example.

Lets assume that:

C=70 – number of resource units in a multi-project enviroment;

N=2 – number of projects (Pr1 i Pr2), operating in a multi-project enviroment;

project Pr1: t1=4; T1=10; $t = \frac{300}{C}$;

project Pr2: t2=7, T2=14, $t = -2C + 100$.

In order to complete both projects on time it is necessary to provide 30 resource units for project Pr1 and 43 resource units for project Pr2. Altogether it is necessary to have 73 resource units, also we lack for 3 resource units.

The functions $\hat{f}_i(t)$ and $\hat{g}_i(t)$ are to be defined as follows:

$\hat{f}_1 = \frac{-4t + 40}{3}$, $\hat{f}_2 = \frac{-2t + 28}{3}$.

$\hat{g}_1 = \frac{2}{3}(T - 10)$, $\hat{g}_2 = \frac{1}{2}(T - 14)$.

The tabulation of resources allocation between projects Pr1 i Pr2 in 1-unit increments is to be carried out:

c1	c2	t1	t2	f1	f2	g1	g2	U
23	47	13	6	0	5,333	2,028986	0	3,304348
24	46	12,5	8	0	4	1,666667	0	2,333333
25	45	12	10	0	2,667	1,333333	0	1,333333
26	44	11,5	12	0	1,333	1,025641	0	0,307692
27	43	11,1	14	0	0	0,740741	0	-0,74074
28	42	10,7	16	0	0	0,47619	1	-1,47619
29	41	10,3	18	0	0	0,229885	2	-2,22989
30	40	10	20	0	0	0	3	-3

Since the project Pr2 can not be performed earlier than in 7 units of time, the optimal allocation of resources between projects is as follows: the project Pr1 gets 24 resource units and the project Pr2 gets 46 recource units. Then income from the project Pr2 will amount to 4 units and penalties from the delayed project Pr1 implementation will amount to 1.67 units. Generally we get a surplus of 2.33 units.

4. Results and Conclusion

The method of effective management and project risk modeling in multi-project environment is suggested. The simulation modeling is carried out in order to verify methods efficiency. The example of effective resources allocation between two projects in a multi-project environment is given. This method should be used for the distribution of non-renewable resources between projects operating in a competitive multi-project environment.

5. References

[1] ДСТУ ISO 9000-2001

[2] Мазур И. И., Шапиро В. Д. Управление проектами. Справочник для профессионалов, 2001

[3] . Верес О. М, Катренко А. В. , Рішняк І. В. , Чаплига В. М. Управління ризиками в проектній діяльності (2003) // Інформаційні системи та мережі. Вісник Національного університету “Львівська політехніка”. №489. с.38–49

[4] Родина Л.А. Имитационное моделирование в контексте управленческого прогнозирования (2004) // Вестник Финансовой академии. Вып. 1(29). http://www.vestnik.fa.ru/1(29)2004/8.html

[5] Бланк И.А. Основы финансового менеджмента (1999). 511с

[6] Глущенко В.В. Управление рисками. Страхование.(1999). 334с.

[7] Катренко А.В., Рішняк І.В. Методи управління ризиками в ІТ-проектах (2008) // Комп’ютерні науки та інформаційні технології (CSIT-2008): ІІІ міжнародна наук.-практ. конф., 25-27 вересня 2008р.: тези доповіді. С.245-247.

[8] Варджешш А.Г., Глушенко В.В. Системы управления (2000), 296 с.

[9] Верес О.М., Рішняк І.В. Оцінка ризику проекту (2013) // Інформаційні управляючі системи та технології: Міжнародна науково-практичної конференція (ІУСТ - Одеса -2013), м. Одеса, 8-10 жовтня 2013р., с.148-149.
[10] Oleh Veres, Ihor Rishnyak Assessment of project risks (2013) // Computer Science and Information Technologies (CSIT'2013): VIIIth International Scientific and Technical Conference, Lviv, 11 – 16 November. p.90-91.
[11] Rasmussen J. Risk Management in a dynamic society: a modeling problem (1997) // Safety Science. Vol.27, №2-3. p.183-213.
[12] Lipshitz R. Coping with uncertainty: A Naturalistic decision-making analysis
[13] Olsson R. Risk management in a multiproject environment: An approach to manage portfolio risks (2008) International Journal of Quality & Reliability Management. Vol.25, №1. p.60-71
[14] Chapman C. Project risk management: processes, techniques and insights (2003). 389 p.
[15] Laslo Z. Resource allocation under uncertainty in a multi-project matrix environment: Is organizational conflict inevitable? (2008) // International Journal of Project Management. № 26.8. p. 773-788.
[16] J. F. Gonçalves, J. Mendes, M.A. Resende Genetic algorithm for the resource constrained multi-project scheduling problem (2008) // European Journal of Operational Research. № 189.3. p. 1171-1190.

Seven Rudiments of Personal Agility for Construction Agility

Author

Raji Sivaraman, M.S, PMI-ACP, PMP, Principal of ASBA LLC, Singapore/USA, Adjunct Professor, Feliciano School of Business, Montclair University, USA, email:- raji.sivaraman@asba-llc.com

Co-author

Michal Raczka, MBA, PMI-ACP, PMP, CISA, IT Strategy Vice Director at mBank S.A., Warsaw, Poland, email: michal@raczka.biz

Abstract

This paper shows a slightly different look at how the construction industry can take personal agility into their overall equation and how the authors feel that their seven-agility model will certainly enhance this particular business arena in multiple dimensions. The strategy used with the Seven Personal Agility (PA) Lighthouse model that the authors explain make the construction organizations ride on calm seas. Our model, which is *Educational Agility* where flexibility in all types of problem solving techniques and critical thinking skills allow innovation with agile thinking. *Change Agility* looks at how overall actions affect others, and the organization in the long run, as every crewmember of a ship is as important as the captain to lead the ship to the PA lighthouse. For business value to grow, *Political Agility* is a must, which the authors think emerges with distinctive divide may it, be between stakeholders, departments, geographic divides etc. For collaboration, emotions cannot come in the way, which navigates us to *Emotional Agility* that warrants agile appearances and sometimes suppression of inner feelings. Emotions involves the brain and the mind, two of the most agile parts of an organization's cerebrum including the construction arena that is now seen in the horizon as *Cerebral Agility*. To reduce mental fatigue/anxiety, support healthy brain function of the construction world, a clear intellectual thought is imperative. All of the above PA can be engineered only if *Learning Agility* is honed. Self- Awareness and knowledge of strengths/weaknesses negates any blind spots. Last, but not least the *Outcomes Agility* is now shown in the full beam of the authors PA lighthouse(shown in Exhibit 1) which is a symbolic figure that the authors use to guide various organizations to land safely on to the successful sands of their businesses.

Keywords: Vendor, Personal Agility, Construction Agility, Investment Needs, PA Lighthouse

Introduction

Can you think of the amount of emotions, learning, change, cerebral, political, education and outcomes agility that is involved in a construction project? The authors are going to attempt to get you to have a feel of the same if you already have not. To vet your appetite, the authors will deep dive just a little bit. The authors feel that one agility competence without the other may not always be leading an organization to safe shores. The guiding light and beams from all seven (shown in Exhibit 1) will certainly make it happen.

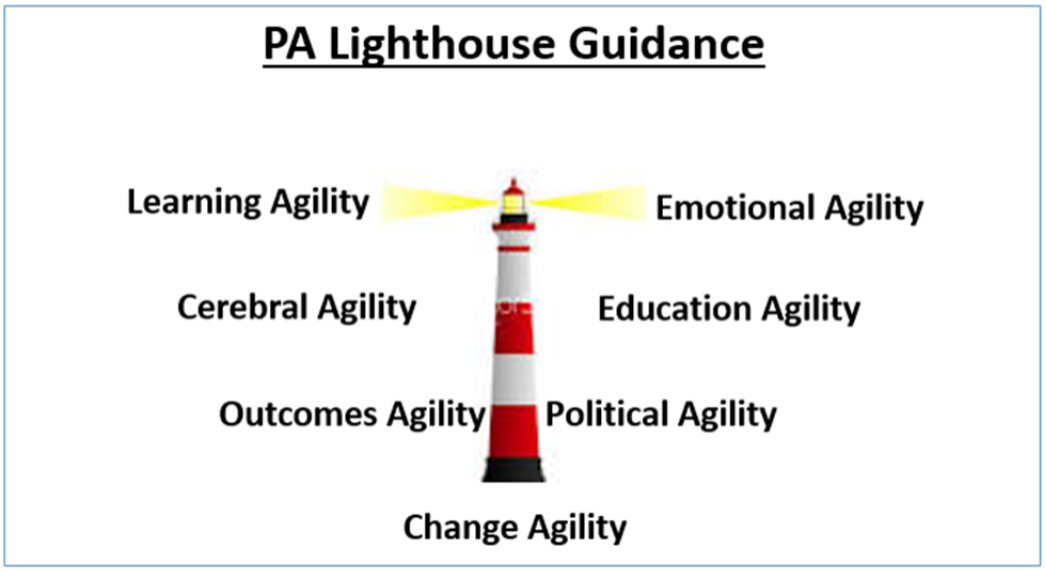

Exhibit 1: Personal Agility Lighthouse Guidance

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Education Agility

Education Agility in our context is getting the feel of the pain points of the person sitting in a different chair. In the construction industry, it is required to recognize two most important but different roles in order to be successful. First, is a Customer sometimes known as an Investor and second, is the user (who will use the product). It is imperative to understand that the customer and the user may have different views and perspectives in most situations. Showing high level of education agility will help to successfully manage and meet different requirements. From a team point of view, we should also be aware of T-shaped people. This is the way to be resilient. All team members should share their knowledge and experience with others. As such, the teams will be able to survive any thunder and storms.

Change Agility

In terms of scope and budget, the LRM (last responsible moment) concept borrowed from Lean thinking fits perfectly for the construction industry. Reaching the end goal as satisfaction of the customers and users can be achieved without much turbulence if one keeps in mind that commitment can be deferred to the point where non-decision moments will have a negative impact. Having options is a luxury and in this particular case we need to have the cost of options in mind. During a construction, it is vital to put intellectual effort and decide if a building will have 10 or 20 floors. But there is little value in making decisions about the specifics of the 9th floor for example. Here we need to use the architecture principles, which allow us to adapt to changing user requirements. Developers should understand the KANO model (as shown in Exhibit 2) of the customers' and users' satisfaction. This will give them the power and knowledge to make appropriate decisions and to figure out if decisions should be deferred, or left open for further dialogue. Don't push for a fix scope, but communicate clearly the next steps and points of decisions.

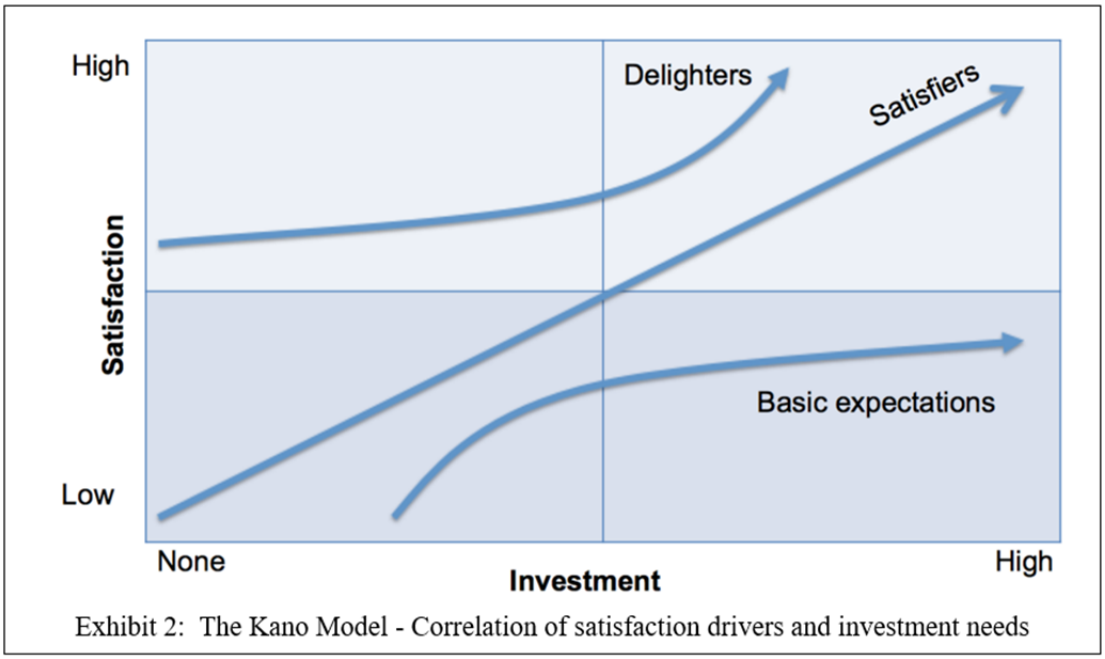

Exhibit 2: The Kano Model - Correlation of satisfaction drivers and investment needs

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Political Agility

Politics is everywhere and the construction industry is no exception. The ability to understand diverse cultures and politics of an organization and be able to maneuver them in an effective way for the employees and organization holistically. Identifying political barriers within the organization and working to build positive relationships between vendors, customers, contractors, and many other stakeholders internal and external in any construction company requires great mentors who can provide advice to others on how to navigate intricate typhoon and stormy situations. Accepting, and working with this reality within a structure with exceptional and effective communication skills top down and bottom up is what the seven agility model brings to the construction world.

Emotional Agility

Being aware of one's inner experiences along with being able to quickly yet effectively evaluate one's thoughts, feelings & experiences in a mindful manner is critical. Always staying true to ones values makes project managers in the construction industry leaders of choice in varied productive ways. They practice self-awareness and because of this, they are seen as managers who comprehend both their own strengths and weaknesses and those of their team members. When in the construction vertical, waves constantly change as far as the budget, quality, time, etc.; self-evaluation, seeking feedback from those around them generating innovative ideas, assisting them to make less mistakes and experience less stress. Emotionally agile leaders are respected by their colleagues for their humility and desire to act objectively committing to their values in the vast construction ocean.

Cerebral Agility

Here, one thinks about problems from a fresh perspective and is unperturbed when faced with a complex and ambiguous idea. Sometimes known as mental agility, intelligence and book smarts play a lesser part. It is a person's intellectual curiosity and search for new and interesting horizons. Pronounced listening skills makes a mentally agile person sponging insights from their surroundings 360 degrees. In any construction project or environment, these kinds of individuals thrive because they are constantly looking for new methods to implement and better, fresher discernments into how to solve simple/complex engineering and modelling problems.

Learning Agility

It is an answer to the question how to stay open to new discoveries and learning opportunities. Both developers and investors must understand that they need to have the courage to admit that they do not know everything. Construction industry tends to keep slow changes pace as architecture and materials change very slowly. In order to be innovative; leaders should be open to learn from other industries. It could even be the IT industry; for example, the microservices architecture principles. In other words, it can be explained as a modular construction. The honeycomb (as shown in Exhibit 3) is an ideal analogy for representing the evolutionary microservices architecture. Each cell in the honeycomb is independent but also integrated with other cells. By adding new cells, the honeycomb grows organically to a big, solid structure. When creating a new solution for customers and users the investment in the interdisciplinary team of engineers from different industries could be crucial. The more perspectives we have the more creative we are.

Exhibit 3: Honeycomb of modular/microservices architecture

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Outcomes Agility

Outcomes Agility means inspiring, and pushing to excel beyond one's limit. It is about the long-term outcomes and benefits. Not only are delivery and sales, goals; but long-term satisfaction visibility as well. For example customer recommendations, learning from lessons learnt, crowd sourcing just to name a few. Striving for excellence in terms of sustainability of our business and products should be the most important outcome. There is no end state.

