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# A Comparison of Project Management in System and Research Projects

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**Abstract:** Project management is one of the oldest management processes with reference already to project management during the building of the pyramids. However, the current form of project management with the support of different tools such as electronic management systems, is relatively new. Although there are different project types the processes, principals and successes of these types might differ. In this research we are interested in the differences and similarities between system development projects and research projects. In our investigation we used a systematic review where we used a coding schema to identify themes in the two types of projects. In comparing the two types of projects, it was found that processes and principals do compare in several themes in the number of references to the themes, but the success factors for the two types of projects are significantly different.

**Keywords:** Systems Development Project Management, Research Project Management, Project Management Processes.

## 1. Introduction

Although much has been done to enhance the processes involved in management of IT projects, there are still a large number of projects that fail [21]. Every project that a project manager manages has its own challenges and is unique, which often create uncertainty [22]. Uncertainty leads to risk increase and delays in projects, which often frustrate the client involved in the project and make the client feel that the service is not adequate and the project do not benefit them.

Systems development (SD) projects and research projects have their own ways of delivering their respective goals where the management of these projects might or might not be similar. The project management (PM) of the two types of projects (system and research) has a direct influence on them and it provides control as well as a structure to work from. Without PM the project progress is uncertain and could be in jeopardy. That is why a clear understanding of what the type of project has to offer can increase the success factors of both projects types.

As both system and research projects have certain processes that they have to follow it is possible to compare the two types of projects to identify similarities or differences during the PM process. Considering the way that research projects complete their processes and manage them could shed some light into how the processes could be improved.

In our research we explored the differences between research and system projects. In order to identify the differences it was necessary to compare system and research PM cycles. The purpose of this research was to identify and describe the PM processes that are

associated with a research projects as well as system development projects and to see how they differ or are similar.

In our research we also identify the research project processes that could be followed to ensure a successful project. Furthermore, the research identify the SD project processes that could be followed to ensure a successful project and highlight similarities and the differences of research and SD PM.

In this paper we first provide general background on project management (PM) in section 2, followed by the research methodology. The results from the systematic review is provided in section 4 with a discussion in section 5.

## 2. Project Management

Project management (PM) has proven useful for businesses for a couple of years now and in a way helped shape how business is done the following are some of the benefits that a business might have when implementing PM [21]. *"Project management reduces risks, cuts costs and improves the success rates of projects dramatically*" [1].

When businesses take on projects they need to be certain as to what risks are and what they can do about it. The reduction of risks helps a business to be able to complete projects successfully [23]. Project management cuts cost by effectively managing time and resources and reducing risks. This gives businesses a competitive advantage if applied correctly.

The cut costs and reduced risks inevitably lead to higher success rates of projects because they are managed properly. "Good project management discipline stopped us from spending money on projects that fail" [1]. Project management allocates the required resources as they need them, but can also prevent allocating resources to project that will fail in the first place. Feasibility studies done in the initial stages of PM can determine if a project has a high possibility of failure and then reject it before it can cost the business anything [21].

Project management makes the success of a project measurable. By creating mile stones and making sure the success can be measured before attempting to do a project can make a project go down the road of success instead of failure. "Without a consistent approach and clear milestones, decision points and metrics to measure your success, you're just flying by the seat of your pants" [1]. By having a measurable project the team can focus on what is important and stay on track. Project management creates successful and driven project that can lead to the success of a project. If PM is done properly the chances of a project failing and costing business money is small [22].

Project management is not yet perfected and still have many problems that it can encounter. According to Johnston & Brennan [2] PM faces three critiques namely "Current circumstances cannot have a precise up-to-date representation and have the plans to change them, project management and project manager is not immune to influences of higher management that get involved with the project and project management plans can push tasks to execution without looking at the status of the production system into account" [2:74].

Project management is a tool used to complete project in an effective and efficient manner that ensures the highest quality with lowest risk. Project management has come a long way from its origins and hold many benefits to businesses that use it. Even though PM is not perfect, businesses will find that it is a very useful tool to use when implementing projects.

