



Software Architecture and Standarized Project Management

Georgios Manoliadis

Software Engineer, MSc University of Manchester,
United Kingdom

Abstract: *The last ten years companies and organizations have implemented standardized software project management expecting project success and improved performance. Major standards for Software Engineering are Underwriters Laboratory standards and CMMI (Capability Maturity Model Integration). In more detail, information technology practices in project management. The aim of this research is through literature review to investigate the contribution of the project management standards to better project performance and success. In conclusion, project management standards are highly recommended for large-scale long-term organizations as they are helpful, lead to higher performance, can be easily adopted and can lead to project success.*

Keywords *Software Architecture, software Project Management, Standardization, Standards*

I. INTRODUCTION

Communities of practice and groups of practitioners, such as PMI or IPMA, develop and support project management standards helping communities to maintain skill and knowledge. It is evident that the goal of their existence is to manage projects more easily and efficiently by using commonly accepted standards. Incorporation of standards in project management practices is not trivial. McHugh and Hogan [1] investigated the adoption of internationally recognized project management methodologies by organizations. They recognized the significant aid of standards in project management. In accordance with the above, On the contrary, standards adoption is generally difficult since related companies have to integrate them into the organizational context. On the other hand, Glass(2009) [2] reports that standards, though understandable at higher level, are not easily implemented at a lower level or are implemented in different ways according to different beliefs, resulting in confusion and therefore conflicts. Garcia (2005) reported extra costs for the standard transition phase.

Project success is defined on time, with cost and standard meeting the customers expectations. McHugh and Hogan (2011)[1] claim that adoption of project management standards is useful to organizations and can lead to project success. Additionally project management standards help organizations to apply more efficient practices, improve their relationship with their customers and gain support from communities of practice [3] Milosevic and Patanakul (2005) [4] through a questionnaire survey, where 55 project practitioners participated, conclude that standardized project management may increase projects success.. Of course it is expected that managers having a variety of experience believe that there is no need to switch to a standardized methodology if the existing is working successfully. The question arising is: Are project management standards helpful, are they easily adopted and do they lead to project success?

Also, the ease of their application is going to be examined. We focus our analysis on large-scale long-term software projects. The following sections present selected papers that were found in this limited area of research. More specifically, on how standards enable adoption of Project Management practice (Garcia, 2005), on how standardization project management leads to projects success (Milosevic and Patanakul, 2005) and on how communities of practice adopted internationally project management methodologies (McHugh and Hogan, 2011).

II. STANDARDS

Keil and Robey (1997) [5] reported that 40% to 50% of information technology projects fail to handle time and cost effectively. An option to tackle these failures is to introduce better project management processes that are widely acceptable. Standards are introduced as a way to gather methodologies in an organized way that is reviewed by a community, organization or standard office. According Merriam-Webster dictionary (2013), a standard is established by authority, custom, or general consent as a model or example. Standardization can

sometimes be a requirement for companies to enter a market. But even if standardization is not a necessity, following standards can be a proof that companys products will be compatible to satisfy customers needs and practices. Also, a standard is necessary for evaluating or finding suppliers. Major standards for Software Engineering are Underwriters Laboratory standards and CMMI (Capability Maturity Model Integration). In more detail, CMMI influences information technology practices in project management.

III. LITERATURE REVIEW PRESENTATION OF CHOSEN ARTICLES

An important element in Garcias (2005) research is the good standard. A good standard does not follow specific guidelines. Garcia(2005) presents separated good standards to those that explicitly deal with the assigned project and

those that do not. Such standards are for instance the ones of the Project Management Institute (PMI) that can be generally applicable to projects context and affect the project management by reducing the time and minimizing arguments. As complicated standards can lead to confusion and consequently to conflicts, therefore a good standard must be simple.

Standards are ways to manage three major factors of the PM process. These factors are people and their skills, technology and the projects environments (Figure 1). Garcia discusses the effects of the adoption of PM (Project Management) standards in organizations. Specifically, the author concludes to a number of successful project management practices. The author also mentions that adoption of PM standards can benefit project managers and increase the probability of a project's success.