Results and Conclusion

The end result of having this seven agility model is to enhance performance, ability to be adaptive, be curious, the eagerness to experiment with new concepts and methods. The authors strongly believe through their various interactions in the corporate, volunteer and academic worlds, and hands on working knowledge that their Personal Agility Light House will definitely get the helmets of each construction project to steady grounds and with solid foundation. The authors feel that the seven flavors when mastered are a definite desirable factor because it means that the person held in question possesses the adequate background, practice and experience to successfully apply themselves in the workplace, to meet the organizational and company goals. Ultimately, construction agility is achieved.

References

http://www.balticpmconference.eu/

http://www.bersin.com/Lexicon/Details.aspx?id=14906

http://www.kornferry.com/developing-learning-agility

https://hbr.org/2013/11/emotional-agility

http://leadershipall.com/learning-agility-5-factors/#results

http://www.ajoconnor.com/blog/learning-agility-2020-leadership-competency

http://www.kanomodel.com/

http://microservices.io/

https://www.packtpub.com/mapt/book/application_development/9781786466686/1/ch01lvl1sec10/microservices--the-honeycomb-analogy

Testing the Split-Attention and Multimedia-Effect Guidelines for the Design of Instructional Material in a Programming Environment

Fabian Deitelhoff

fabian.deitelhoff@fh-dortmund.de
Computer Science Department
University of Applied Sciences in Dortmund
Sonnenstraße 96, 44139 Dortmund, Germany

Abstract: *Instructional Design is the process of adapting a learning environment to the learner's abilities. There are several in psychology well tested guidelines to improve the design of instructional material to meet the learner's needs. In this paper, I present a work in progress proposal to test the Split-Attention and the Multimedia-Effect guidelines for the design of instructional material used within a programming environment. Programming is a complex cognitive activity and the design of a programming environment should support learners. The hypothesis is, that learners will highly benefit from a tested and well-designed programming environment. Both design guidelines will be validated with data from task performances (e.g. correct answers) and with gaze data of participants collected by an eye-tracking system.*

Keywords: Programming, Instructional Design, Instructional Material, Eye-Tracking, Cognitive Theory of Multimedia Learning, Cognitive Load Theory, Split-Attention, Multimedia-Effect, Simplex

1. Introduction

The process of creating a computer program out of a mental model, commonly known as programming, is a complex cognitive activity (see [1]). This is especially true for novice programmers trying to learn how to program. Novices facing challenges like algorithmic constructs, datatypes, and problem solving in general. In text-based programming languages novices have problems with the initialization of variables (see [2]), understanding loops and when they terminate (see [3]), and logical operators in conditional (IF) statements (see [3]), just to name some common problems.

Well-designed instruction material like task descriptions and API documentations can be helpful in above mentioned situations, because those problems are often directly related to syntax misunderstandings. In this paper, I present a work in progress proposal to test the two design guidelines Split-Attention and Multimedia-Effect for the layout of instructional material (see [4]).

2. Simplex

Simplex is the name of a simplified programming language. It is integrated into a minimalistic programming environment meant to be a distraction free learning environment. Both the language and the environment will be used within a PhD project to support learnings with gaze based data and social navigation. According to the taxonomy of Kelleher and Pausch (see [5]), Simplex can be categorized as Mechanics of Programming (1), Expressing Programs (1.1), Simplify Entering Code (1.1.1), Simplify the Language (1.1.1.1) and Prevent Syntax Errors (1.1.1.2).

Simplex is simplified according to the number of keywords and programming abstractions. The output of the language is a binary format that is interpreted by the LEGO Mindstorms EV3. The EV3 is used as a proxy object to visualize one's program. Currently, the Simplex-IDE is a prototype with basic functionality for compiling and transferring artifacts for and to the LEGO Mindstorms EV3. Figure 1 shows the current state of the IDE.

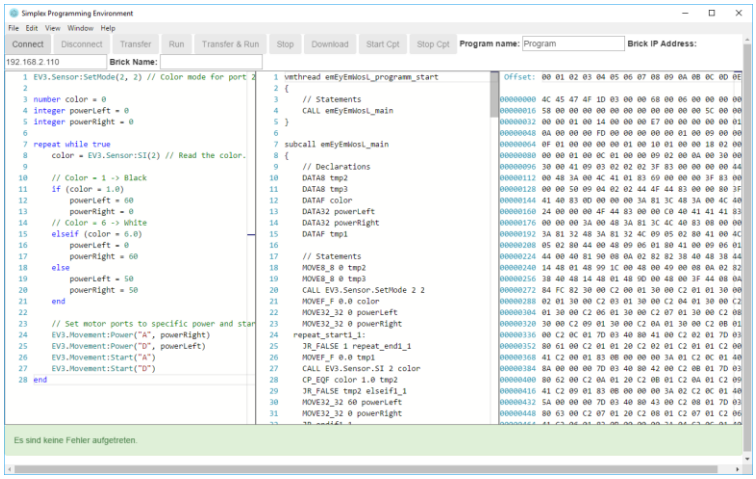


Figure 1: The current design of the Simplex IDE.

3. Study Design

The currently planned study design is based upon at least two groups of participants. One group will use one specially prepared programming environment for the Split-Attention scenario and one will use the environment without such adaptions. At a minimum 12 participants will be needed in total with 6 participants in every group. Currently it is questionable if both identically groups can be used to do the Multimedia-Effect study or two new groups will be needed. If the latter is the case four groups of participants are need.

Both studies will be realized within an own programming environment with a self-defined programming language called Simplex. In every scenario Eye-Tracking systems are used to collect gaze movement data of every participant. Therefore, it is possible to use this data to draw conclusions about the usage of the different programming environment instances with different adaptions.

4. The Scenario for Split-Attention

In the scenario for testing the Split-Attention, two groups of participants will solve question-based tasks in terms of programming. Every participant will see a small number of less than 10 questions. To answer such questions every participant can use additional instructional material integrated within the programming environment. This material consists of textual descriptions like parts of an API documentation and additional code snippets. The questions are based upon Simplex snippets that shows some specific programming task like solving a mathematical calculation, initializing variables or performing common used programming techniques like loops.

One of two groups of participants will be doing such tasks in a split design. In this case the Simplex snippets and outputs of one test run are on the left side of the programming environment. On the right side, one can find the additional instructional material. The second group of participants will be in an integrated design. In this scenario both the Simplex code and the additional instructional material are mixed within one integrated view.

The hypothesis is, based upon the well-known Cognitive Theory of Multimedia Learning (CTML) (see [6]), that participants will put a lot of effort in integrating the related information given in the instructional material. Therefore, participants solving tasks in the integrated scenario of the programming environment should perform better in terms of correct to incorrect answers.

Data of studies doing this in other scenarios, like describing art by 16-year-old Dutch pupils, showed, that this assumption is incorrect (see [7]). This scenario described in this paper will test the hypothesis in terms of programming and programming environments.

5. Multimedia-Effect

In the scenario for testing the Multimedia-Effect, two groups of participants will again solve question-based tasks in terms of programming. In this case one group will have scientific visuals like figures and small animated graphics (GIF files) to support them answering the given questions. For example, programming tasks like judging the correct output of a loop or a visualization of one execution flow can benefit from having figures and animated graphics.

The second group of participants will solve the same tasks but without those additional visualizations within the instructional material. The hypothesis is, again based upon the CTML, that the group of participants with the visualizations included in the instructional material perform better due to an enriched mental model. Again, data of other studies doing this in a different scenario showed, that this assumption is incorrect (see [7]). The scenario described in this paper will test the hypothesis in terms of programming and programming environment.

6. Conclusion

The planned studies are used to verify the two instructional design guidelines Split-Attention and Multimedia-Effect in scenarios common to programming and programming environments. Both studies are part of a larger PhD project in which a learner community (i.e. programming environment) will be improved with asynchronous gaze sharing and social navigation for teaching problems solving principles. This programming environment is based upon Simplex and instructional material. Therefore, both studies have the potential to provide some insights in how to design a programming environment with integrated instructional material.

7. References

[1] Pea, Roy D.; Kurland, D.Midian (1984): On the cognitive effects of learning computer programming. In: New Ideas in Psychology 2 (2), S. 137–168. DOI:10.1016/0732-118X(84)90018-7.

[2] Shneiderman, Ben; Mayer, Richard (1979): Syntactic/semantic interactions in programmer behavior. A model and experimental results. In: International Journal of Computer and Information Sciences 8 (3), S. 219–238. DOI: 10.1007/BF00977789.

[3] Ebrahimi, Alireza (1994): Novice programmer errors. Language constructs and plan composition. In: International Journal of Human-Computer Studies 41 (4), S. 457–480. DOI: 10.1006/ijhc.1994.1069.

[4] Mayer, Richard E.; Moreno, Roxana (2003): Nine Ways to Reduce Cognitive Load in Multimedia Learning. In: Educational Psychologist 38 (1), S. 43–52. DOI: 10.1207/S15326985EP3801_6.

[5] Caitlin Kelleher and Randy Pausch. Lowering the barriers to programming: A taxonomy of programming environments and languages for novice programmers. ACM Comput. Surv., 37(2):83137, 2005.

[6] Mayer, Richard E. (2009): Multimedia learning. 2. ed. New York NY u.a.: Cambridge Univ. Press.

[7] Jarodzka, Halszka; Holmqvist, Kenneth; Gruber, Hans (2017): Eye tracking in Educational Science. Theoretical frameworks and research agendas. In: Journal of Eye Movement Research 10 (1). Online verfügbar unter https://bop.unibe.ch/index.php/JEMR/article/view/2959.

Abstract for poster session

Mobile Banking System in Palestine and its Readiness to Serve the Community

Amr Saleem*[1], Ala Nuseibah[2]
[1] Bank of Palestine, Ramallah, Palestine ,amrosaleem@yahoo.com
[2] Dortmund University of Applied Sciences and Arts, Dortmund, Germany

Most banks nowadays try to find the best ways to serve their customers in quick, smart and accurate ways and with high security.

The technological revolution in recent years has prompted bank administrators to think of a smooth customer service mechanism through technology, starting with e-services such as SMS and then internet banking through web pages until the emergence of smartphones and the availability of internet services everywhere through GPRS, 3G and wireless technologies. This was facilitated by mobile applications that can be downloaded free of charge. Such applications were especially needed in Palestine.

The launch of this new application for smart phones is in line with the ongoing development policy adopted by the Bank to provide the best services, and cope with the difficult conditions of the Palestinian people under the closures, checkpoints and difficulty to reach the centers and branches that provide such services. This is a quality leap in providing innovative solutions and providing banking services at all times and the best. However, the launching of the project to introduce mobile banking faced many challenges, among which were political, but the project succeeded to launch the mobile banking services by the year 2015 in Palestine.

This paper will describe mobile banking systems, their evolution and the factors contributing to their success and benefits for users. This will be supported by a case study on the project to launch the mobile banking system at the Bank of Palestine. The paper closes with reflections on the case study and recommendations for project management in the banking sector in Palestine.

*corresponding author

Utilizing cognitive load in speed reading (RSVP) – insights from an eye tracking study

Benedikt Schröder, Christian Schlösser

benedikt.schroeder020@stud.fh-dortmund.de, christian.schloesser@fh-dortmund.de
University of Applied Sciences and Arts Dortmund
Emil-Figge-Straße 42, 44227 Dortmund

Abstract:
Rapid Serial Visual Presentation (RSVP) enables much faster reading for a loss of control in the reading process. This contribution explores the use of eye tracking as a sensor to measure cognitive load to detect issues during the RSVP and outlines preliminary results from a work-in-progress study.

Keywords: RSVP, eye tracking, speed reading, cognitive load, pupillometry

1. Introduction

Rapid Serial Visual Presentation (RSVP) describes the dynamic playback of texts in a small space. Single words are presented on a fixed position called optimal reading point and then replaced automatically [1]. In comparison to normal reading (250-300 words per minute), RSVP allows to read up to 1000 words per minute [2]. Figure 1 shows the steps that are internally performed by the RSVP system. Each word of the sentence (Fig. 1 left) is optimally aligned for brain recognition (Fig. 1 center). The RSVP system then presents one word at a time (Fig. 1 right) for a predefined period and replaces it automatically with the next one.

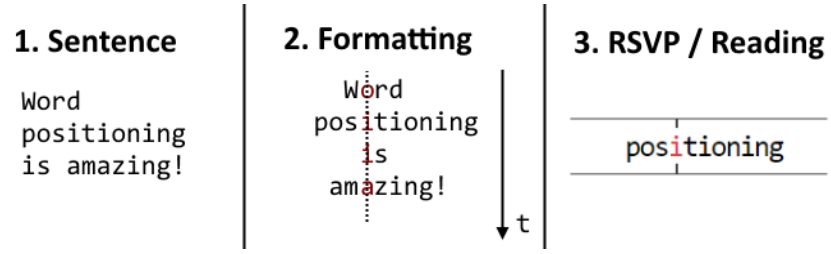


Figure 1: Internal process of an RSVP reading application

This way RSVP creates a flipping book of text, so it can be read without moving the eyes. Therefore, this type of presentation is more like a video than a static text, so an external control is required. When the viewer loses the optimal reading point, it is quite difficult to recover it. There is also no possibility for regression, including jumping back to previous words. Still, this kind of presentation for example offers many advantages in mobile applications where space is limited [3].

Eye tracking as a methodology is primarily used to record eye movements for analysis purposes, but can also be used for gaze-controlled interactive applications such as virtual keyboards. Eye trackers also offer the ability to detect changes in pupil size. The human's pupil responds to a variety of stimuli, e.g. light and emotions, but also to cognitive load [4].

We seek to explore the benefits of combining RSVP with eye tracking. On the one hand, eye tracking could function as an input device for RSVP. On the other hand, it should be investigated whether the pupil dilatation can be a reliable measurement for cognitive load and hence improve the reading process. For example, such a system could automatically show translations or definitions for unknown words and replay whole sentences if needed. This could especially be helpful for second-language acquisition.

2. The current study

Aim of this work-in-progress study is to explore the combination of RSVP and cognitive load detection via eye tracking. Using an iterative approach, different cognitive load inducing tests were designed and analyzed, ranging from easy and complex texts, second language texts to jokes, semantic fields and math formulas. The study was conducted with five university level participants. All of them were german native speakers. The eye tracking recording was conducted in a controlled laboratory setting to eliminate external influences.

3. Observations

Figure 2 shows excerpts from two different tests of one participant. An easy text with missing words on the left and math tasks on the right. The grey bars indicate the point in time when the stimuli are presented. The easy text only shows subtle changes in pupil dilatation. Even the missing word does not create any relevant pupil dilatation. In contrast, the clearest effect was observable in solving the math task. After about 200 milliseconds the pupil diameter increases slowly due to cognitive load. Depending on the task difficulty, the increase of the pupil's diameter differs in size and duration. After this period the diameter converges back to its original size.