## 3. Research methodology

The purpose of this research was to investigate the differences or similarities between SD PM processes and research PM processes. The two project types where chosen because it formed part of a larger project called Mosaic 2. Research projects where also chosen because the authors were familiar with this type of project. Systems development projects where chosen as it a new field for project management and fail more often than others. An interpretive philosophy was followed where secondary sources on PM in the two domains were considered and the project management processes of system development projects and research project processes was compared. The research was qualitative due to the exploratory nature where the goal was to understand the difference between the two approaches to project management and the focus was not to assign numerical values or be measured in any way.

The research strategy selected for the research was a systematic review where we considered published works that have relevance to the PM processes followed in SD projects and research projects.

The collection of data in this research was conducted based on the research strategy of a systematic review. According to Chaleunvong [3]:"Data-collection techniques allow us to systematically collect information about our objects of study (people, objects, phenomena) and about the settings in which they occur" – in our research the systematic review process makes provision that data is collected in a systematic manner where the resources considered show information about the object of the study. This connects with the idea of a systematic review that makes use of a protocol. The data that is collected followed this protocol to ensure the data in consistent with the research subject as well as relevant. The protocol followed is based on the Cochrane handbook for systematic reviews of interventions [4].

The data that was gathered on PM in system development projects and research projects, principles and success factors were placed into lists in Excel. Themes were created for recurring processes, principles and success factors. The process was repeated separately for SD projects and research project. After the themes were identified the themes were compared with one another to identify the themes that correlate with each other and show the similarities and differences.

### *3.1 Source selection collection during the Systematic review*

For the source selection during the Systematic review the researchers first established the search criteria, language, search methods and the source list.

For our Systematic review, the studies were sourced from online databases that are freely available to access. The University of Pretoria was used as main resource but there was also material reviewed that is available on the Web from reliable academic institutions. The review also included academic books and all journals that were considered was peer reviewed. Only articles were considered that was written in English.

For our searches we used the online search engines and the University of Pretoria Library search mechanisms. We first considered the titles of the source and after that the abstracts were considered in order to further filter out irrelevant materials. The final list of sources was read completely to find the proper materials.

### *3.2 Execution of the Systematic review*

A search done on the different search engines provided more than 100 significant sources on PM. Due to the nature of PM numerous sources repeat the same information. The sample of how the table was constructed during the Systematic Review is provided in Table 1. Due to limited space it is not possible to list all the sources in this article, but it is

available on request from the authors. In Table 1 the name of the source, theme considered in the source, reason for inclusion and search key used to find the resource is listed.

*Table 1: Data sources for data collection*

| Citation | Name | Theme | Inclusion | Search key |
|---|---|---|---|---|
| (Avison, Baskerville, & Myers, 2001)[11] | Controlling action research projects | Research Projects | Contains research processes And research principles | Research projects |
| (Mauthner, 1997)[12] | Methodological Aspects of Collecting Data from Children: Lessons from Three Research Projects | Research Projects | Contains research processes And research principles | Research projects |
| (Denscombe, 2014)[13] | The Good Research Guide: For Small-scale Social Research Projects | Research Projects | Contains research processes And research principles | Research projects |
| (Bell, 2014)[14] | Doing Your Research Project: A Guide for First-Time Researchers | Research Projects | Contains research processes And research principles | Research project process |
| (Akker, Bannan, Kelly, Nieveen, & Plomp, 2007)[15] | An Introduction to Educational Design Research | Research Projects | Contains research processes And research principles | Research project process |
| (Packendorff, 1995)[16] | Inquiring into the temporary organization: new directions for PM research | Research Projects | Contains research processes And research principles | Research PM processes |
| (Meade & Presley, 2002)[17] | R&D Project Selection Using the Analytic Network Process | Research Projects | Contains research processes | Research PM processes |
| (McNiff & Whitehead, 2009)[18] | You and Your Action Research Project | Research Projects | Contains research processes And research principles | Research PM processes |
| (Pinto & Slevin, 1989)[19] | Critical Success Factors In R&D Projects | Research Projects | Contains research processes And Success factors | Research PM Success Factors |
| (Pinto & Mantel Jr, 1990)[20] | The causes of project failure | Research Projects | Contains research processes And Success factors | Research PM Success Factors |