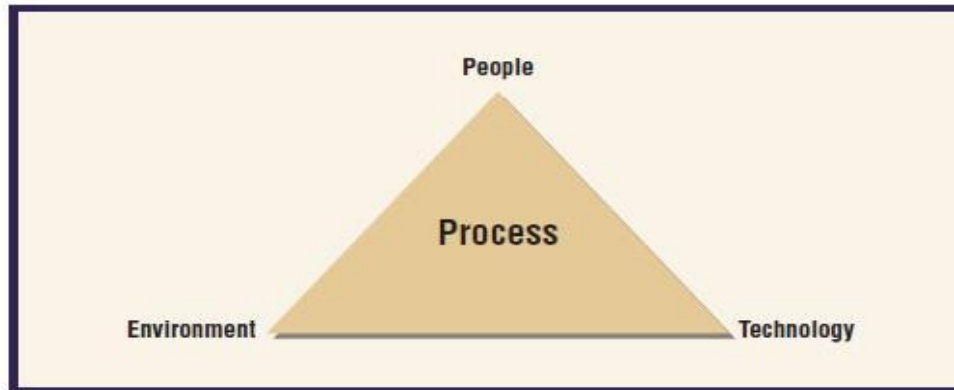


Figure 1. Three major factors of the PM process (Garcia 2005)

Crucial advantages of adopting a standard can be found when deploying practices. There is a possibility that a standard might not fit to the organization's environment. More than one standard in an organization can cause conflicts. Sometimes companies employ experts to find standards that fit in each division of the company, producing an organizational standard. Standardized products fit to standardized companies. For Garcia(2005), mutual adoption is the process where an organization customizes a technology for its needs. Organizations commonly construct variations of standards to easily adapt to them. Unfortunately, organizations often adopt standards before planning if they are suitable to organizations goals and environment, resulting in harmful consequences.

According to Garcia(2005), customer-supplier relationships gain benefits from the application of standards in organizations. In this way the customer can monitor and evaluate the development process. Also, clients with certain standard tend to work with suppliers with the same standard. For the supplier the cost is reduced. On the other hand, overreliance to a specific standard is negative for a company. One case of standard use is when government or industries adopt a policy for customers or suppliers. The underlying companies must adopt it, either to avoid legal issues or to sustain competitiveness. Practitioners community is a major factor for the development and improvement of their area of expertise. There are numerous groups of practitioners nowadays, like the community of the website gantthead, PMI members and CMMI.

Once a standard fits to the organization context and environment, and its adoption is planned carefully, the organization will gain a lot of benefit from it. On the other hand, when a company does not have a plan for standard adoption and is not consisted of a project-based structure then the adoption can be harmful. Garcia(2005) mentions that adopting a standard is not inexpensive and that it is very important for organizations to be aware of the risks, timing and drifts in the adoption process.

Milosevic and Patanakul(2005) investigate the increase of project success and performance through the transition to standardized project management (SPM) in long term large-scale ("high-velocity") industries in electronics and software. These industries are changing radically, as new technologies emerge and thus projects must be able to adopt and change easily. Milosevic and Patanakul(2005) mention that these industries have high uncertainty, system complexity and risk involvement. For this case study, a questionnaire that included the degree of project success as the dependent variable was developed. This aggregate variable consists of four criteria namely: schedule, cost, quality and customer satisfaction. These criteria were measured on a 5 point Likert scale (5 is the highest preferred option and 1 is the least preferred option). Seven independent variables, the success factors, were selected, namely: the project organization, PM process, information management systems, PM tools, PM metrics, project culture and project leadership. Each question corresponded to one variable. The level of standardization of each factor was also investigated. The responses in terms of the independent variable were again measured on a 5 point Likert scale. The sample consisted of 55 participants (project managers, directors and team members). Of those, 31 were from the computer and software industry and 24 from electronics industry. It should be noted that this research was preferred as it engaged with projects in the software industry and 37% of the projects had a budget greater than 5 million dollars which can be considered large scale. For the statistical analysis of data, a bivariate and a multivariate data analysis were used. The output of this process was a mean value as high as 3.2 out of 5.0. It can be presumed that this standardization factor has a medium value. The assumption made was that a project with higher success will have a higher rate of the SPM success factors.