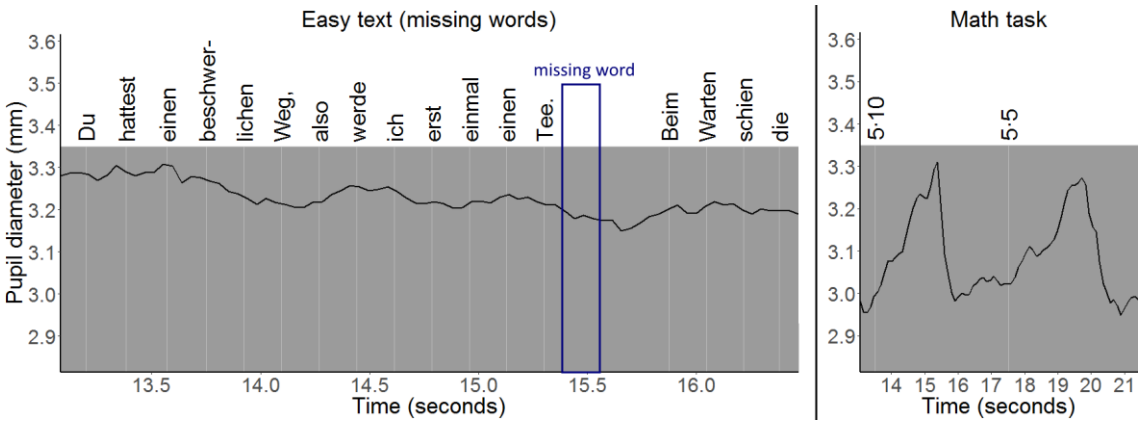


Figure 2: Pupil dilatation during RSVP reading tasks

4. Conclusion and future work

Pupil dilatation can be measured and mapped to the origin for cognitive load quite well in math tasks. But it is much more difficult to relate cognitive load to a certain word in a text, due to the dilatation delay and the quick replacement of words. This will be a part of the future work in this study. Also, the mentioned control capabilities of eye tracking for RSVP will be investigated.

5. References

[1] Beccue B., Vila J. (2004) Assessing the Impact of Rapid Serial Visual Presentation (RSVP): A Reading Technique. In: Ramos F.F., Unger H., Larios V. (eds) Advanced Distributed Systems. ISSADS 2004. Lecture Notes in Computer Science, vol 3061. Springer, Berlin, Heidelberg

[2] Thomas, M.: What Is the Average Reading Speed and the Best Rate of Reading?: http://www.healthguidance.org/entry/13263/1/What-Is-the-Average-Reading-Speed-and-the-Best-Rate-of-Reading.html, last visited on Jun 8, (2017)

[3] Dingler, T.; Rzayev, R.; Schwind, V. & Henze, N.. RSVP on the go. In Michael Beigl, Paul Lukowicz, Ulf Blanke, Kai Kunze & Seungyon "Claire" Lee (Hrsg.), the 2016 ACM International Symposium (S. 116–119).

[4] Holmqvist, K.; Nyström, M.; Andersson, R.; Dewhurst, R.; Jarodzka, H. & van de Weijer, J. (2011). Eye tracking. A comprehensive guide to methods and measures. New York: OUP Oxford.

Agile transformation of product development organizations in automotive industry, chances, risks and hurdles

Hans-Juergen Neumann M.A.
Senior Quality Manager
Continental Automotive GmbH, Germany
h.j.neumann@web.de
Brunnenstrasse 153,
65428 Ruesselsheim - Germany

Abstract: *Product development in the automotive industry has changed during the last 20 years dramatically. Cycle time of products is reduced, number of models increased, in-house production, design and validation are transferred to suppliers, new features to be adapted. This leads to an adaption of project management methods; the methods must change from constructivist to evolutionary, known as agile project management methods. The avoidance of human safety risk is dominating the development culture, which is opposite to the market needs and customer demands, a classical dilemma. Legal requirements to avoid personally stressing conditions will be touched upon. The importance of resistance, fears and ignorance is investigated in a qualitative explorational exemplary study. It is found that the variation of hurdles is not automatically related to experience and education levels. The conclusion is a model, the so-called Ludwigshafener model (AT = KLP A^2), to be used as a recommendation during agile transformation of organizations in the automotive industry.*

Keywords*: agile transformation, product development, project management, automotive industry, cycle time, ASIL, MaxQDA, change management*

1. Introduction

Cycle time in physical product development is a key indicator for success in automotive markets. Cycle time has been reduced during the last decades, especially in the automotive industry for new models and worldwide concept cars. Product development follows the trend of shorter lifecycles and customizing; currently, we see six years for automotive models instead of 10 years in the past [2]. The worldwide numbers of models are adapted to consumer requests and marketing efforts by the automotive industry [3]. In 1980, the Volkswagen (VW) model variety was shown in four models: Polo, a small-sized car; Golf, medium size; Passat, limousine; and Scirocco, sports car. In 2008, VW increased their model variety from 4 to 15 models with multiple equipment variants: the Fox, under the still existing Polo; Golf was placed under the new model Jetta; New Beetle and Eos as fun cars; Touran, Tiguan and Touareg and new models called sports utility vehicles (SUVs); limousines like Passat were added with the high-class model Phaeton; Scirocco as a sports car; and new models for families and sport activities like Caddy and VW-Bus model T5, which were integrated from commercial vehicles into coupe passenger cars. The numbers of models for group brands like Audi, Skoda, Seat, Porsche, etc. are also to be reviewed. In fact, group models will be "recycled" in other countries or company brands (e.g. General Motors [GM] Opel Vectra to Chevrolet Neon). Rapid prototyping, virtual lifecycle validation and worldwide projects with 24/7 activities are state of the art. The in-house original equipment manufacturer (OEM) production has been downsized from 35 to 23%, in-house efforts for research and development (R&D) from 70 to 50% in the time period from 2000 to 2015 [1]. In fact, the workload was increased, so external suppliers, the so-called tier 1, have filled upcoming gaps more and more with their subsupplier tier 2 and 3. Due to this megatrend for the last decades, there is now a massive labor displacement expected in the future. When, for example, classical fuel engines are replaced by electrical systems, development of fuel systems, mechanical transmissions, hydraulic brakes, etc. will no

longer be needed. Other products like camera and sensor technologies and digital safety products in hardware and software are new challenges. As a result of this “digital leadership”, there is an estimation for Germany only of an approximately 42% loss of all jobs during the next 20 years. In the USA, 47% of all people work in jobs at risk of disappearing by 2033. One of the risk avoidance policies of organizations is project management (PM). Project management will transfer from constructivist to evolutionary PM methods, many known as agile PM. Well known, but personal behavior mostly disrespect, e.g. not seen as a major factor: “Agile concepts can be misinterpreted; however, most of the respondents have a pragmatic understanding what Agile is all about” [4]. So what are the risks, hurdles and chances during a transformation into an agile organization, coming from a classic conservative culture, for the employees?

2. Method

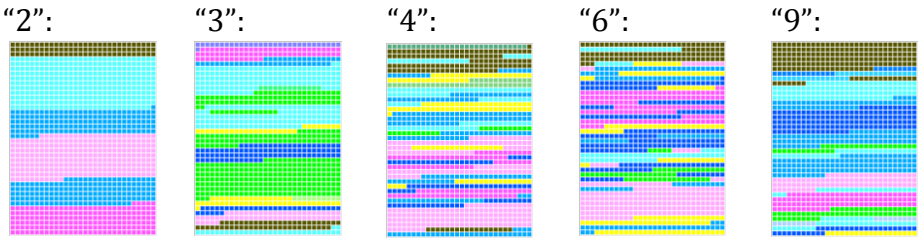
Transformation of organizations was investigated and analyzed for the relevant existing information in general. For the automotive industry, functional safety of the final product should be strictly respected. Also, legal requirements, national and international norms and different customer specifications were reviewed. Within this qualitative explorational exemplary study, there were guided interviews with 11 experts in the automotive industry, hereafter named “1” to “11”. All interviews were done with the same timeframe. These experts were chosen because of longtime experience in development (approximately 10 years or more), a minimum of one scientific paper and/or an academic education, engineering degree, etc. The evaluation was done with MaxQDA version 12 from VERBI, Germany, and represented descriptively. Interpretation of the results was rebounded to the state of the art and analyzed towards a letter of recommendation. The aim of the study was to decrease an academic void, which is seen in the status of the hurdles for the employees. The investigated field is physical product development for experienced designers and supervisors within the automotive industry in Germany.

3. Findings

Agile concepts are mostly understood as “a concept with a reduced timing”. Some people see agile as a “concept for organizations to be able to adapt the current needs”. This means to be able to accept new methods which are sometimes opposite from the current culture and strategy. An example is safety hazards products, which were dealt with most likely conservatively. In the automotive industry, this topic is covered by the Automotive Safety Integration Level (ASIL) and mandatory for OEMs (original equipment manufactioner) and tiers by ISO 26262 [6]. These severity levels start from S0 (no injuries) and go through S1 (light hurt) and S2 (heavily damaged) to S3 (mortal). They are combined with the exposure level E0 (incredible unlikely) to E4 (high probability). The controllability levels from C0 (in general, to be handled by all drivers), C1 (99% can handle), C2 (over 90% can handle) and C3 (less than 90% can handle) define the level of effort during development and validation. For low levels, the usage of a quality management (QM) system according to IN ISO 9001 and IATF 16949 is to be used. High levels from level A to level D need in the worst case the usage of a fault three analysis (FTA) with documented final risks. The automotive industry is anxious not to fail; on the other hand, it is forced to be cheaper, quicker, etc. broken down to the lower plane of the designers and project managers. This dilemma and overloading of tasks, the personal stressing conditions lead to personal strain. Regarding legal requirements in Germany and also international standards, like DIN EN ISO 10075, there are company and supervisor responsibilities that employees have only to be charged with workload according to their personal competence level [5]. Introduction of agile methods means a change of the work environment which is to be released by labor unions in Germany. The investigated group of experts see the fear, resistance

and ignorance of most of their personnel as hurdles against agile methods. The importance of risks and chances are lower than the importance of management behavior and company culture. The understanding and commitment to agile methods is not related to education and experience level. The acceptance of agile is different in combination with the variation of topics by the interview partners. The interview was colorized according to the coding type and numbers in order of the timeframe during the interview. Racing green was personal information; blue shows hurdles like fear, resistance and ignorance; yellow shows risks; green the chances; hot pink and pink show the importance of management and culture of agile transformation to the employees in their organization.

Sample of interview line-up coding:



4. Results and conclusion

The considerations explained in this contribution show the need for a deeper investigation. The knowledge and the acceptance of the people in organizations regarding the introduction of agile PM methods in the automotive industry is inhomogeneous. Success during implementation is limited when people are not involved and do not get a chance to understand what the benefit of the change from classic to evolutional PM is. Other major hurdles were defined as resistance, fear and lack of knowledge. The pre-agile group is less connected to organizational culture and shows less trust in management. The common understanding of sense is a key in transformation towards an agile organization, especially during the periods of being outside of comfort zones. Therefore, the model for *agile transformation* (AT) is named the Ludwigshafener model. It is a product out of the parameters *knowledge* (K), *learning* (L), *positive* reinforcement (P), fear (German: *Angst*) (A) and *acceptance* (A), shown in the following formula:

$$\mathbf{AT = KLP\ A\hat{}2}$$

Each of these parameters are independent from education and experience, and they are individual per employee. To minimize the risk, one of the root causes for introduction of PM, the users of the processes and agile methods must be prepared for acceptance and knowledge with positive reinforcement. So, the fears of the employees must be reduced while communication with the management. Employees could become “learning individuals”.
A “learning organization” is then called a “agile organization” !

5. References

[1] Mercer-Consulting/Fraunhofer Gesellschaft, Future Automotive Industry 2015, 2003.

[2] B.Ebel, M.Hofer, Automotive Management", Springer-Verlag, Berlin Heidelberg 2014

[3] *Automotive Netzwerk Südwestfahlen, Situation Automobil 2008*; Download 8.11.2016.

[4] Agile in Automotive – state of practice 2015, Kugler Maag Cie /Kornwestheim 2015, www.kuglermaag.de/agile2015

[5] Betriebsverfassungsgesetz, Germany 25.09.2001 (BGBl. I S. 2518) from 20.04.2013 (BGBl. I S. 868) m.W.v. 01.08.2013 § 87 Abs. 1 Nr. 7.

[6] Martin Hillenbrand, Funktionale Sicherheit nach ISO 26262 in der Konzeptphase der Ent-wicklung von Elektrik / Elektronik Architekturen von Fahrzeugen, Dissertation Karlsruher Institut für Technologie Institut für Technik der Informationsverarbeitung, KIT Scientific Publishing, Karlsruhe 2012).

An Approach for harnessing maximum benefits from a Knowledge Management System

Sarosh Khan, Matthias Waidmann, Thomas Strücker
University of Applied Sciences and Arts Dortmund
Emil-Figge-Strasse 44, Dortmund, Germany

Abstract

This paper proposes a set of recommendations to be included in a Knowledge Management System (KMS) in projects in order to maximize the benefits from KMS. This paper provides an overview of qualitative and quantitative benefits of implementing a knowledge management strategy in project-based organizations. Because of the temporary nature of projects with changing structures, teams, processes, practices, tools and methods, the implementation of an effective knowledge management strategy holds critical importance. The project-based organizations considered in this paper mostly are from IT industry. The paper also highlights the challenges and problems in the processes of creating, capturing, and sharing both tacit and explicit knowledge in typical project-based organizations. Based on the contemporary literature, these particular problems will be identified and current approaches and models on how to handle them will be analyzed. The authors propose a small framework based on the literature survey and suggest certain important aspects to be included in KMS such as Project Management Office having Central Role in KMS, Involvement HRM department as an active contributor to KMS, development and updating of Communities of Practice (COP), involvement of IT department as a major stakeholder and provision of incentives to employees. The authors recommend, based on research, that these aspects must be considered in a KMS design and development in order to harness the complete qualitative and quantitative benefits from a KMS in organizations.

Key words: *Knowledge Management, Project Management, Quantitative measurements, Quality; Knowledge Management Systems*

Introduction

Importance of knowledge management

Knowledge and the management of knowledge are two important topics in industries for the last thirty years. In the mid-1980s, individuals and organizations started to realize the important role of knowledge in competitive markets. International competition led to a stronger emphasis on product and service quality. In addition, diversity and customization became more and more important (Desouza & Evaristo, 2004). Nowadays knowledge management is considered of utmost importance for organizational learning. Especially in project-based organizations (PBO) effective knowledge sharing is still a challenge. PBOs are temporary systems of actions created for performing the projects tasks and creating new knowledge. The main challenge is to establish an effective process of knowledge sharing and the integration between several projects to prevent redundant work and repeating mistakes from the past. (Almeida & Soares, 2014).

Project memory

The concept of project memory, which originates from the concept of organizational knowledge, tries to solve some of these problems. Walsch & Ungson introduced the notion of

organizational memory, defining and elaborating its structure. Organizational memory refers to the ability of an organization to function similar to the human brain in terms of dealing with knowledge. The organization is capable to acquire, store, reuse and transfer the knowledge similarly to the human brain. Furthermore, the organization can continuously learn from its interactions with market changes and competitors acquiring and processing information. Similarly, to the process of the individual memorizing, the organization stores information and recalls it when needed. Elements of the organizational memory are located in individuals, technologies, organizational structures, etc. (Walsh, J. P., & Ungson, G. R., 1991)
The project memory describes knowledge from a project's history that can be brought to bear on present. Therefore, it is necessary to differ between two kinds of knowledge. Managing technical and procedural results of a project is not enough. It is also important to manage the organizational knowledge. Therefore, the process of reaching the results, what was done and how, must be recorded. As previously mentioned, it is not possible to make of use the documents' results without this knowledge. In order to keep the context and process information, documents have to be appended with meta-knowledge that links knowledge items to their environment. Therefore, tools are needed to manage project knowledge and meta-knowledge. For using this project memory in other projects, it is necessary to create a project organization memory. The project organization memory is knowledge stored from an organization's past project(s) that is brought to bear on present (Kasvi, et al., 2003).

One possible institution for managing the project organization memory is the project management office (PMO). It is a formal layer of control between top management and project management within in a PBO. The shape and roles of a PMO vary depending on the context they are incorporated in. A PBO needs coordination processes for the integration and management of knowledge across projects. The PMO has the potential to take this role. It connects the higher management, the PMO personal and the project teams. It can create a network structure for knowledge sharing to promote individual and group learning. The PMO develops and maintains a set of standards and methods by providing centralized archives of project knowledge in form of lessons learned and project templates (Pemsel & Wiewiora, 2013).