## 4. A comparison of Processes in System and Research Projects

Project management as we use it today is relatively modern. Different methods of restructuring management and adapting special management techniques are used in order to control and use your resources more effectively [25]. Forty years ago PM was a concept used by the U.S. Department of Defence contractors and construction companies. Today PM is used in diverse fields including construction, chemicals, banking and hospitals. In the 1980 software development sectors also started to use PM during the software development life cycle [26]. In this study our focus was on the difference between traditional software development PM and PM for research projects.

### *4.1 Project Management in Traditional Systems Development projects*

Project management (PM) can be applied to all projects in general, but not all projects are the same. If the history of PM is considered, system development (SD) projects are a new type of project to be managed, which has its own unique way in which it is managed. During PM the project manager needs to consider the project initiation, planning, execution, monitoring and control, and closure. The following gives an overview of the activities is followed during the SD project:

- *Project initiation* is the phase where the feasibility of the project is established. During the initiation of the project a cost benefit analysis is conducted to establish if the project and the system will be useful and consider if there are not alternatives to developing a new system from scratch. At the end of this process the team should make recommendations as to whether the project can continue or terminated.
- *Project planning* is the phase where the project is planned and milestones are set to measure the project. In the system development project requirements of the system are collected that include all angles and be as complete as possible. The end user's requirements should be included into the requirement. Problems need to be identified and planned for properly to ensure they do not become issues later on in the project.
- *Project execution* is the phase where the work that has been planned in the project planning process is executed. In SD projects this is where the requirements of the business are met. This phase entails designing the system, developing and then implementing the system. The design shows the layout of screens, functionality and features of the system to be made. The development phase uses the design and creates the end product using development tools. During implementation the system are placed into the business itself.
- *Project monitoring and control* is where the tasks are scrutinized to ensure quality and to identify any problems that might arise and correct them. For system development projects this phase will include testing as well as the feedback from the business.
- *Project closure* is when the project is complete and the project is evaluated for the success. In SD projects this phase cannot commence as long as there is a maintenance agreement. These projects get evaluated by customers and if all the requirements that were identified were met.

Schwalbe [5] states that the two most important principals of PM are to ensure that your projects are driven by your strategy and to engage your stakeholders. Kearns [6] defined eight principles for SD projects, namely:

1. Get the user of the systems involved
2. Use a problem solving approach
3. Establish phases and activities
4. Establish standards for consistent development and documentation
5. Justify systems as capital investments
6. Don't be afraid to cancel or revise scope
7. Divide and conquer
8. Design systems for growth and change.

The first principle is the same as involving your stakeholders. The second principle, *Use a problem solving approach*, is necessary since the purpose of the SD project is mostly to fulfil a need or to prevent a problem. Principle 3, *Establishing phases and activities,* involves the proper planning and Principle 4, *Establish standards* involves the documentation of standards to ensure clear communication. Systems must be implemented only if it is a profitable endeavour as long as it aligns with the businesses strategy (Principle 5). Principle 6, *Don't be afraid to cancel or revise scope,* guides the PM to revise the scope at any time. A word of warning is that the PM should always be cautious of scope creep. For Principle 7, *Divide and conquer*, the project is broken into smaller pieces to be managed properly because the project might be very large and complex and too much to handle as a whole. When designing the system it must designed in such a manner that it makes provision for *growth and to be changed* (Principle 8).