The research method was composed of three parts (Figure 2). At the first step, the main factors of standardized project management were found according to interviews with 12 project managers, analysis of the answers given and the related

case study research in the literature (qualitative method). In the interviews the managers were asked to describe their beliefs and experiences about Standardized Project Management and project success. At the second step of the method, a hypothesis analysis has been made and the results were formed in a questionnaire that was completed by the participants (quantitative method). At the third step, follow up interviews were conducted to clarify results from this case study (qualitative method).

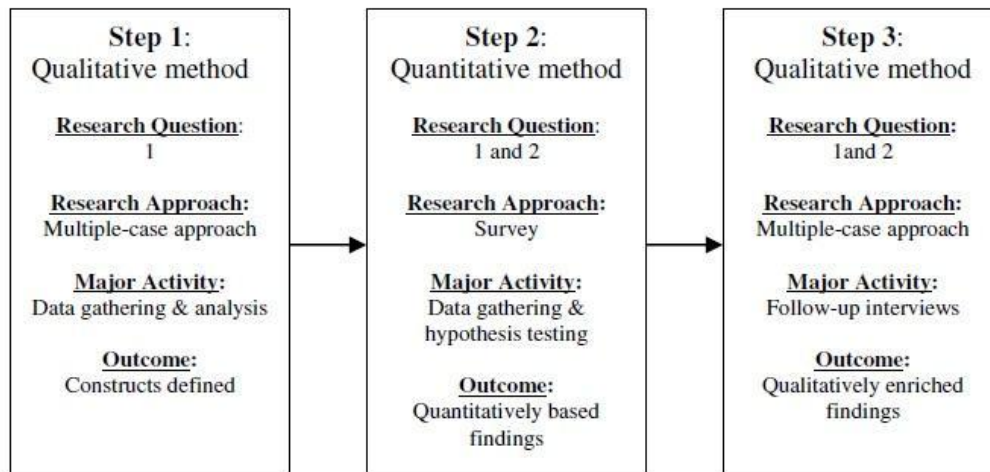


Figure 2. Steps of the research method (Milosevic D., Patanakul P., 2005)

By the results of the questionnaire and the interviewees' answers it has been found that the standardization of the PM factors is likely to affect the project success. A positive correlation of the standardized project management factors and project success was observed. More specifically, the research method discovered that increasing three of the standardization PM factors raised the project success possibilities. These factors were PM tools, leadership skills and PM process. Another informative result was that by standardizing the PM process phase, the processes of life-cycles phases, activities and milestones could be improved.

Lately, new integrated information systems have been created. Once a project and its performance elements are included in the system, they are connected with company's projects pool. The software aids project managers by giving advice on future moves and decreasing risks. Personnel that have the values of a standardized culture will be more enthusiastic, committed and willing to support. Also, standardized projects don't spend resources on creating process for each project. The researchers found a high number of customized standards in companies. A novel theory that was introduced by the researchers was that standardized tools aid project success. Also, standardized PM process is a factor that has been understood to be critical to the success of a project. Uniformity assists companies to deliver projects on time because when processes are executed repeatedly it is more efficient than having one process for every project. When a good standardized PM process is introduced in a company then the repeatability is high. Advanced information management systems were new systems when the authors conducted this research, on 2005, and thus project managers and team members didn't have enough experience on them. PMBok (2000) does not refer to standardized PM but only on PM tools and PM process. Another important conclusion made was that SPM factors don't have the same weight in every organization.

The researchers also concluded at a certain standardization level which is called inflection point. Above this level the organization does not benefit from improved PM standardization, but instead disturbances appear. This point differs for every organization and depends on the nature of the projects and the format of the organizational structure. It is worth mentioning that inflection point is known to organizations and lower standardization often appears because companies are afraid of that phenomenon.