Research aims and methods

The introduction presented the importance of knowledge management and some of the main challenges with a short illustration of possible solutions. The aim of this paper is to figure out quantitative and qualitative benefits of using knowledge management within a PBO and projects. The authors also want to identify the key aspects of a sufficient KMS. The results are based on a literature research. Part of the research was current literature regarding knowledge management used in PBOs and projects.

Research results and discussion

Challenges and problems of knowledge management in projects

Many PBOs have knowledge transfer processes. Nevertheless, these processes are often inefficient. One of the main reasons for that is the fact that PBOs are fragmented and have a high degree of autonomy among a PBO's sub-units (Pemsel & Wiewiora, 2013). The execution of projects creates a lot of different kinds of information in a short amount of time. They differ from formal official documents to informal and unstructured notes of individuals or groups. This information is structured to the needs of the project and meaningful only within the project and its operational and social context. At the end of the project, the context disbands and so does the meaningfulness of the information structure and organization if it is not captured and stored. The explicit and codified knowledge is "trapped" within each project and can be hardly shared with others (Almeida & Soares, 2014).

Furthermore, the social system is dispersed at the end of the project. This means that the amount of tacit knowledge steaming from the team's social relations is also not available anymore. Even though the loss of tacit knowledge is not that strong because teams can be fully or partly resembled for further projects, knowledge sharing on a social level needs to be analyzed too when considering projects as a context for social activities. The culture and networks of an organization may be useful for creating motivation and the ability to make project-based knowledge available for the whole organization (Almeida & Soares, 2014).

The characteristics of projects such as its temporariness and the uniqueness of the result lead to the fact that not only the reuse of the information in other projects is difficult, but also that challenges occur during the process of trying to efficiently capture this knowledge **(Serrat, 2008)**.

Scholars report that one major problems in implementing KM is the bridging strategy and practice **(Hahn & Subramani, 2000)**, **(Cerchione & Esposito, 2016)**

Besides that, Hahn and Subramani **(2000, p. 306)** reported that challenges related to the utilization of information technology for knowledge management can be divided into three big groups: balancing information overload and potentially useful content, balancing additional workload and accurate content, and balancing exploitation and exploration.

Pemsel and Wiewiora **(2013, p. 39)** concluded in their studies on the PMO that the management of tacit knowledge is limited. Terzieva **(2014)**, however, reported about the lack of investigation on perceived benefits from tacit knowledge management.

Santos et al. **(2012)** presented typical challenges for complex research and development projects, exploring such fields as knowledge sharing, information exchange and retrieval, communication barriers, interdependence of knowledge and skills, and different technical terminologies. Among them, the following major knowledge sharing barriers were identified: codification process, inadequate information technology **(Project Management Institute, 2013)**, lack of initiative and strategy by the workers **(Terzieva, 2014)**, and lack of time and resources were identified as in such type projects **(Santos, et al., 2012, p. 27)**.

Insufficient resources and the lack of means and ways of sharing and reusing knowledge often are additional problems people face **(Serrat, 2008)**.

Quantitative benefits of KM

While the importance of KM enhanced it the past decades, the assessment of its returns is lagging. Organizations spend many resources into improving their knowledge infrastructure but invest very little on efforts in measuring the results of their knowledge management endeavors. Also, very little literature is found regarding this topic because of the lack of quantification methods for the returns of knowledge management. Quantitative models are important for the top management to make decisions like how much to invest into KM and what strategies can be adopted to improve the KM of the organization (Yu, et al., 2006).

For measuring results of knowledge management systems (KMS) Swaak et al. (2000) conducted a survey and concluded that there are two main approaches for measuring results related to knowledge management. The first one is the questionnaire approach. Within this approach, a questionnaire with closed and open questions completed by participants of a KMS creates a profile of an organization. This profile is used for further subsequent interviews and workshops. The focus is on extending the knowledge sharing and learning about the potential of an organization. The multiple indicator approach distincts between ‘customer capital’, ‘innovation capital’, ‘financial concepts’, ‘international business process’, and ‘human capital’. For each category, Swaak et al. (2000) created a large number of indicators that are mostly objective and quantitative. The collection of these indicators is used to evaluate the results of a KMS.

For the performance measurement of KMS del-Rey-Chamorro, et al. (2003) developed an eight-step framework to create indicators for KMS. The framework is divided into three levels. The first level is the strategic level where measures regarding the organization’s goals are comprised. In the intermediate level, indicators that link the process performance indices at the operational level are included. The third level is the operational level and contains the

indicators that represent the process performance of KMS. The results of del-Rey-Chamorro, et al. (2003) may help to create a framework for measuring the performance of a KMS, however, they mainly focus on results of the manufacturing industries and may not be fully applicable in other industries (Yu, et al., 2006).

Yu, et al. (2006) state that before it is possible to quantify the benefits of KM, it is necessary to identify the benefits to be quantified and to recognize the KM processes that really add value to the problem-solving processes. The benefits of KMS can be divided into tangible benefits and intangible benefits. Tangible benefits are for example time shortening, cost reduction and man-hour saving. In contrary, the reputation of the company, knowledge repository, growth of knowledge and experience of the staff, and a culture of knowledge sharing are intangible benefits of a KMS. For their quantitative benefit model, Yu, et al. (2006) divided the benefits of KMS into three different types of benefits. The time benefit is the saving of time to solve a problem with a KMS compared to a traditional process. The saved number of man-hours with a KMS in comparison to a traditional process is the man-hour benefit. The last benefit is the cost benefit, which is the saving of costs spent to solve a problem with a KMS compared to the cost spent in a traditional process.

Yu, et al. (2006) conducted a case study together with China Engineering Consultants, Inc. (CECI), a leading Architect/Engineer firm in Taiwan. CECI implemented their own KMS system with different kinds of communities of practice. One special community of practice is a special SOS system, which provides a forum for emergency problems. The case study used a survey within the KMS participants. 17 out of 52 SOS cases were responded and therefore analyzed. The results are presented in table one.

Table 1 Results of the benefit calculations (Yu, et al., 2006)

Case	Time benefit *TB* (%)	Man hr. benefit *MHB* (%)	Cost benefit *CB* (%)
1	70.0 %	92.0 %	75.0 %
2	66.7 %	71.7 %	28.2 %
3	71.4 %	88.8 %	87.2 %
4	60.0 %	89.5 %	80.8 %
5	80.0 %	70.2 %	60.7 %
6	0.0 %	93.6 %	80.0 %
7	93.3 %	96.2 %	94.2 %
8	85.7 %	87.6 %	78.7 %
9	66.7 %	71.5 %	26.8 %
10	80.0 %	97.0 %	85.0 %
11	0.0 %	87.0 %	70.8 %
12	71.4 %	98.1 %	78.8 %
13	50 .0%	93.1 %	88.8 %
14	66.7 %	89.1 %	85.1 %
15	66.7 %	80.7 %	68.8 %
16	71.4 %	96.9 %	94.2 %
17	71.4 %	71.2 %	71.2 %
Average	63.0%	86.6 %	73.8 %

The survey showed that the time benefit was 63% in comparison to a traditional process. The cost benefit was 73.8% and the man-hour benefit even 86.6%. Even though, it's a single case study and more quantitative results are needed, it shows that KMS can help a company to save time, costs and man-hours.

Qualitative benefits of KM

As identified in the previous section about challenges, projects face typical problems in KM as they are temporary. Often, a lot of knowledge gets lost on the way as it is not documented when being produced. However, when these challenges are overcome, there are not only the quantitative but also qualitative benefits which are identified in the following part of this article.

Knowledge management, if implemented systematically, addresses the issue of "strengthening positive interactions between providers and resources by developing a suitable context" (Lin, et al., 2012) (Serrat, 2008). The study of Alavi and Leidner (1999) shows that KM affects process results and organizational outcomes positively. According to their report, among the main improvements derived through KM are the following: shortening the proposal time for client engagements, saving time, increasing staff participation, making the opinions of plant staff more visible, reducing problem-solving time, better serving the clients, and providing better measurement and accountability (Leidner & Alavi, 1999, p. 19). The improvements are summarized in figure 1.

Process Outcomes	Organizational Outcomes
Communication	Financial
· Enhanced communication	· Increased sales
· Faster communication	· Decreased cost
· More visible opinions of staff	· Higher profitability
· Increased staff participation	Marketing
Efficiency	· Better service
· Reduced problem solving time	· Customer focus
· Shortening proposal times	· Targeted marketing
· Faster results	· Proactive marketing
· Faster delivery to market	General
· Greater overall efficiency	· Consistent proposals to multinational client
	· Improved project management
	· Personnel reduction

Figure 1: Perceived benefits of perceived benefits of existing knowledge management systems

Source: (Leidner & Alavi, 1999, p. 20)

According to Terzieva, "efficient knowledge management maximizes internal efficiency, profitability and ensures competitive advantage to the organization" (Terzieva, 2014, p. 1095) (Leidner & Alavi, 1999) (Hahn & Subramani, 2000).

Another conceptualization of KM is offered by Reich et al. (2012) based on a study of IT-enabled business projects. The model developed by the authors represents two principal elements: Knowledge Management and Project-based Knowledge. The latter is divided into three types of knowledge that can be considered as qualitative benefits of KM: knowledge of desired business value, knowledge of the organizational solution, and knowledge of the technical solution (see fig. 2).

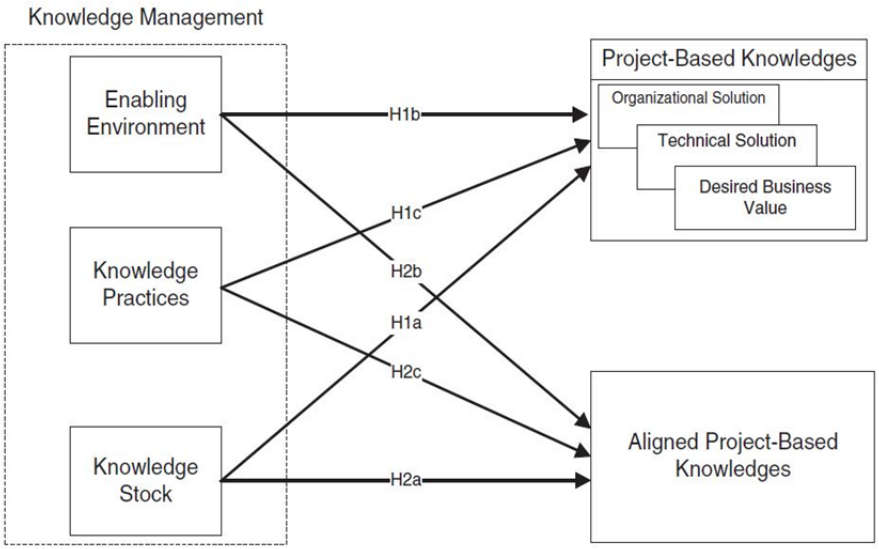


Figure 2: Knowledge management dimensions and project based knowledges
Source: (Reich, et al., 2012, p. 665)

The authors' model was approved by the research that demonstrated "a significant positive relationship between each of the three elements of knowledge management (Knowledge Stock, Enabling Environment and Knowledge Practices) and the development of project-based knowledge artefacts" (Reich, et al., 2012).

As projects are temporary endeavors (Project Management Institute, 2013, p. 3), it is challenging to manage knowledge, as it gets lost from project to project if it is not captured, stored, and managed. Hahn and Subramani (2000) developed a framework for knowledge management support representing structured and unstructured knowledge (see figure 3).

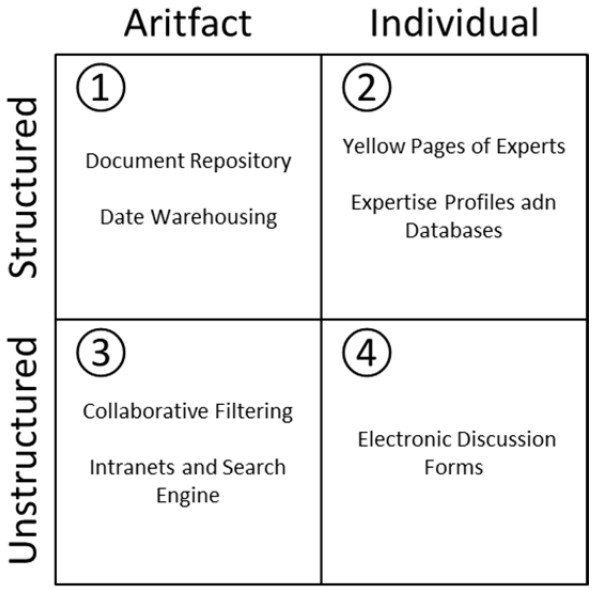


Figure 3: Framework for Knowledge Management Support
Source: (Hahn & Subramani, 2000)

Another big benefit besides the alignment of knowledge is the fact that often new knowledge is produced, which means that synergy effects appear (Reich, et al., 2014). According to (Reich, et al., 2014) the project manager in the IT enabled business must focus on managing project knowledge in order to achieve value in the business.

Discussion and Recommendations

The implementation of KM brings a many of benefits to an organization. These benefits have been discussed in detail in the quantitative and qualitative sections of this article.

It is difficult to measure the benefits realized by implementing KM in the companies because the measuring process requires lot of investment in terms of time and money as the many interdependencies of tasks and different circumstances make it hard to identify an exact value of the benefit. The quantitative benefits realization was discussed through a case study of China Engineering Consultants, Inc. (CECI) in Taiwan. It was observed by the authors that there were numerous reasons behind the realization of the benefits in this company which can be discussed in future researches. In addition to that the authors found out that it is very difficult to separate qualitative benefits and quantitative benefits as the former leads to the later.

It has been proposed by the authors that in order to harvest these benefits the most important thing is the KMS as well as the right culture and environment. The authors have come up with recommendations which can pave way for the realization of these benefits mentioned in the Quantitative Benefits and Qualitative Benefits sections. The recommendations for KMS are put in a graphical form in figure 4 and discussed in detail below.

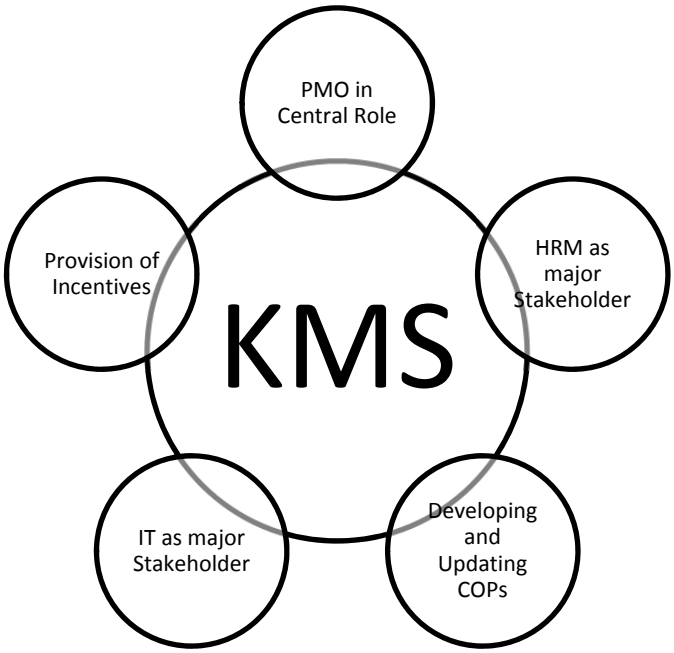


Figure 4 Knowledge Management System essentials

Project Management Office having Central Role in KMS

The authors suggest that in order to realize these benefits, the PMO should play the role of a Knowledge "Warehouse". KMS should be designed in such a way that the PMO holds a central role as a project manager doesn't have time to keep record of all the explicit knowledge produced from the initiation to the closure of a project. In general, the research findings state that the PMO doesn't play that role effectively in most of the reviewed organizations. Similar

results have been identified by Pemsel & Wiewiora (2013) who conclude that in a project based organization PMOs do not completely understand the complete sense of knowledge sharing needs and expectations. Therefore, KMS are ineffective most of the time. As a conclusion, it is of utmost importance that while designing a KMS, the PMO should be given a central role in KM.