According to Schwalbe [5] the success factors of a SD project include adequate funding, staff expertise and engagement from all stakeholders. Adequate funding for a project is necessary for the allocation of resources, without enough funding the project will

run out of resources and fail to be completed. Staff expertise is a valuable resource and have people with the proper skill can help the project be a success. Engagement of all stakeholders has been mentioned earlier is a critical part of the projects success.

### *4.2 Project Management in Research projects*

According to OECD [7] research is "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications" [7]. Research projects need to be managed just like any other project and can have its own challenges and have its own subtypes within them. As mentioned, during PM the project manager needs to consider the project initiation, planning, execution, monitoring and control, and closure. Research projects might include their own activities during a phase, but still follows these phases.

- *Project initiation* starts by looking at three processes. Firstly the identification of a research problem that forms the basis of the research project. The second step is the literature review where the existing literature that have been done on this topic is discussed [8]. The literature review gives background to show what has been done and to ensure the validity of the study. The next step is to clarify what the purpose of the research is.
- During the *project planning* process the specific research questions are identified that needs to be answered by the research. The research questions are an indication of the scope of the research. The planning process involves also the creation of the conceptual framework for the research. This is useful when making comparisons or placing into context complex ideas [8]. It also helps in the collection and analysis of data. Finally in this phase the methodology gets chosen to fit with the type of research that is conducted.
- The *Project execution* phase is where the actual research gets done. The data collection method that has been chosen in the planning process is applied and data is gathered and stored for analysis. After the required data has been collected the analysis process starts. The data is processed into useful information that has relevance to the topic in the endeavour to answer the research questions [8]. After the analysis process the information is interpreted and a conclusion is provided on the contribution of the research study.
- Project *monitoring and control* includes the reporting and evaluation process, which entails the checking that the sources of the data that are used are valid and from credible sources [8], that the data collection and analysis process were conducted with rigour and that the contribution aligns with the data collected.
- The final process is the *project close* where the research findings, recommendations and future research (if any) are defined [8].

In a collaborative research project, capacity, flexibility, effective communication, shared power and knowledge are important [9]. *Capacity* in this context means that the people involved in the project need to have the capacity to contribute and do what is required of them to add to the research. Research is commonly an academic field which requires people with the capacity to write, analyse and interpret data to contribute to the body of knowledge in academia. *Flexibility* refers to the team members that should be flexible during the research project and accommodate members from the project team. To gather data properly the members of the project team need to accommodate the research subjects when it is available. The project needs to be flexible enough to be able to adapt to the problems that arise in the duration of the project. The effective *communication* between the members of the team is required to make sure the research is done effectively and also to keep

consistency in the methods that is used during the project. *Shared power* means that everyone involved in the project has a voice to contribute to the research equally given the specific context of the research while *knowledge* should be shared and not monopolized by a few members in the team. The knowledge must be added to the greater body of knowledge based on that topic.

According to Kaya, Oner, & Başoğlu [10] the critical success factors for research projects are:

1. Type and quality of people
2. Project manager's ability to communicate.
3. Project manager's ability to lead
4. Project requirements
5. Total quality management project.

*Adequate quality* refers to the quality of the project team where they need to be able to contribute properly and bring knowledge to the project. The project manager needs to be able to *communicate* properly and make sure all channels are accessible to enable communication. This is critical as without proper communication the project will be inconsistent and be at risk for failure. The project manager needs to be able *to lead the team* and control the project to ensure it gets done. If a project manager cannot lead a project the project will have no direction and will be at risk. The *project requirements* need to be clear from the beginning of the project. When research projects are done and the requirements are not clear the research that is done might not be useful. Lastly, the research that is done needs to be monitored regular to ensure it is of top *quality*. If all these factors are met the project has a good chance of succeeding.

## 5. Comparison of System and Research Projects

Although there are many different types of projects, it is obvious that the project management tasks as described above differs from systems development project management tasks. For a project manager that was involved in either one of the two types of projects, knowledge on the similarities and differences might be useful when involved in the other type of project. Understanding the similarities and differences should enable the project manager to transfer knowledge gained from the previous project type to the new one. This can also be used to transfer knowledge to new project managers to see how similar or different the two types of projects are.