McHugh and Hogan (2011) present an investigation concerning the adoption of internationally recognized project management methodologies by companies in Ireland. The research was conducted to analyze the adoption of internationally recognized project management methodologies (IRPMM). The research has been made in Ireland, which is a very interesting country in terms of PM, as the adoption of PM in companies is the second highest in the world (Naughton and Kavanagh, 2005). However, the results that were found cannot be presumed to be generalisable on a global basis. The adoption of IRPMMs was examined in a sample of 5 large scale companies that consisted of more than 50 employees. The mentioned companies deal with technology services that develop software applications. Financial, insurance and construction companies were also included. We have to mention here that the case study might not perfectly accurate for our needs as software companies might perform differently with IRPMM comparing to companies from other industries. The companies included in the research should have acquired PMI or PRINCE2 standard in the past three years. It is a benefit that the managers had a variety of experience before and after the acquisition of the standard, as it is an open area to achieve informative results with the help of statistical methods. In order to choose the appropriate PM standardized methodology, the factors are:

- the existence of PM certification providers for training and support, the form of the organization and which methodology is better to it,
- how the methodology is in practice feasible when the scale of the company's projects varies.

The investigated companies were found from certification bodies and from personal connections of the researchers. It can be mentioned that the number of companies the researcher is using, is small and it might limit the quality of results. The research method used, was a personal interview that was conducted at the working environment of the project manager. The interview questions were influenced by research literature. The method used is interesting because it mentions some of the insights of how organizations treat the methodologies.

The transcripts of the interviews and the notes made by the interviewees were examined to find similarities and differences. Two of the organizations didn't have a methodology before acquiring the IRPMM certificate, while other three companies were using an internal methodology. Two of the latter were using the same methodology for every project, while another company was altering the methodology depending on the project.

As McHugh and Hogan(2011) claim, the benefits of using a standard are that the company is ensured of using the best practice in project management, the competitiveness of the company would be increased, as customers are interested in standardized companies and thus the company can gain more clients. Recruiting personnel with knowledge to this international standard is easier and the companies can be supported by a vast number of specialists. On the other hand, the disadvantages of using in-house methodologies are:

New personnel need time to be accustomed to them, some of the groups of the organization don't use them so coherently, they are considered infeasible to be customized for small projects.

All the project managers believed that the implementation of the new methodology improved the quality of the projects delivered and increased the project success. Some of the project managers, especially three of them, reported that it took time to adjust to the new methodology. Project management standardization helped these companies to cancel projects that were going to fail and so, the companies avoided losing extra money.

Customization was mostly found in large-scale companies, as they tend to adjust standards to their special needs. McHugh and Hogan (2011) also claim that it's better to scale down the methodology to meet the needs of the organization. Although, some external customers demand for an IRPMM, others disagree on moving to a new methodology. Time is needed to switch to a new methodology

The personnel didn't disagree on the adoption of the new methodology. Large scale organizations provide the money and resources needed to switch to an IRPMM. In small organizations the personal desire of the project manager is the main factor to acquire knowledge of an IRPMM. Support by other divisions of the company is needed to have a successful adoption.

A novel ending is that, customers also have to contribute, in some circumstances, for the successful adoption of the new methodology. In general, if senior management, personnel and customers do not aid, the transition will not succeed.

The methodology must be easily customizable to be popular in large organizations as these organizations tend to customize methodologies to their needs. Large companies also tend to implement versions of their standard methodology to fit to small projects. PMBoK was found not easy for small projects, in contrast with PRINCE2 methodology.

IV. DISCUSSION

Recently, a significant improvement has been made in standards developed by the community of practitioners (PMI and IPMA). These standards solved problems that could not be covered by the traditional methods. The application of these standards coupled with best practice methodologies has been measured in terms of project success. By measuring the related project success factors it is reported that projects success is improved. For the case of large organizations the application of these modern standards is going to produce integrated project management practices and minimize risks. This is the result of the community of practitioners efforts and the will of individuals to adopt these standards.

PM standards can be helpful to projects and aid their performance. Garcia(2005) and McHugh and Hogan(2011) mention that standardized PM aids large scale organizations to gain more customers as there is a demand for standardized organizations. Very often, customers that use specific standards are searching for companies that use the same or a variation that standard. Both researchers are claiming that many organizations switch to standardized PM for the support comfort. It is very important that large scale organizations can be assisted by specialists when training personnel and in general, at the transition phase. Also, support can be given when the standard doesn't operate as expected.