Involve HRM Department as an active contributor to KMS:

The authors recommend that the HRM of an organization should be actively involved in the KM process of organizations. Aziri, et al. (2013) also emphasized and concluded in their research that a strong correlation between HRM and KM exists. The HRM department is the most important department and responsible from the recruitment, training and development to the exit of individual from the organization. Therefore, it is important that the HRM department should be a key stakeholder in the KMS. It has also been recommended by the authors that HRM should also include such provisions in KMS that tacit knowledge from the individual leaving the organization could also be extracted from him/her so that knowledge can be effectively stored and transferred.

Development and updating of Communities of Practice (COP)

It is of utmost importance to create CoPs and continuously update them. Sarirete (2008) also highlights that CoPs and social learning have a huge impact on learning as well as on knowledge sharing. CoPs develop trust among individuals and foster an environment in which tacit and explicit knowledge can be transferred. The results of the study of China Engineering Consultants, Inc. (CECI) discussed in the Quantitative benefits also indicates that the development of CoPs is part and parcel of every KMS (Yu, et al., 2006). It has also been concluded in the same study that the CoPs should be continuously updated and each CoP should be led by a responsible manager.

Involvement of IT Department as a major Stakeholder

The authors suggest that the IT department should not be used as tool but rather be involved in the whole KMS development process from the initiation till the closure of a project.

According to MitaliChugh, et al. (2013) KM is useless for competitive purposes until communication and application system support the various business operations. Moreover, knowledge creation, seeking, and dissemination are improved by IT and IT is an important facilitator for storing and sharing organizational knowledge. MitaliChugh, et al. (2013) also consider IT is an indispensable enabler of KM. IT supports the categorization and collaboration of explicit forms of knowledge at low cost (Pinho, et al., 2012)

Provision of Incentives

It is also very important to provide incentives to the knowledge carriers. As mentioned by Stropkova (2014), there are two ways to motivate employees, extrinsic and intrinsic incentives. While extrinsic motivation deals with financial rewards, bonuses or a new position etc. - all things outside ourselves and outside our passion and personal self-esteem - intrinsic rewards come from inner feeling, joy of work, challenge, learning and all the things people do that satisfy them internally. A research on the effect of incentives on KM in the Indian IT sector has also been carried out by (Asish O. Mathew, 2015).

It has been concluded that provision of incentives has a positive correlation with KM. Asish O. Mathew (2015) also emphasize on the fact that the top management should give

consistent focus on the incentives provided for knowledge sharing. The success stories of several leading organizations further strengthen this point that incentives in the forms of employee stock options (ESOP), Knowledge currency units (KCUs), etc. are very effective in promoting higher level of KMS performance. Stropkova (2014) also concludes that sharing of knowledge is the key to success, which can only be experienced within a properly set up environment. There is no ultimate incentive system, but there are various incentive systems that are specifically designed for a specific company. Therefore, the authors propose that provision and providing incentives should be included in a KMS.

Conclusions

The study in this paper mainly focused on the knowledge management benefits. The benefits have been categorized as qualitative and quantitative. It has been proven through various case studies that KM brings a great number of benefits to organizations. The authors in this paper have come up with recommendations for a KMS. It has been proposed that to develop an effective and efficient KMS, it is of paramount importance to include the recommendations proposed. The authors were not able conduct primary research due to limited time. However, from the study it can be established that the recommendations of this paper, if included in the process of development of a KMS, will provide many quantitative and qualitative benefits to an organization. For confirmation, the authors suggest further research especially case studies to approved the created small model.

References

Almeida, M. V. & Soares, A. L., 2014. Knowledge sharing in project-based organizations: Overcoming the informational limbo. *International Journal of Information Management*, December, Issue 34, pp. 770-779.

Asish O. Mathew, L. L. R. R., 2015. Effect of Incentives on Knowledge Sharing and Learning – Evidence from the Indian IT Sector. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering,* 9(3).

Aziri, B., Veseli, N. & Ibraimi, S., 2013. *HUMAN RESOURCES AND KNOWLEDGE MANAGEMENT.* Zadar, Croatia, s.n.

Blaize Horner Reich, A. G. ,. C. S., 2014. How knowledge management impacts performance in projects: An empirical study. *International Journal of Project Management,* Issue 32, pp. 590-602.

Cerchione, R. & Esposito, E., 2016. A sytematic review of supply chain knowledge management research: State of the art and research opportunities. *Interntional Journal of Production Economics,* Issue 1.

del-Rey-Chamorro, F. M., Rajkumar, R., van Wegen, B. & Steele, A., 2003. A framework to create key perfomance indicators for knowledege management solutions. *Journal of knowledege management*, Issue 7, pp. 46-62.

Desouza, K. C. & Evaristo, J. R., 2004. Managing Knowledge in Distributed Projects. *Communications of the ACM*, April, Issue 47.

Hahn, J. & Subramani, M. R., 2000. A framework of knowledge management systems: issues and challenges for theory and practice. *ICIS'00 Proceedings of the twenty first international conference on Information systems,* pp. 302-312.

Kasvi, J. J., Vartiainen, M. & Hailikari, M., 2003. Managing knowledge and knowledge competences in projects and project organisations. *International Journal of Project Management*, November, Issue 21.

Leidner, D. & Alavi, M., 1999. Knowledge Management Systems: Issues, Challenges, and Benefits. *Communications of the Association for Information Systems,* Issue 1, p. 7.

Lin, Chinho, Wu, J.-c. & Yen, D. C., 2012. Exploring barriers to knowledge flow at different knowledge management maturity stages. *Information & Management,* 49(1), pp. 10-23.

MitaliChugh, NeerajChugh, Punia, D. & AlokAgarwa, 2013. *THE ROLE OF INFORMATION TECHNOLOGY IN KNOWLEDGE MANAGEMENT.* s.l., Conference on Advances in Communication and Control Systems 2013.

Pemsel, S. & Wiewiora, A., 2013. Project management office a knowledge broker in project-based organisations. *International Journal of Project Management*, January, Volume 31.

Pinho, I., ArménioRego & Cunha, M. P. e., 2012. Improving knowledge management. *Journal of Knowledge Management,* 6(2), pp. 215-240.

Project Management Institute, 2013. *A guide to the project management body of knowledge.* s.l.:s.n.

Reich, B. H., Gemino, A. & Sauer, C., 2012. Knowledge managementand project-based knowledge in it projects: A model and preliminary empirical results. *International Journal of Project Management,* Issue 30, pp. 663-674.

Reich, B. H., Gemino, A. & Sauer, C., 2014. How knowledge management impaacts performace in projects: An empirical study. *International Journal of Project Management,* Volume 32, pp. 590-602.

Santos, Santos V. R., S., A. L. & Cavallho, J. A., 2012. Knowledge sharing barriers in complex research and development projects: an explanatory study on the perceptions of project managers. *Knowledge and Process Management,* 19(1), pp. 27-38.

Sarirete, A., 2008. *Knowledge Management in the Communities of practice.* s.l., s.n.

Serrat, O., 2008. Notions of Knowledge Management. *Cornell University.*

Stropkova, A., 2014. *The importance of incentive systems to knowledge sharing.* s.l., s.n.

Swaak, J. et al., 2000. *Measuring knoledge mangement investements and results;two business cases.* s.l., s.n.

Terzieva, M., 2014. Project Knowledge Management: how organizations learn from ecperience. *Procedia Technology,* Issue 16, pp. 1086-1095.

Yu, W.-d., Chang, P.-l. & Liu, S.-j., 2006. *Quantiying benefits of knowledege management systems.* s.l.:s.n.

Different Dimension of Knowledge Management Benefits in Projects– An Empirical Overview

Tribane Saha [1], Subin Baidya[2], Kamran Musa[3], Ala Nuseibah[4]
[1,2,3,4] University of Applied Sciences and Arts Dortmund
Emil-Figge-Strasse 44, Dortmund, Germany

Abstract

Globalization has crafted the era of shared ideas, which has fueled up the emergence and conceptualization of knowledge management in recent years, paving the transformation to knowledge-based economy from profit-based economy. In this era of ever evolving business landscape, knowledge management propagates rapid and continuous advancement to competitiveness and sustainability to any business entity as well as projects. As projects are known as temporary and unique endeavors, it is very challenging to capture all the disseminated knowledge in a project. But due to the significance of knowledge management implication in projects' success, it is gaining more and more appreciation in practice (Polyaninova, 2011).

In this paper, we intend to discuss how knowledge management as intellectual capital has facilitated the improvement of projects. Our paper is a descriptive overview based on a study of various literature sources and case studies in literature. For this purpose, we have considered the value addition to a project due to the adaptation of effective knowledge management expressed in qualitative and quantitative measures. Based on our findings, we have classified the benefits of knowledge management into two streams: benefits expressed in quantitative measures (for simplification, from here on we will call them quantitative benefits) and benefits expressed in qualitative measures (for simplification, from here on we will call them qualitative benefits). Quantitative benefits are measurable statistical values added for the company or a project such as return on knowledge (Wen-der Yu, Pei-lun Chang, Shen-jung Liu, 2006). Qualitative benefits have been listed as the improvement in different perspective of an organization like processes, employee and customer satisfaction, business objectives, innovativeness, flexibility etc. (Hall, 2010)

Keywords: *Knowledge management, Quantitative benefits, Qualitative benefits, Project management*

1. Introduction

The ability to manage knowledge is becoming more significant in today's knowledge economy. The creation and transferring of knowledge is an increasingly important factor in projects. Knowledge is being regarded as a valuable commodity for development of products and highly mobile employees (Darkir, 2005). Knowledge management is the systematic coordination of an organization's people, technology, processes, and organizational structure in order to add value by innovation. This coordination is achieved through creating, sharing, and applying knowledge as well as through improving the valuable lessons learned and best practices (Beccerra-Fernandez, 2004). Hence the need of knowledge management initiative arises to become a solution for such problems, which brings together people, process and technology and helps organizations to achieve their goals and vision (Hanisch, 2009).

Knowledge Management (KM) is vital factor to successfully undertake projects. The temporary nature of projects increases the need for KM practices that operate well for the purpose of solving issues such as knowledge shortages and task reworks. The ability to manage knowledge in projects includes the capacity to create, absorb and share project-related information, which is a big part of organization's culture (Beccerra-Fernandez, 2004). Using gained knowledge to learn from the failures and successes in previous projects is vital for long-term sustainability and competitiveness of the organization. Although the project approach is often perceived as an appropriate way of organizing for innovation, the research on project-based learning consistently shows the problems about learning and capturing, sharing and diffusing knowledge (Darkir, 2005).

The main purpose of our paper is to identify multi-dimensional views of knowledge management benefits and illustrating how proper implication of knowledge management can foster the project success rates. Our paper is organized in the following sections- interfaces between knowledge management and project management and our research results with analysis of different benefits of knowledge management. In the results and discussion section, quantitative and qualitative benefits are described. And we also attempt to explain the impact of knowledge management in project success through "Integrated model of PM-KM" by Yeong and Lim (2010). The final section presents our study findings and discusses the implications of the findings.

2. **Interfaces between knowledge management and project management**:

Project management and knowledge management are too often handled as standalone disciplines. But the interrelation between these two disciplines is quite undeniable. For having a deeper understanding about that, we will review some definitions about the related terms and on the later part we will explain how knowledge is generated and integrated through different project management phases.

Project management is the application of knowledge, skills, tools and techniques to project activities to meet the project requirements (PMI, 2013). On the other hand, knowledge can be defined as a "mix of framed experiences, values, contextual information and expert insight that provides a structure for evaluating and integrating new experiences and information" (Davenport & Prusak, 1998). According to Bollinger & Smith (2001), knowledge management is a resource in terms of what the organization knows about customers, products and processes, and resides in databases or is gained through the sharing of experiences and best practices both internally and externally.

Knowledge management allows the capture and deployment of a company's collective experience located anywhere in the business, for instance on hardcopy documents or in databases (explicit knowledge) and knowledge contained in people's minds (tacit knowledge) (Awad & Ghaziri, 2004). Ikujiro Nonaka (Nonaka, 1990) worked extensively with the concepts of explicit knowledge and tacit knowledge and introduced the SECI model which has become the cornerstone of knowledge creation and transfer theory. According to the theory, there are four ways to share, combine, convert and create the knowledge types. These are socialization (S), externalization (E), combination (C) and internalization (I) (thus, *SECI* model). This model can work in hand with the project phases as shown in figure 1. For instance, 'Socialization' processes tacit to tacit knowledge on the project during project meetings, post project reviews, feasibility testing. During 'Externalization' process, project's tacit knowledge is codified by creating project charter or WBS. The explicit knowledge can be merged during 'Combination' process of KM, for example by creating project plan that combines all other project plans. When people review codified knowledge during 'Internalization' process of KM, such as project's lessons learned or review meeting reports from previous projects, they may gain new tacit knowledge, which they can apply in future projects implementation (Polyaninova, 2011).

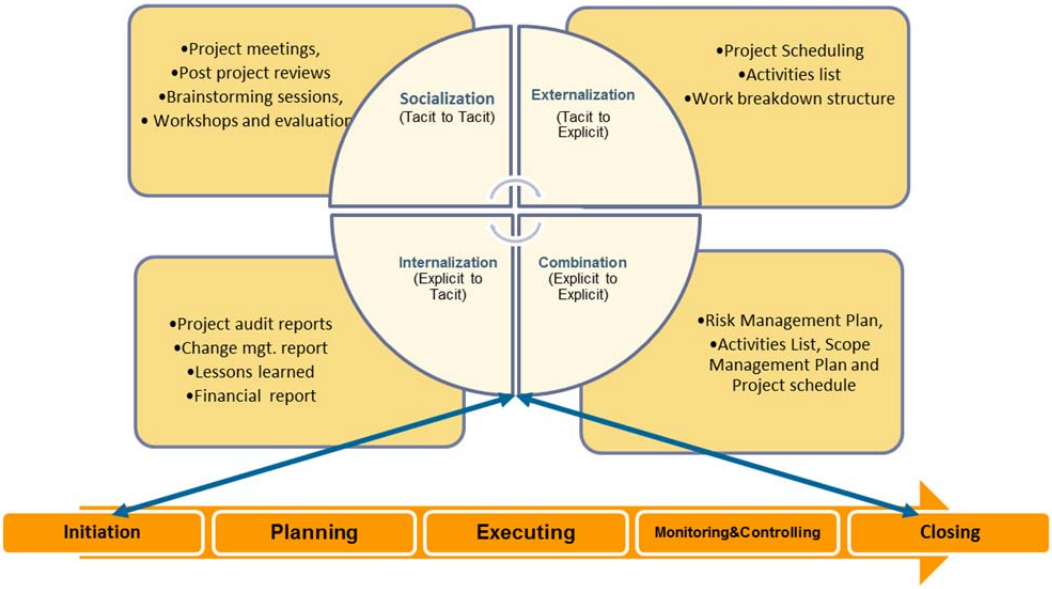


Figure 1: Knowledge Spiral Model and Project Activities (adapted from Polyaninova (2011), modified by authors).

The elements mentioned in these four quadrants are not only specified to these particular knowledge converting area but can also be used interchangeably or in a transposable manner. For example, in case of project scheduling, for an experienced project manager it is externalization as he/she is doing that from his/her previous knowledge and experience but for a new project manager it might a case of internalization first. He/she might look at the previous templates or documents to gather knowledge or idea for preparing project scheduling.