During the systematic review we specifically considered processes, principles and success factors of both types of projects. The factors were compared with one another to determine if there are any overlapping themes. In Figure 1 a summary is given to indicate the frequency of process factors mentioned.

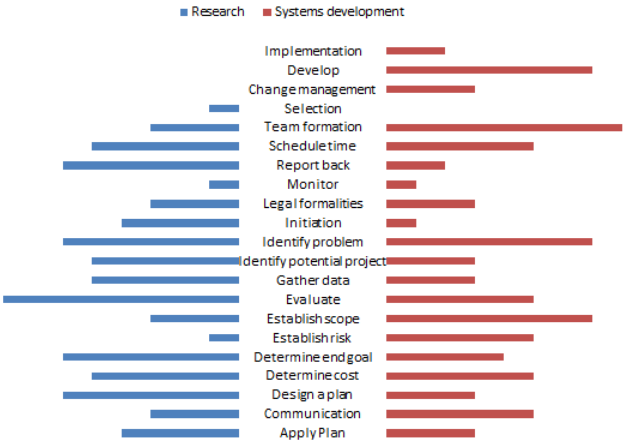


*Figure 1: Process factors frequency in PM and SD projects*

In Figure 1 blue lines indicate research projects and the red SD projects. The top four processes show that they are unique to their specific project type. For example, the goal of research is not to implement anything (although a development might be part of the research process. Similarly change management is a theme that are linked to SD projects and usually not linked to research projects. Even though the same processes are mentioned in the two projects they are not as prevalent in both. The 2 processes that appear in both PM and SD projects, are the *Evaluation and Identify Problem* with a frequency of being mentioned 13 times. This implies that in both research projects and SD projects there should be extra consideration both those processes.

For principal factors, 16 different themes were identified during the data analysis process (Figure 2). *Ethics* and *troubleshooting* were the only significant themes that emerged in research projects that were not pertinent in systems development project management while themes that were pertinent to SD included *Automation, Conflict management, Build relationships, Expectation management* and *Support*.

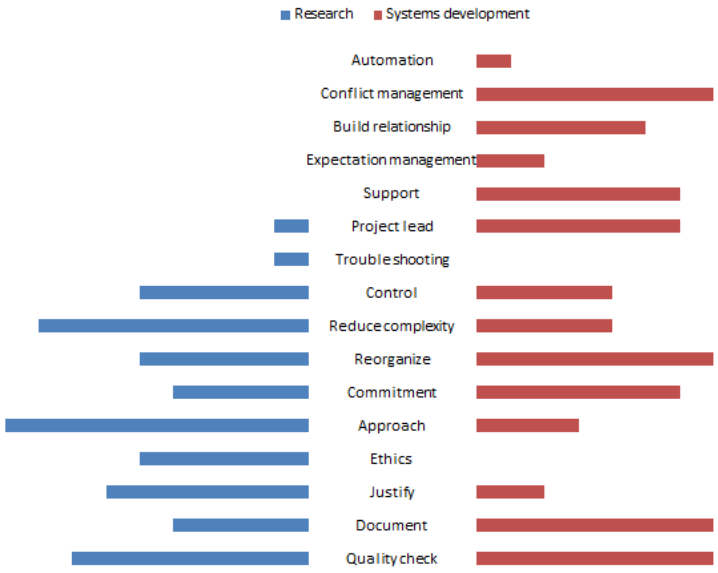


*Figure 2: Principals factors frequency in PM and SD projects*

The principle that was mentioned the most in both projects were *Quality Check*, which implies that in both research projects and SD projects there should be extra consideration when checking the quality of the project and making sure it is on track to reach the end goals. In research projects the *Approach* followed to do the research are mentioned the most with *Conflict Management, Reorganize and Documentation* emerging as significant themes in SD projects.

