

THE IDEA OF OPERATIONALIZATION OF THE CONCEPTUAL MODEL OF PROJECT DRIVEN ORDERS FOR SMALL AND MEDIUM-SIZED ENTERPRISES IN CONDITION OF UNCERTAINTY

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Summary: In the chapter the main idea of a conceptual model is presented. The model is being prepared in order to define the project driven order dedicated to small and medium-sized enterprises (SMEs), with particular emphasis on conditions of uncertainty. Its operating model and in the context of the solutions show that it may constitute an additional dimension to the management of production processes or service implemented ordered by individual and unique customer requirements.

Keywords: project, conceptual model, project driven orders, small and medium-sized enterprises, uncertainty.

1. Introduction

Majority of enterprises, especially small and medium-sized ones, manage many projects on a daily basis. Most projects are realized by enterprises in a multi-project environment. The analysis of scientific researches indicates that 84% small and medium size enterprises work with multiple projects. Another results indicates the predominance of projects with less than 50 activities (84%) and about 95% of projects have less than 100 activities [1, 2]. Projects of such type are more and more complex and their level of complexity and connection with other orders influence complexity of the planning process.

The need to manage a one-of a kind project (project driven order) has been a commonplace since the construction of the pyramids in Egypt [3]. Projects are very common in the enterprises [4].

Project management has been discussed by many researches. The reasons that attract researchers to this topic could be the following:

- project management is a challenging issue for enterprises, organizations,
- project management is very broad, there are opportunities for future research,
- project management has impact on a range of practices.

In environments related to project management there is a strong need for developing the theory of this field of knowledge, which recently has been strongly emphasised in the works of Engwall [5], Meredith [6] and Morris [7]. The last paper is a kind of retrospective research note. The discussion in the paper bases on ontology, epistemology, and methodology of project management. Figure 1 presents the global view of project management over the past five or more decades.

Project driven orders is becoming increasingly popular in recent years. It is the result of transforming on goods market. Project-based working is widespread today [8, 9]. The business model is transforming from the traditional, mass production oriented model to

make-to-order oriented model. In practice it means execution of unique, single, customized orders [10]. These kinds of orders can be treated as project driven orders. An enterprise in the demand-driven make-to-order environment supply a wide variety of products requiring a customized product. Management of complex, multi-parametrical and multi-criteria problems of project driven orders is one of the significant challenges of the project management, especially in small and medium-sized enterprises. Realization of project has become more and more significant. A project driven order can be defined as a set of coordinated activities realized in an integrated and unique way to achieve the strategic and operational aims and objectives using limited resources. A project represents a form of investment. The outcomes can be treated as a return on this investment. Each project driven order should be treated as an investment opportunity.