The research of Owen (2008) also suggested the same and showed how knowledge is developed at the task level which is embedded into the project methodology in the project environment and eventually improves the capability of an organization. So, it is important to share knowledge across projects in order to avoid unnecessary reinventions of what has been already done and decrease chances for failure in that way (Carrillo, 2005). Retention of project knowledge will add huge value to the whole organization as it provides advanced interdisciplinary knowledge base for future potential project works. By creating strong corporate project knowledge base, companies can reflect the character and specific features of project implementation in a given industry.

3. Methodology

Our paper is an investigative research depending on the secondary data collection from various studies, company data and case studies. The limitation of our study is that we could not use recent statistics due to the limitation of access for our quantitative analysis part.

For the discussing the qualitative benefits we mainly emphasized on various articles. One of them is by (Liebowitz & Megbolugbe, 2003), where they described how an organization with successful project implementation portfolio uses KM to increase the success of projects. They analyzed a case study of NASA where Projects are crucial to accomplish NASA missions. Knowledge Management was given a higher importance for the project success within the company. NASA developed Project Management Web Site, an organization-wide Knowledge Management Systems (KMS) which worked as a repository of documents to help the various flight programs and projects in seeing what others have done. Use of such KMS enables sharing of best practice documents, lessons learned, PM and systems engineering methodologies, examples of review packages and rationale for why some strategic decisions were made.

Another example of a KMS that aids NASA programs and project managers is the Process-Based Mission Assurance (PBMA) framework that relates to the NASA Procedure and Guideline for NASA Program and Project Management Processes and Requirements. Best practice documents, lessons learned, video nuggets of experts, online communities, and other features are part of this system. Codifying the knowledge and experiences related to the performed projects and making them available within the organization allows innovating and improving feature projects, reducing reinvention of wheel and increases the reuse of organizational knowledge and experiences. NASA's organizational culture promotes knowledge sharing among the employees by providing related training and education via the Academy of Program and Project Leadership (APPL). APPL has been engaged in such initiatives as: teaching and administering the Project Management Development Environment curriculum; holding knowledge sharing forums with project managers at the various NASA Centers; developing case studies of successful and unsuccessful NASA missions; and other knowledge sharing initiatives. It is clear that NASA encourages and leads its employees to knowledge based culture, which in turn helps to produce better project deliverables and more successful projects. We also considered the article by (Lierni & Ribiere, 2008), which was conducted through a survey with huge number participation of project managers around the world.

And for the quantitative benefits we have considered the statistical data from early adopters of knowledge management in business arena (Vesta, 2002) along with other relevant literatures. For the purpose of better understanding we have attached the table as appendix.

4. Result and Discussion:

Different research work showed knowledge management implication has benefited in different ways in respect of projects. Based on our analysis we have classified the benefits into two major streams –Quantitative and Qualitative benefits. The elaborated discussion is as follows-

Qualitative Benefits:

Qualitative benefits in an organization can be felt and realized but cannot be described in numbers. These are intangible benefits which supports managing body to gain quantitative benefits. The main areas where qualitative benefits can be noticed are the processes, employees and customers. (Wen-der Yu, Pei-lun Chang, Shen-jung Liu, 2006)

Improved Processes: It refers to the working culture of a firm. Knowledge management uses common single knowledge platform which makes one-step process. With this the process becomes very efficient and quicker providing knowledge in unified, accurate and consistent manner. The redundancies are reduced and process acceleration occurs with better communication channel. (North, Reinhardt, & Schmidt, 2003) The knowledge repository of the firm becomes bigger by which there is regular reuse of internal knowledge. Likewise there are fewer errors, improved safety and the processes become more transparent. (North, Reinhardt, & Schmidt, 2003)

Competent Employee: With the use of knowledge management, the employees become more efficient as well. The employees gain more knowledge which enhances their personal knowledge base. The staffs become more motivated towards which helps in improving their teamwork as well. With all these things, the employees develop competence within them which ultimately results in quantitative benefits of an organization and projects. (North, Reinhardt, & Schmidt, 2003)

Customers Satisfaction: Customers are the ultimate target of every projects and organization. Satisfying customer experience is always a top priority. Stats suggest that 86% people stop doing business with just one bad experience and 82% will share with friends. Knowledge

management avoids content clutter providing only relevant answer directing to the required knowledge. (Hall, 2010)

Creativity and Innovation: Knowledge management also brings creativity and innovation to the firm. It helps introduce new ideas to generate more ROI and gain competitive advantage. Maintaining good knowledge base in an organization, maintain sustainable growth with fewer problems. It provides dual benefit enabling business to reduce the cost of service providing and in the other hand identifying strategies to increase customers and lock them in. (Hall, 2010)

Better risk management: knowledge-based risk management (KBRM) that utilizes knowledge management processes in risk management processes to improve the efficiency of risk response planning process and thereby improving the effectiveness and increase the likelihood of success in innovative Information technology projects (Alhawari, Karadsheh, Talet, & Mansour, 2012). It is also realized that, in software development projects of micro and small Brazilian incubated technology-based firms, for risk management, firms have found that knowledge management techniques of conversion "combination" would be the most applicable for use; however, those most commonly used refer to the conversion mode as "internalization" (Neves, 2014).

Quality Assurance: As project management necessities to guarantee project deliverables within the shortest period of time, reusing of existing knowledge among different phases of development process significantly helps project managers to keep the project on the right track. (Kasvi, Vartiainen, & Hailikari, 2003) . It is realized that, the application of the knowledge management processes in software development assures high quality of deliverables by selecting the right process of knowledge management for the right knowledge area in the right phase of software development lifecycle (Alawneh & Al-Ahmad, 2008).

Quantitative Benefits:

Quantitative benefits provided by the application of knowledge management are those which can be measured and presented in facts and figures. They can also be understood as tangible benefits. These benefits in a project or in an organization can be perceived generally in terms of time shortening, cost reduction and man hour saving. This benefit is generally calculated by return on investment (ROI) for implanting the KM strategy in a company. (Wen-der Yu, Pei-lun Chang, Shen-jung Liu, 2006)

Revenue Growth: Knowledge Management helps in generating revenue for a firm through various sources. As it is already clear that applying knowledge management helps make process quick, increase customers, provides competitive advantage, these all factors grows revenue in a company. It increases the sales of good and service which automatically increase revenue. (Vesta, 2002) IBM Global Services were able to generate 400% increase in service revenue (More on Appendix).

Time Benefits: One of the benefits that KMS brings in a project is time benefit. Here time benefit can be considered as the saving in amount of time required for problem solving. Knowledge management system provides right information at the right time in case of any sort of problem. With proper knowledge management, the employee become intelligent and decreases their learning time. With right information, time taken to solve the problem is automatically reduced. (Wen-der Yu, Pei-lun Chang, Shen-jung Liu, 2006). There was 95% reduction in time to resolve technical queries in Schlumberger with the use of In Touch KM system. (More on Appendix)

Cost Reduction: Cost benefits are always the major concern for top management. Application of knowledge management system reduces cost to obtain the required information to all the stakeholders. The cost of searching or buying information is decreased with the help of KMS

since there is scientific record of the previous and all relevant information. (Wen-der Yu, Pei-lun Chang, Shen-jung Liu, 2006) Between 1991- 1998, Chevron Texaco was able to reduce 2 billion annual operating cost (More on Appendix). The operational cost is reduced as the employees become intelligent and also the processes are less. Likewise the information for customer is easily available by which there will be less need to provide customer service. (Vesta, 2002)

Man-hour benefit: another measurable benefit provided by knowledge is man- hour benefit. With the use of knowledge management, steps to acquire information vanish. Information obtaining process doesn't go in step in every use makes the efficient utilization of human resource. The operational activities become efficient making optimal use of human resource. As there are less chances of errors, employees can devote in other productive activities generating direct man hour benefit. (Wen-der Yu, Pei-lun Chang, Shen-jung Liu, 2006)

5. **Impact of knowledge management in Project success**:

Under this section, we have explored how to merge knowledge management and project management concepts for improving project success rates in project based organizations. In this regard, we have emphasized on the integrated KM-PM models proposed by Yeong and Lim (2010) and tried to incorporate some additional factors as well from other studies.

Integration of knowledge management and project management is essential as a support to management of continuous learning activities throughout project development process (Reich, Gemino, & Sauer, 2012) .Knowledge management supports the creation and alignment of three types of project based knowledge that is critical to achieving desired business outcomes: Culture, Technology and Process. Here, by culture it means the organizational shared values, beliefs, assumptions which govern how people behave in the organization. Technology means the application of knowledge in practical purposes and process here stands for initiating, planning, executing, monitoring and controlling and closing (PMI, 2013) . Organizational structures, cultures and technologies are believed to be tightly interconnected (Handzic & Durmic, 2015). In order to perform successfully, the factors of project management and knowledge management require continuous feedback from each other in order, as well as an alignment between existing knowledge and newly created knowledge related to project culture, process and technology (Yeong & Lim, 2010).

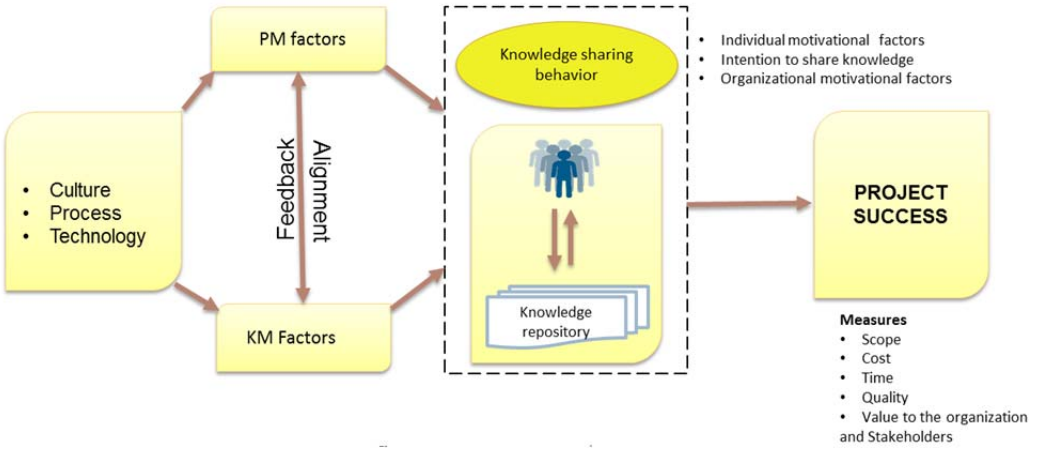


Figure 2: Impacts of Knowledge management in Project success, Adopted from integrated model of KM in PM by Yeong & Lim (2010), (Modified by authors.)

From our analysis part, we have seen that human resource has worked as driving force in achieving the project success as it is the only living element of the organizational system. Project team and project customer directly influence all phases of project development process, which in turn affects the project success (Darkir, 2005). Since knowledge is seen as the most valuable organizational asset in the knowledge economy, the model core incorporates the knowledge stock component thus updating the project knowledge respiratory in a regular basis (Handzic & Durmic, 2015).

Besides that, individual and organizational/ environmental knowledge sharing behavior and intension of sharing knowledge of the employees work as motivational factors, which strongly affect the performance of project team. In other words, there should be an alignment between the digital readiness and cognitive readiness among PM and KM factors. And altogether leads to the project success which can be measured in terms of scope, time, cost, quality and overall value addition to the organization and shareholders. (Yeong & Lim, 2010).

Furthermore, knowledge sharing in this context affects not only the success of current projects in a given time, but also of all the future projects in an organization, as reuse of existing knowledge saves project time and costs. More importantly, it helps to synthesize different human- and object orientated perspectives on knowledge and proposes a multidimensional view of the concept to assure project success (Yeong & Lim, 2010).

Conclusion

The aim of this paper was to better understand what we know about KM benefits in projects. Based on systematic literature review, we defined theoretical findings on various aspects of quantitative and qualitative benefits of KM. However, our body of knowledge regarding quantitative benefits is fragmented, making us call for more intense research. There is a strong need for more research on the quantitative benefits of KM application to provide actual proof of the usefulness of KM activities.

The reviewed studies highlight interfaces between projects and knowledge management processes. KM process has its own challenges as many organizations do not consider it as an important asset. Failure to practice effective KM shows project teams don't utilize knowledge storage and lessons learned opportunities enough.

Application of KM can be improved by developing capabilities needed for knowledge management, aligning what you say with your actions, giving and receiving feedback from your staff, creating changes based on these feedbacks, making knowledge management part of everyone's job, convincing units to share their knowledge with other units and reward knowledge sharing.

Bibliography

Alawneh, A. H., & Al-Ahmad, W. (2008). An extended knowledge management framework during the software development life cycle,. *International Technology Management Review*, 1(2), 43-62.

Alhawari, S., Karadsheh, L., Talet, A., & Mansour, E. (2012). Knowledge-based risk management framework for information technology project. *International Journal of Project Managememt*, 32 (2012), 50-65.

Awad, E., & Ghaziri, H. (2004). *Knowledge Management.* India: Pearson Education.

Beccerra-Fernandez, I. G. (2004). *Knowledge Management:Challenges, Solutions and Technologies.* Upper Saddle River, NJ. Pearson- Prentice Hall.

Bollinger, S. A., & Smith, D. R. (2001). Managing organizational knowledge as a strategic asset. *Journal of Knowledge Management*, 5, 8–18.

Brún, C. D. (2005). ABC of Knowledge Management. *Knowledge Management Specialist Library*.

Carrillo, P. (2005). Lessons learned practices in the engineering, procurement and construction sector. *Engineering, Construction and Architectural Management*, 12(3), 236.

Darkir, K. (2005). *Knowledge Management in Theory and and Practice.* Montreal: Mc Grill University.

Davenport, T. H., & Prusak, L. (1998). Working knowledge-how organizations manage what they know (1st ed.). *Boston, MA: Harvard Business School Press.*

Desouza, K. C., & Evaristo, R. J. (2006). Project management offices: A case of knowledgebased. *International Journal of Information Management*, 26(5), 414–423.

Hall, C. (2010). Knowledge Management: The Holy Grail for Today's Economy. *Best Practices in Knowledge Management*.

Handzic, M., & Durmic, N. (2015). Knowledge management, intellectual capital and project management: Connecting the dots. *The Electronic Journal of Knowledge Management,*, 13(1), 51–61.

Hanisch, B. L. (2009). Knowledge management in project Environments. *Journal of Knowledge Management, 13*, 148-160.

Kasvi, J., Vartiainen, M., & Hailikari, M. (2003). 'Managing Knowledge and Knowledge Competences in Projects and Project Organizations'. *International Journal Of Project Management*, Vol 21,Issue 8,P-571-82.

Liebowitz, J., & Megbolugbe, I. (2003). A set of frameworks to aid the project manager in conceptualising and implementing knowledge management initiatives'. *International Journal of Project Management*, Vol.21,p 189–198.

Lierni, P., & Ribiere, V. (2008). The relationship between improving the management of projects and the use of KM. *The Journal of Information and Knowledge Management Systems*, Vol. 38 No. 1, p.133-46.

Mehta, N., Hall, D., & Byrd, T. (2014). Information technology and knowledge in software development teams: The role of project uncertainty. *Information & Management*, 51 (4), 417–429.

Neves, S. (2014). Risk management in software projects through knowledge management techniques: cases in Brazilian incubated technology-based firms. *International Journal of Project Management*, 32 (1), 125–138.

Nonaka, I. (1990). *Management of Knowledge Creation.* Tokyo: Nihon Keizai Shinbun-sha.

North, K., Reinhardt, R., & Schmidt, A. (2003). The Benefits of Knowledge Management: Some empirical evidence. *Journal of Universal Computer Science*, vol 9 (2003),no 6, S. 463-471.