There was a significant difference in the success factors listed for research and those listed for SD projects (Figure 2). As was the case for the processes and the principal factors discussed above, there were a number of themes that emerged for both the projects types but also a significant number of themes that did not match. For SD and research projects the success factors that were mentioned in most of the resources for both projects was the *Client acceptance* as well as *Provide benefit.* An indication of the importance of the two factors for project success – the project manager need to ensure that the client will accept the project and that it provides some benefit to the stakeholders. In the case of research projects the *Client acceptance* was mentioned in cases where research produced an artefact. In SD projects *Resource allocation* still remained the most mentioned theme that supports the notion that project management focuses on the effective use of resources to be successful.

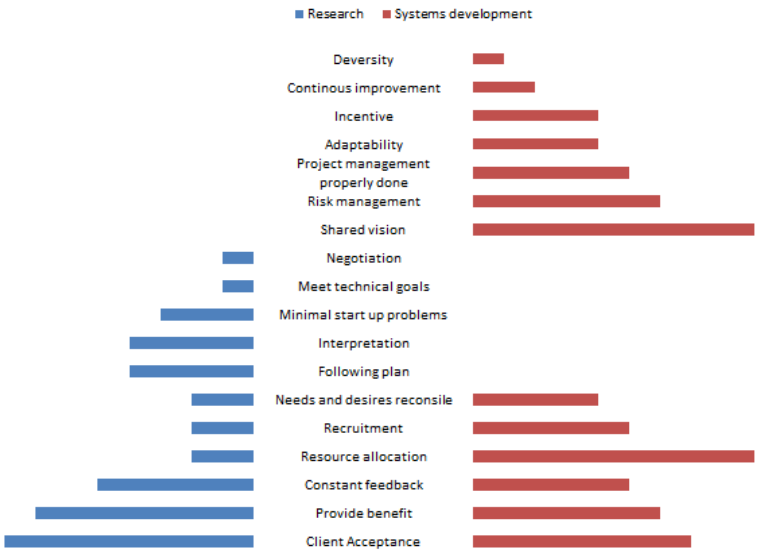


*Figure 3: Success factors listed in research and systems development projects*

## 6. Conclusion

The purpose of this research was to look at research projects and system development projects and investigate if there are many commonalities or to what extend are they different.

During the systematic review sources were selected, data collected and themes identified in order to compare the perceived importance of the themes using the number of references to each theme as indication. The different themes were contrasted with one another themes that emerged as important from a SD perspective was the *Selection of the team*, *Conflict Management, Reorganize, Documentation* and a shared vision. From a research perspective the *Quality, Research Approach* and *Acceptance* of the project were highly referenced. The process and principals had the most commonality in themes, where success factors had the most different themes.

Project management remains a complex process to manage in different types of projects. The purpose of this research was to investigate how it is conducted in two types of projects. Further research is necessary to investigate which tools used in project management is ideal for both SD and research projects and to what extend a research project is really 'manageable'.

## References

[1] PMI. (2010, May 22). *The Value of Project Management* . Retrieved 05 23, 2015, from PMI: http://www.pmi.org/Business-Solutions/~/media/PDF/Business-Solutions/Value%20of%20Project%20Management_FINAL.ashx

[2] Aconfiny, D. (2012). Applying the managemnt system methodology to a project management problem situation. In D. Y. Kadiri, *TOTAL PROJECT MANAGEMENT (A Systems Approach) PUTTING THE PIECES TOGETHER* (pp. 73-74). n.a: Lulu.com.

[3] Chaleunvong, K. (2013). *Data Collection Techniques.* Retrieved 06 05, 2015, from Training Course in Reproductive Health Research Vientine: http://www. gfmer. ch/Activites_internationales_Fr/Laos/Data_collection_tecniques_Chaleunvong_Laos _2009. Htm

[4] Higgins, J. P. (2008). *Cochrane handbook for systematic reviews of interventions* (Vol. 5). Chichester: Wiley-Blackwell.

[5] Schwalbe, K. (2014). *Information technology project management* (7 ed.). Boston: Cengage Learning.