There is a debate on whether PM standards can be easily adopted. Both Garcia(2005) and McHugh and Hogan(2011) mention that adopting a standard isn't inexpensive. Large scale organizations, which are our viewpoint, provide the necessary money and resources more easier than small organizations. Though adopting a standard is time-consuming for large organizations, the problem for small organizations is the cost. Also, decision-making for switching to a standard is time-consuming for large organizations. Both Garcia and McHugh and Hogan(2011) state that a customizable methodology is referred for large scale organizations. The nature of the organization must be well examined to find the appropriate methodology. All three researchers discuss the difficulties of the adoption of standards. Garcia(2005) mentions serious consequences if the proposed standards do not fit the organization, Milosevic and Patanakul(2005) mention reluctant project management participants, while McHugh and Hogan(2011)[1] state that some project managers take significant time to adjust or disagree on moving to new technologies. McHugh and Hogan(2011)[1] also mention that large organizations tend to customize methodologies in their own needs. All three researchers agree that the community of practitioners aid organizations to adopt new standards.

As for the research methods the researchers used, McHugh and Hogan (2011) used interview with open-end questions that compared to Milosevic and Patanakul (2005) that used a three way research method composed of analysis, questionnaire and interview. Garcia(2005)[3] states a theoretical output of her twenty-year experience in the software engineering industry.

V. CONCLUSION

Nowadays, the adoption of internationally recognized standards from large scale organizations is necessary. This necessity becomes apparent since there is a need to avoid conflicts which occur due to different methodological approaches between the organizational divisions. Also, the need for competitive performance leads companies, that perform large-scale long-term projects, to adopt standards which are constantly maintained by international standardization offices and institutions and have a large community of practice.

Flexibility can be mentioned as one of the key elements of modern PM standards. Although enterprises develop internal project management processes, transition to standardized project management is not necessarily complicated due to the fact that modern standards are customizable to adjust the needs of the enterprise[6]. On the other hand, this adoption to a PM standard requires time, money and a careful study of organizations structure. As project success is an achilles heel for organizations, adopting a standard is observably correlated with improvement of project success. The three PM factors correlated to project success are PM tools, PM process and leadership[7]. Standardized project management increases project success as long as related factors are improved [8]

Standardized PM aid the companies to improve performance and limit the cost and time of their projects in the long run. Also, by following an inter-national methodology risk is reduced, since it is reviewed by standardization bodies and is generally approved by the industry. Additionally, by the adoption of standardized project management, PM process is a common language for the parties involved in the life-cycle of a project. Stakeholders, senior administrators and customers can speak this common language. In this way, disruptions can be avoided and customers can easily evaluate the position of the project.

To summarise, project management standards are highly recommended for large-scale long-term organizations as they are helpful, lead to higher performance, can be easily adopted and can lead to project success.

REFERENCES

- [1] McHugh, O. & Hogan, M. (2011). Investigating the Rationale for Adopting an Internationally Recognised Project Management Methodology in Ireland: The View of the Project Manager, *International Journal of Project Management* 29(5) p637-646
- [2] Glass R. L. (2009). Doubt and Software Standards. *IEEE Software*, Vol. 26, Issue 5, p 103
- [3] Garcia, S. (2005). How Standards Enable Adoption of Project Management Practice., *IEEE Software*, vol. 22, no. 5 (Sep/Oct 2005), pp. 22-29
- [4] Milosevic D., Patanakul P. (2005) Standardised project management may increase development projects success, *International Journal of Project Management*, Vol 23, p 181-192.
- [5] Keil, M. and Robey, D. (1997). Turning runaway software projects around: the de-escalation of commitment to failing courses of action, *ICIS '97 Proceedings of the eighteenth international conference on Information systems*, p. 472-473
- [6] Merriam-Webster dictionary. (2013), [Accessed March 21st, 2013] Available from <http://www.merriam-webster.com/dictionary/standard>
- [7] Naughton, E., Kavanagh, D. (2005). Is Project Management De cit a Brake on the Irish Economy? [Accessed March 21st, 2013] Available from http://www.projectmanagement.ie/articles/ireland_a_leader_in_project_management_practice.htm.
- [8] PMBok. (2000). A Guide to the Project Management Body of Knowledge Accessed March 21st. 2013 Available from http://www.ucongreso.edu.ar/grado/carreras/lsi/2005/dir_proyec/pmbok_2000.pdf