Owen, J. (2008). Integrating knowledge management with programme management. *In M. E. Jennex (Ed.), Current issues in knowledge management,*, (pp. 132–148). New York: IGI Global.

PMI. (2013). *A guide to the project management body of knowledge(PMBOK).* Project Management Institute.

Polyaninova, T. (2011). Knowledge Management in a Project Environment: Organisational CT and Project Influences. *doi:10.21427/D7NK7M*, vol:41, iss:3,.

Reich, B. H., Gemino, A., & Sauer, C. (2012). Knowledge management and project-based knowledge in IT projects: A model and preliminary empirical results. *International Journal of Project Management,*, 30(6), 663–674.

Terzieva, M. (2014). Project knowledge management: how organizations learn from experience. *CENTERIS 2014 - Conference on Enterprise Information Systems.* Troia.

Vesta, W. (2002). Measuring Knowledge Management. *The American Productivity & Quality Center (APQC)*.

Wen-der Yu, Pei-lun Chang, Shen-jung Liu. (2006). Quantifying Benefits of Knowledge Management System-A case study of an Engineering Consulting Firm. *International Symposium on Automation and Robotics in Construction* , 124-29.

Yeong, A., & Lim, T. T. (2010). Integrating knowledge management with project management for project success. *Journal of Project Program and Portfolio Management*, 1(2),8-19.

Appendix

Organization	Target Value Proposition	Approach	Results
Chevron Texaco	Reduce operating costs, improve operational excellence, improve safety	CoPs, facilitate transfer of best practices, People finder	• Two billion dollar reduction in annual operating costs (1991 v. 1998) • $ 670 million came from refining best practices. • Total investment of more than $ 2 million (total figure unknown)
Dow Chemical	Provide faster access to information, improve information management , improve sales leads	Content management , communities of practice	• Increase number of sale leads • Increase in new product sales • Improved customer satisfaction scores • CM investment of over $3 million for startup $8 million annually.
GE Plastics	Decrease customer service costs	Customer portal, customer knowledge repository	• Number of test chips created decreased from 4. 2 to 2.7 • Average reduction of 4.5 hours per color match • Saving s o f $2.25 million per year • Total investment unknown
Schlumberger	Knowledge in the hands of employees and customers	CoPs, InTouch KM system, intranet, extranet, content management	• $200 million cost savings • 95% reduction in time to resolve technical queries • 75%reduction in updating modifications • Total investment o f approximately $20 million
IBM Global Services	Revenue growth , industry leadership	COPs, knowledge managers, Intellectual Capital Management System	• 400 percent increase in service revenue • Tim e savings of $24 million in 1997 • Approximately $ 750 K to start up, $7 50K annually to maintain

"Successfully Implementing KM" (1999)", "Managing Content and Knowledge" (2001), and "Retaining Valuable Knowledge" (2002) benchmarking studies

Qualitative and quantitative benefits of knowledge management in projects: a combined approach from literature and practice

Marina Mayor Musetti [1*], Ekaterina Terenteva [2], Natalia Carranza Madrazo [3], Ala Nuseibah [4]
[1,2,3,4] University of Applied Sciences and Arts Dortmund
Emil-Figge-Strasse 44, Dortmund, Germany

Abstract

Organizational learning and Knowledge Management (KM) through project development have become prerequisites for companies to ensure their success in a rapid changing environment. Considering the relevance of this statement, this paper investigates theoretical approaches and practical cases of Knowledge Management (KM) application, as well as several aspects of project's performance towards the increase of competitive advantage within an organization and the creation of customer value. Therefore, the aim of this article is to identify and analyze how knowledge management dimensions and processes positively impact an organization's performance in both a qualitative and quantitative way. Moreover, we discussed how Xerox's Knowledge Management System creation and implementation has benefited the organization by saving labor costs and increasing customer service performance. The research approach follows a two-step procedure: a qualitative and a quantitative study. The qualitative study consists of a literature review showing how KM dimensions (Absorptive Capacity, Knowledge Stock, Enabling Environment, Knowledge Practices, Knowledge Transfer, and Knowledge Application) and processes influence projects, focusing on performance and results for the company itself and their customers to generate business value (Reich, et al., 2014; Cepeda-Carrion, et al., 2017). The quantitative study was carried out by analyzing case studies from literature and practice, as well as companies' white papers, aiming to show the numerical impact of the proper management and application of knowledge in projects. The findings of this research show that the proper management of project knowledge allows organizations to stay competitive in a globalized environment (by adaptation and innovation) and increases their overall performance. We argue that several aspects, such as effective resource usage and employee empowerment lead organizations towards the creation of customer satisfaction and increase in service performance (Davidson & Rowe, 2009). Due to the nature of projects (temporary endeavors), project managers should apply KM in a way that value created (knowledge) through project's life cycle is properly documented. Furthermore, the proper execution of KM contributes significantly to a positive influence on the level of customer satisfaction. This influence is not only restrained to customers itself, but also to the project team, project managers and organization.

Key words: *Knowledge management, Projects, Organizational Performance, Added value, Benefits*

Introduction

Knowledge Management (KM) is described as a source of competitive advantage (Leseure & Brookes, 2004). KM focuses on discovering, absorbing, transferring and applying knowledge – an economic resource and an important aspect within an organization. KM is beneficial to both organizations and projects. This relies on the nature of projects, considered as temporary endeavors. When a project reaches its completion, team members are split, bringing away the knowledge that has been gained through the project's phases. The lack of KM, or its

* corresponding author: marina.mayormusetti003@stud.fh-dortmund.de

poor practice, can lead to squandered activities and rework, impacting the project's performance (Leseure & Brookes, 2004).

This research aims to understand the value KM adds to projects. This added value can be seen from two different perspectives – qualitative and quantitative. Our goal is to answer the question "What are the qualitative and quantitative benefits of KM in projects?", adding relevant information to the existing literature on the topic. Our research contributes to the discipline by combining the academic view with practice, especially by bringing quantitative evidence of the benefits of KM in projects and organizations, which are limited in the existing literature.

In order to state the qualitative added value of KM in projects, we performed a literature review on the topic, using different scientific journals and reliable sources. As for the quantitative perspective, we analyzed case studies present in literature and in practice, as well as companies' white papers. We decided to focus on a case study from Xerox, since it includes all the relevant information that helps explaining the main goal of this research. Based on the methodology performed, we could state and conclude KM's added value within a project and its direct impact on the organizational performance.

Theoretical background and discussion

This section is divided into three sub-sections. First, we summarize the findings of previous research and discuss about Knowledge, Knowledge Management and its relation to projects, followed by the value KM adds to projects. The last two sub-sections discuss this added value from both qualitative and quantitative perspectives.

2.1) Knowledge, knowledge management and its relation to projects

Knowledge can be defined as "facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject" (Oxford University Press, 2017). Knowledge, considered as a significant economic resource, has become one of the most important assets within an organization. According to Martelo Landroguez, et al. (2011), if an organization wishes to exploit their own knowledge, it must understand how it is created, shared, and applied. Therefore, KM appears in order to determine how to acquire, represent, retain and effectively manage knowledge. The use of KM has grown both at the academic level, as well as in practice (Cepeda-Carrion, et al., 2017). Literature about KM is vast and presents similar but also different approaches on how to manage knowledge.

Reich, et al. (2014) says KM encompasses three dimensions – Knowledge Stock, Enabling Environment, and Knowledge Practices. Knowledge Stock means the level of knowledge an organization has, thus its total cognitive capacity. Enabling Environment means the level of technology support combined with the trust within teams, which facilitates Knowledge Practices. Knowledge Practices explain how an organization maps their own knowledge, as well as its ability to share it. Furthermore, it involves activities that generate usable knowledge forms (socialization, internalization, combination and externalization) (Reich, et al., 2012).

Cepeda-Carrion, et al. (2017), on the other hand, says KM encompasses three different dimensions – Absorptive Capacity, Knowledge Transfer, and Knowledge Application. Absorptive Capacity reflects the organizations ability to exploit effectively external knowledge. Knowledge Transfer reflects the knowledge exchange that exists between individuals and teams or from a team to the organization. Knowledge Application reflects the proper application of knowledge after absorbing and transferring it.

The two approaches mentioned could be combined into the following order: Absorptive Capacity, Knowledge Stock, Enabling Environment, Knowledge Practices, Knowledge Transfer, and Knowledge Application (Figure 1). Meaning that an organization aiming to manage knowledge should exploit external knowledge, assess its knowledge level, create an

environment that allows its transfer, be able to assess the ability to share knowledge, transfer it (meaning transformation from tacit to explicit knowledge) and finally apply what has been absorbed and managed. From those steps, Knowledge Transfer (KT) and Knowledge Application (KA) seem to be the most critical processes. Without KT, an organization is not able to apply knowledge. And without KA, all the previous steps become purposeless. Hence, the organization will not become more competitive (Cepeda-Carrion, et al., 2017).

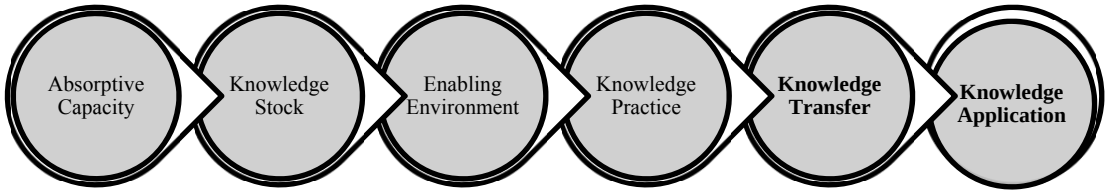


Figure 1. Proposed model of KM dimensions (Based on Reich, et al., 2014; Cepeda-Carrion, et al., 2017; Illustration by authors, 2017)

KM is also known to have a significant impact on projects. By definition, a project is "a temporary endeavor undertaken to create a unique product, service or result" (Project Management Institute, Inc., 2013). Due to its temporary nature, the knowledge gained through a project's life cycle is lost when the project ends, unless it is documented and shared, especially if the project team is disbanded (Sokhanvar, et al., 2014). For this reason, KM can be an effective and efficient tool that enables an organization to learn from past projects and avoid common mistakes. Literature discusses several ways KM influences projects. Its influences rely on the fact that knowledge is crucial to successfully meet project goals. Reich, et al. (2014) research shows that KM does not directly impact project performance; nevertheless, it is useful to produce high quality project documents. Moreover, KM can positively impact added value within a project, without negatively impacting budget and schedule targets.

Complementing the significance of KM, Maqsood & Finegan (2009) study shows that an organization's knowledge assets created through projects can be its distinguishing competitive advantage. The research shows that KM is helpful to sustain innovation in projects in two complementary ways. Primary, organizations are able to locate knowledge in an external environment and bring it inside the organization, incorporating it into the work practice. Subsequently, KM helps organizations perform more efficiently, by gaining, assimilating and applying external innovative knowledge. All in all, KM impacts projects by adding value, both in a qualitative and a quantitative way. The next sub-sections bring findings and discussions in the mentioned topics.

2.2) Qualitative evidence for the added value of knowledge management in projects

In line with what has been previously discussed, this sub-section examines how KM positively affects different aspects of projects in a qualitative way. Benefits can include customer value creation, organization's competitive advantage through the development of social capital, customer satisfaction (Cepeda-Carrion, et al., 2017) and decreased project execution time. The proper management of knowledge allows the achievement of those benefits through effective resource usage, customer interaction and empowerment of employees' participation within projects (Davidson & Rowe, 2009). Moreover, KM allows organizations to adapt and innovate (Maqsood & Finegan, 2009).

According to Reich, et al. (2012), a company's Knowledge Stock generates the ability to create an appropriate knowledge, aiming to provide the project teams with effective solutions, to

support making decisions and to bring in innovative ideas. Complementing this statement, Pemsel & Müller (2012) mentioned on their article that organization's social relationship management within projects is vital for its ability to learn and become competitive due to the significant amount of knowledge created in projects.

As an example from practice, in the early 90's, Xerox Corporation became aware of the invaluable on-site solutions created by engineers. The company realized that solutions (knowledge), were not efficiently shared among the engineers and the support staff. In a response to this problem, the company developed a KM Enabling Environment called Eureka, a Web-based DocuShare tool using an Oracle database. Eureka allows Xerox engineers to document newly created solutions and to have access to solutions from other engineers (Mottl, 2001). The development of this project allowed knowledge creation and transfer, positively impacting customer service (qualitative perspective), and thus, enhancing the financial performance of the business (quantitative perspective, discussed on section 2.3) (Moore, 1999).

As previously discussed on sub-section 2.1, KM dimensions (Absorptive Capacity, Knowledge Stock, Enabling Environment, Knowledge Practices, Knowledge Transfer, and Knowledge Application) are important for companies to generate business value. Within the Eureka tool it is possible to perceive five out of the six knowledge management dimensions (Figure 2).

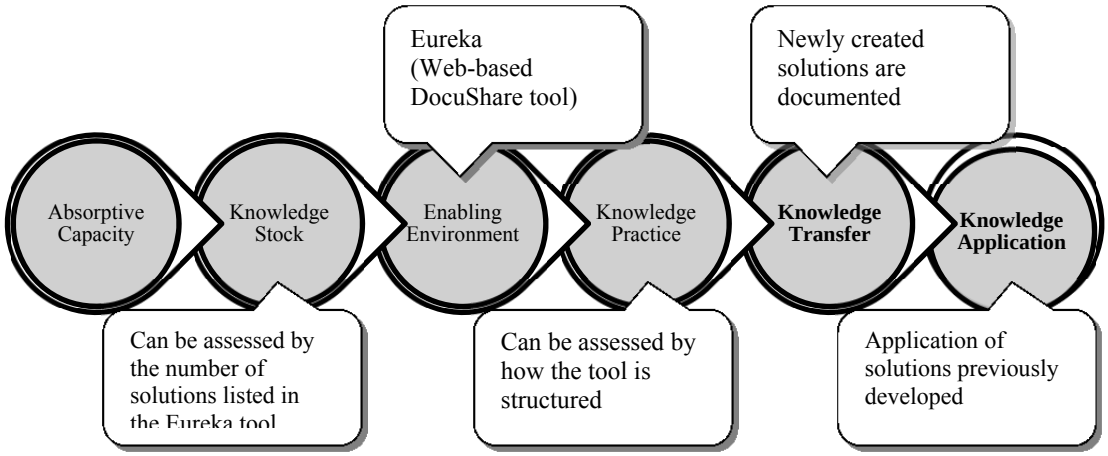


Figure 2. Reflecting the case study on the model (Based on Reich, et al., 2014; Cepeda-Carrion, et al., 2017; Illustration by authors, 2017)

Those dimensions generate three types of domain knowledge – knowledge of the desired business value, the organizational change plan and the technical design. These three types of domain knowledge discussed in literature are also seen in Xerox. As a result, technicians where empowered and valuable documentation with innovative solutions to unique problems was created in a comprehensive technological and social support environment (Moore, 1999).

2.3) Quantitative evidence for the added value of knowledge management in projects

As stated by Ha, et al. (2016), globalization and rapid changes in the trend market have put companies in a situation where they must be able to understand and respond to changes in an effective way to stay competitive. To achieve this state of competitiveness, companies need to pay special attention in their organizational performance by being able to understand, control and improve the facts and figures the company is generating.

As previously mentioned, nowadays, knowledge is considered as a significant economic resource and has become one of the most important assets within an organization due to the fact that it allows companies to improve their distinctive competencies (Sánchez, et al., 2015). Current literature shows for instance that KM practices – such as knowledge, learning, organization understanding, innovative culture, individualized approach and skills – have a positive and significant effect on a firm's performance (Palacios Marqués & Garrigós Simón, 2006). Sanchez et al. (2015) also states that the proper implementation (and consequently, usage) of KM systems in companies has a positive and significant influence in financial and operational performances.