[6] Kearns, G. S. (2002, n.a. n.a.). *Systems Development Life Cycle*. Retrieved 05 23, 2015, from university of south florida: http://faculty.usfsp.edu/gkearns/

[7] OECD. (2002). *Proposed Standard Practice for Surveys on Research and Experimental Development.* Paris: OECD.

[8] J.W., C. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research.* Upper Saddle River: Prentice Hall.
[9] University of Alaska Anchorage. (2012, 5 26). PRINCIPLES OF SUCCESSFUL Community-Based Participatory Research PROJECTS. Available from https://www.uaa.alaska.edu/engage/funding/Faculty_Resources/upload/PRINCIPLES-OF-SUCCESSFUL-CBR-PROJECTS.pdf, Anchorage, Alaska, USA.
[10] Kaya, İ., Oner, M. A., & Başoğlu, N. (2003, 08 16). Critical Success Factors in R&D Project Management in Military Systems Acquisition and a Suggested R&D Project Selection Methodology for Turkish Armed Forces. Kayisdagi, Istanbul, Turkey.
[11] Avison, D., Baskerville, R., & Myers, M. (2001). Controlling action research projects. *Information Technology & People, 14*(1), 28-45.
[12] Mauthner, M. (1997). Methodological Aspects of Collecting. *CHILDREN & SOCIETY, 11*, 16±28.
[13] Denscombe, M. (2014). Action research. In 5 (Ed.), *The Good Research Guide: For Small-scale Social Research Projects* (pp. 122-128). new york: McGraw Hill Education.
[14] Bell, J. (2014). *Doing Your Research Project: A Guide for First-Time Researchers* (6 ed.). New York: McGraw Hill Education.
[15] Akker, J. v., Bannan, B., Kelly, A. E., Nieveen, N., & Plomp, T. (2007). An Introduction to Educational Design Research. Shangai: Netherlands institute for curriculum development.
[16] Packendorff, J. (1995). INQUIRING INTO THE TEMPORARY ORGANIZATION: NEW DIRECTIONS FOR PROJECT MANAGEMENT RESEARCH. *Scandinavian Journal of Management, 11*(4), 319-33.
[17] Meade, L. M., & Presley, A. (2002). R&D Project Selection Using the Analytic Network Process. *IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, 49*(1), 59-66.
[18] McNiff, J., & Whitehead, J. (2009). *You and Your Action Research Project* (3 ed.). New york: Routledge.
[19] Pinto, J. K., & Slevin, D. P. (1989). Critical Success Factors In R&D Projects. *Research Technology Management, 32*(1), 31.
[20] Pinto, J. K., & Mantel Jr, S. J. (1990). The causes of project failure. *IEEE Transactions on Engineering Management, 37*(4), 269-276.
[21] Marnewick, C. (2012) A longitudinal analysis of ICT project success. SAICSIT '12 Proceedings of the South African Institute for Computer Scientists and Information Technologists Conference, Pages 326-334, South Africa.
[22] Tayolr, H., Woelfer, J.P. (2009) Critical skills for IT project management and how they are learned, SIGMIS CPR '09 Proceedings of the special interest group on management information system's 47th annual conference on Computer personnel research Pages 103-112, ACM New York, NY, USA.
[23] Kontio, J., (1999) Risk management in software development: a technology overview and the Riskit method, ICSE '99: Proceedings of the 21st international conference on Software engineering, May 1999.
[24] PMBOK (2016) PMBOK Guide and Standards, On-line available at http://www.pmi.org/PMBOK-Guide-and-Standards.aspx/
[25] Kerzner, H.R., (2013) Project Management: A Systems Approach to Planning, Scheduling and Controlling, 11th Edition, The International Institute for Learning, New York, Wiley.
[26] Kwak, Y.H., (2003) Brief History of Project Management, published in *The Story of Managing Projects* by (Carayannis, Kwak, and Anbari), Quorum Books.