Projects in companies are one way in which an organization works toward competitive advantage and achievement of strategic goals and objectives. As mentioned in the Project Management Body of Knowledge (PMBOK), projects are authorized when there is a business need or a strategic opportunity, development of technology due to market's demand or customer's requirement. Through its temporary nature, projects can help to achieve strategic goals when they are aligned to the organizational strategy (Project Management Institute, Inc., 2013).

In accordance with empirical studies and literature, projects, KM and organizational performance are interrelated. Gasik (2011) mentions on his article that KM is considered as one of the main success factors in projects (especially in complex ones). Therefore, the lack of KM can eventually cause failure of the project. Considering IT projects as an example, the development and implementation of systems in organizations is a knowledge-intensive activity. Knowledge-intensive activities generate the need to create a project-based knowledge, since knowledge is essential to develop the required products. Reich, et al. (2014) show that there is a strong correlation between good knowledge management and a project performance. As discussed, knowledge is an important asset used by companies to develop projects and, hence, achieve a desired state of organizational performance. In practice, companies need to quantify the benefits that knowledge brings to them and analyze how these benefits impact or support the achievement of organizational goals.

As mentioned on sub-section 2.2, the implementation of Eureka, a KM System, has brought Xerox Corporation benefits, such as customer service. From a quantitative perspective, the empowerment of technicians and their knowledge creation and transfer allow them to resolve issues on 80% of calls (Doyle, 2016). Moreover, Xerox has been able to save more than 5% in field service. After the tool rollout in France during the 90's, Xerox could solve 250,000 problems a year, representing a US$ 10 million savings in service parts and labor costs (Hawes, 2002). It is evident that this return on investment increased with the worldwide expansion of the Eureka (Mottl, 2001).

As discussed in this section, the combination of literature and practice leads to the understanding that the application of a company´s knowledge through project execution creates new knowledge and has a direct impact on the organizational performance. The quantification, control and continuous improvement of knowledge, as an intangible asset, keeps a company´s competitive advantage and is a tool that helps them to deal with market changes or customer requirements that may appear. Moreover, Hawes (2002) states that Xerox Corporation have used KM to "improve their own efficiency, streamline their business and make better use of their intellectual assets."

Conclusions

This study started from the presumption that KM adds value to projects in two different aspects – qualitative and quantitative. KM is an important asset to organizations, directly influencing its performance and competitive advantage. Organizations normally use projects as

a tool to achieve their desired goals. The main problem relies on the fact that projects are temporary and the knowledge gained through its phases is lost after its completion. This lost knowledge directly impacts organizations. From a qualitative view, KM applied to projects helps organizations to avoid common mistakes (by learning from past projects), meet project goals, produce high quality project documents, perform more efficiently (lower execution time), and create customer value. The stated benefits contribute to keep an organization competitive. From a quantitative view, KM provides organizations with concrete figures that help them to achieve their goals and to better deal with market changes or customer requirements. Moreover, our findings lead to the conclusion that projects, KM and organizational performance are directly interrelated and this relationship, if managed well, leads to a better assessment of an organizations current situation and a better sense on how to perform in the future to stay competitive. Considering that not every qualitative evidence for the added value of KM in projects could be assessed from the Xerox's white paper, we suggest the further access to this information as base for future research.

References

Cepeda-Carrion, I., Martelo-Landroguez, S. & L. Leal-Rodríguez, A., 2017. Critical processes of knowledge management: An approach towardthe creation of customer value. European Research on Management and Business Economics, Issue 23, pp. 1-7.

Davidson, P. & Rowe, J., 2009. Systematising knowledge management in projects. International Journal of Managing Projects in Business, 2(4), pp. 561-576.

Doyle, K., 2016. Field Service Digital. [Online] Available at: http://fsd.servicemax.com/2016/01/22/xeroxs-eureka-20-year-old-knowledge-management-platform-still-performs/
[Accessed 19 May 2017].

Gasik, S., 2011. A Model of Project Knowledge Management. Project Management Journal, 42(3), pp. 23-44.

Ha, S.-T., Lob, M.-C. & Wangc, Y.-C., 2016. Relationship between Knowledge Management and Organizational Performance: A Test on SMEs in Malaysia. Procedia - Social and Behavioral Sciences, Issue 224, pp. 184-189.

Hawes, P., 2002. Digital Perspective. [Online] Available at: https://www.xerox.com/downloads/usa/en/k/kperspective_whitepaper.pdf

Leseure, M. J. & Brookes, N. J., 2004. Knowledge management benchmarks for project management. Journal of Knowledge Management, 8(1), pp. 103-116.

Maqsood, T. & Finegan, A. D., 2009. A knowledge management approach to innovation and learning in the construction industry. International Journal of Managing Projects in Business, 2(2), pp. 297-307.

Martelo Landroguez, S., Barroso Castro, C. & Cepeda Carrión, G., 2011. Creating dynamic capabilities to increase customer value. Management Decision, 7(49), p. 1141–1159.

Moore, C., 1999. Best Practices: Eureka! Xerox discovers way to grow community knowledge and customer satisfaction. KM World, 1 October.8(10).

Mottl, J., 2001. How Xerox got its engineers to use a knowledge management system. [Online] Available at: http://www.techrepublic.com/article/how-xerox-got-its-engineers-to-use-a-knowledge-management-system/

Oxford University Press, 2017. English Oxford Living Dictionaries. [Online] Available at: https://en.oxforddictionaries.com/ [Accessed 14 May 2017].

Palacios Marqués, D. & Garrigós Simón, F. J., 2006. The effect of knowledge manage-ment practices on firm performance. Journal of Knowledge Management, 10(3), p. 143–156.

Pemsel, S. & Müller, R., 2012. The governance of knowledge in project-based organizations. International Journal of Project Management, 30(8), pp. 865-876.

Project Management Institute, Inc., 2013. Guide to the Project Management Body of Knowledge (PMBOK® Guide). 5th ed. Newton Square: Project Management Institute, Inc..

Reich, B. H., Gemino, A. & Sauer, C., 2012. Knowledge management and project-based knowledge in it projects: A model and preliminary empirical results. International Journal of Project Management, Issue 30, p. 663–674.

Reich, B. H., Gemino, A. & Sauer, C., 2014. How knowledge management impacts performance in projects: An empirical study. International Journal of Project Management, Issue 32, p. 590–602.

Sánchez, A. A., Marín, G. S. & Morales, A. M., 2015. The mediating effect of strategic human resource practices on knowledge management and firm performance. Revista Europea de Dirección y Economía de la Empresa, Issue 24, p. 138–148.

Sokhanvar, S., Matthews, J. & Yarlagadda, P., 2014. Importance of Knowledge Management Processes in a Project-based organization: a Case Study of Research Enterprise. Procedia Engineering, Volume 97, pp. 1825-1830.

Managing Risk Portfolio System

E. W. Thattakath[1], S. Korotunov[2], R. Čiutienė[3], G. Tabunshchyk[4]

[1]PhD Student, Kaunas University of Technology, Lithuania
[2], PhD Student of Software Tools Department, Zaporizhzhya National Technical University, Zhukovskogo, 64, Zaporizhzhya, Ukraine
[3]Prof., Kaunas University of Technology, Gedimino g. 50, LT- 44239 Kaunas
[4] Prof. of Software Tools Department, Zaporizhzhya National Technical University, Zhukovskogo, 64, Zaporizhzhya, Ukraine, galina.tabunshchik@gmail.com

Abstract: *To investigate the relationship between dynamic capabilities and project portfolio risk management the expert methods has been chosen. In the article, the web-system for expert questionaries' and further risk analysis is described.*
Keywords: Project portfolio risk management, dynamic capabilities, portfolio management, web-system

1. Introduction

Considering the results of previous theoretical research the relation between Project portfolio risk management (PPRM) and dynamic capabilities (DC) were established [1]. This work is devoted to the description of the methodology and software platform for empirical research.

2. Methodology of the investigation

To prove theoretical research[1-3] there was selected experts assessment for which the online web-tool was developed.
Research there was developed methodology for further analysis, which was summarized in the questionaries' for the experts, with a Likert scale of assessment (Strongly agree → Strongly Disagree).
Such classification criteria as Size of company, Role/position, Industry was selected. Among Dynamic capabilities we will consider Sensing, Learning, Renewal and replication, Seizing/ utilization [1].

3. Web-System for Risk Portfolio Analysis

Project portfolio risk manager (PPRM) is a web site to collect and process questionnaire data (fig 1) and further risk and dynamic capabilities analysis.

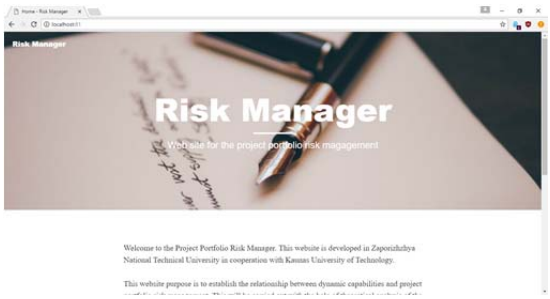


Fig. 1 Main interface of the PPRM web-tool

There is one predefined user in the system – “admin” and there are three roles – “Expert”, “Analytic” and “Administrator”. Users with “Expert” role have ability to fill questionnaire data for the current questionnaire template.

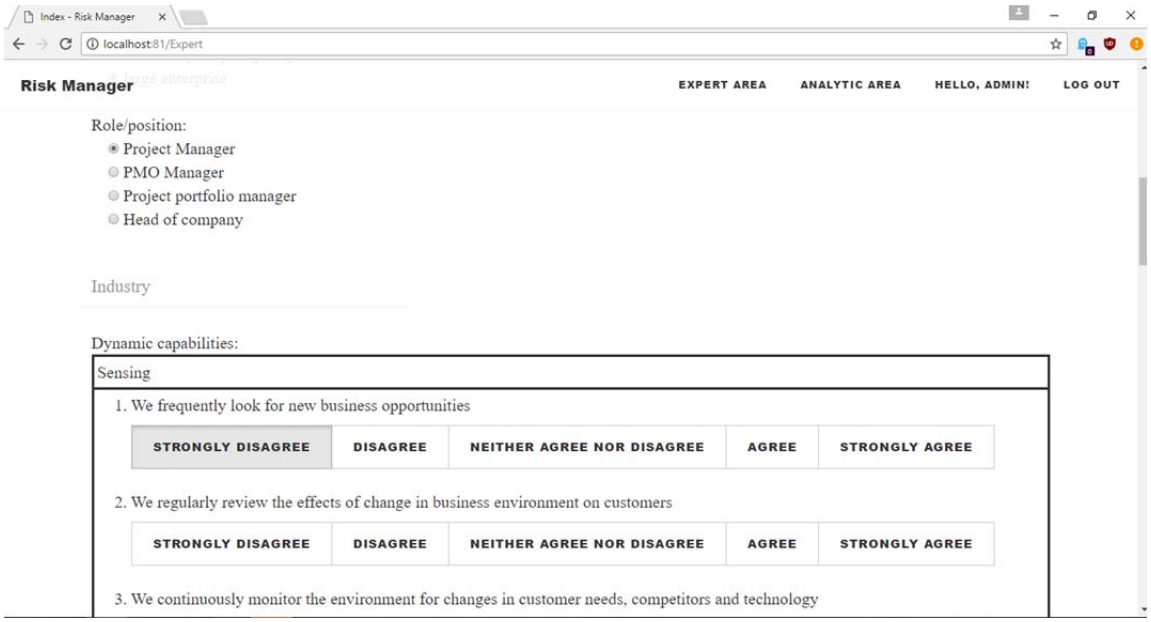


Fig. 2 Dashboard of the system

In the same time users with “Analytic” role can manage users, edit questionnaire template and have ability to get calculated statistics data.

There are few important things needs to be mentioned. First, some entities are major logic blocks such as HTML template itself, order and content of the company size’s options, as well as position’s options, industry input, “dynamic capabilities” and “portfolio risk management” blocks. These blocks themselves have nested sections, questions in these sections and answer’s options.
There are two possibilities for editing – “insert” and “update”. “Insert” option allows analytics to create basically new questionnaire template. This, in its turn, leads to the fact that no questionnaires previously filled by experts will be compatible with new ones. It becomes obviously, if we imagine that analytic add some additional options as the answers, or change its order. Likert’s scale based on the five options is not the same as one with seven options. So experts will be asked to fill questionnaire again. In the same time, all data that was collected for the previous template will be stored in the database and can be still easily processed. “Update” options allows analytic to edit only the text and template leaving order and position of the major blocks as it is. It is basically aimed to prevent typos and simple mistakes.
As a conclusion it can be said that developed architecture is agile enough to tackle different difficulties and can be improved in future to satisfy all the required needs.
On the figure 3 you can see how the suggested questionary is presented:

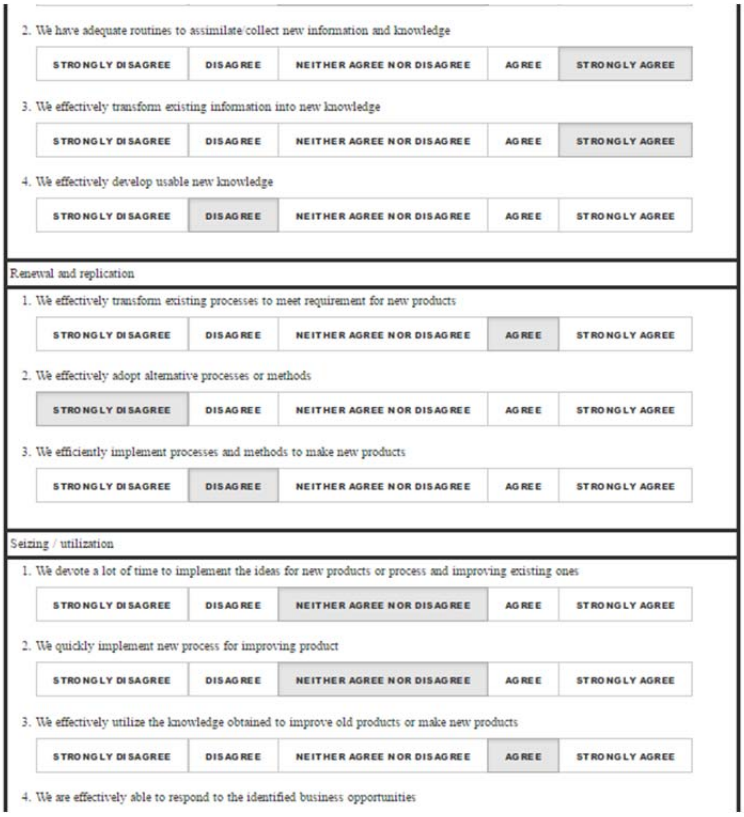


Fig. 3 – Online questionary

4. Results and Conclusion

Based on theoretical research the methodology for investigation was developed by researches in Kaunas University of Technology (Lithuania). For analysis the web system for Risk Portfolio analysis in Zaporizhzhya National Technical University (Ukraine) was developed.
Our further work is to collect expert data for numerical analysis in both countries and to provide extended analysis.

5. References

[1] Thattakath, E. W., Čiutienė, R. The relationship between dynamic capabilities and project portfolio risk management: theoretical framework // Project management development – practice and perspectives : 6th international scientific conference on project management in the Baltic Countries, Riga, Latvia, April 27-28, 2017 : conference proceedings. Riga: University of Latvia. ISSN 2256-0513. 2017, p. 293-308.

[2] Biedenbach, T. & Müller, R. (2012). Absorptive, innovative and adaptive capabilities and their impact on project and project portfolio performance. International Journal of Project Management 30. 621–635

[3] Helfat, C. E. (2007). Dynamic Capabilities: Understanding Strategic Change in Organizations. Malden, MA: Blackwell Pub.

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