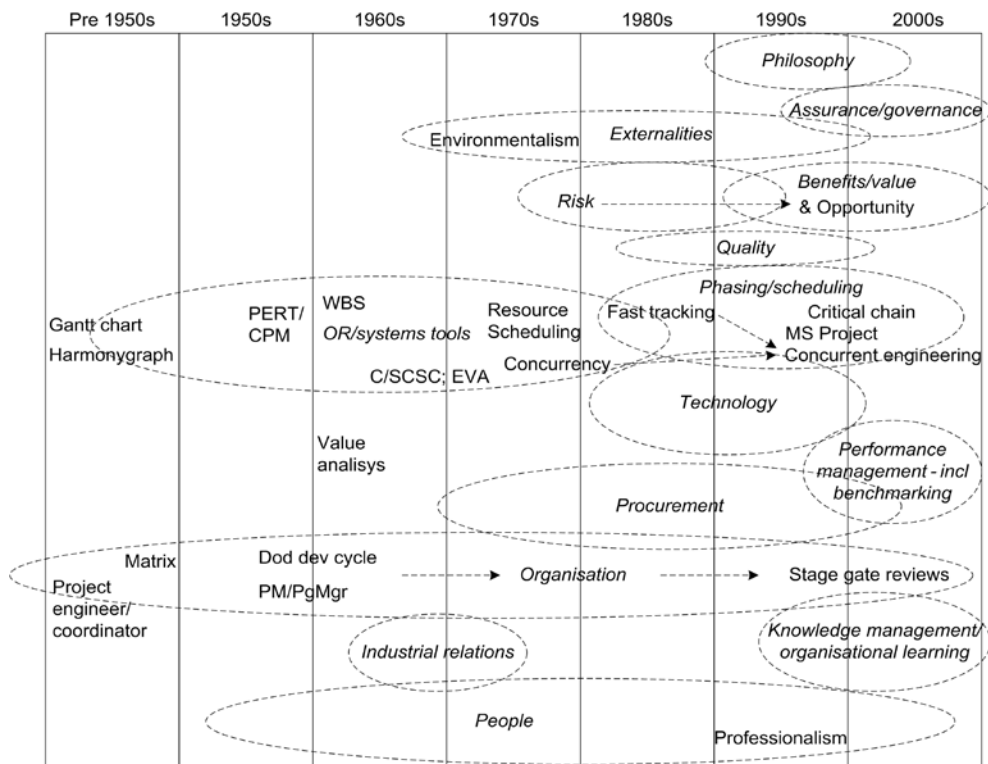


Fig. 1. The project management over last decades [7]

The purpose of the chapter is to present the main idea of a conceptual model. The model is prepared in order to define the project driven order dedicated to small and medium-sized enterprises (SMEs), with particular emphasis on conditions of uncertainty, propose its operating model and in the context of the solutions show that it may constitute an additional dimension to the management of production processes or service implemented ordered by individual and unique customer requirements.

2. The nature of project management in small and medium-sized enterprises

According to the definition of micro, small and medium-sized enterprises prepared by European Commission the micro enterprise is an enterprise with fewer than 10 employees, and turnover of less than €2 million, small enterprise is an enterprise with fewer than 50 employees, and turnover of less than €10 million. The medium sized enterprise is an enterprise with fewer than 250 employees, and turnover of less than €50 million [11].

The SMEs play a very important role in the economy as economic and social development. They are the key generators of employment and income, and drivers of innovation and growth [11, 12, 13]. These type of enterprises account 99,8% of all companies in the European Union, generate 56% of GDP and employ 67% of private sector workers [14]. Furthermore, 91 % of these enterprises are micro-firms with less than 10 workers. Given their importance in all economies, they are essential for the economic recovery [13]. In Poland SMEs generate 47,4% of GDP, 30,1% of GDP is generated by micro enterprises, 7,3% of GDP by small-sized enterprises and 10,0% of GDP by medium-sized enterprises [15]. According to paper [16] projects account on average for one third of the turnover of SMEs. Additionally, the paper shows that the projects in small and size enterprises account for almost one fifth of the economy.

Small and medium-sized enterprises differ from large enterprises. These type of enterprises require simple planning and control systems, informal evaluation and reporting. SMEs have a low level of standardization of procedures and low level of specialization, with multi-tasking. Small and medium-sized enterprises have a high level of innovativeness. People in SMEs prefer tested techniques. It is a consequence of failure in these kind of enterprises [14].

According to the paper [17] small and medium-sized enterprises need project management of their new, innovation project driven orders. But the project management requirements should be different than the traditional forms of project management for larger projects undertaken in large enterprises.

Project management is differ from manufacturing-type operations in that project management is the business process of producing a unique product, service, or result over a finite period of time [18]. The aim of project management is to achieve all of the project goals and objectives while adhering to project constraints [19]. The most commonly used project outcome measures (measure of project success) include cost, schedule, technical performance outcomes and client satisfaction. It can be treated as multidimensional parameter [20, 21]. Planning and realization of orders of a project type bear a certain level of uncertainty. Uncertainty related with estimating time, cost and course of realization of orders of a project type is a crucial feature of orders realized mainly in small and medium-sized companies. Such orders are most often of non-deterministic character. Due to a complex character of orders of a project type and their realization within a given planning horizon it is essential to provide tools that enable solving problems in conditions of uncertainty. There is a strong need to develop the right methodologies aiding decision makers in complex situations, situations connected with solving problems that integrate various subproblems, e.g. time and cost planning for order of a project type, assigning resources, planning the course of work, scheduling, risk identification and risk assessment for orders of a project type and the like.

The last few years brought us attempts of systematization of achievements in the field of project management. Such attempts were made by Bredillet, who published an article

entitled “Exploring research in project management: Nine schools in project management research” in *Project Management Journal* in 2008 [22]. The author presented progress in development of project management and defining research trends in every school of thought on project management.

Project management is a subject of more and more number of research works in main academic centres. Research results are published in prestigious scientific magazines, such as: *Project Management Journal*, *International Journal of Project Management*, *Long Range Planning*, *European Management Journal*. Project management practitioners and theorists meet at congresses concerning the topic. Project Management Association Poland is an association that actively operates in Poland. The number of research centres actively dealing with the subject of project management is constantly growing. The centres form the Department of Project Management within their own framework (the first operating department in Poland was run by professor Trocki in Warsaw School of Economics).

Project management has developed significantly in the last three decades, which can be seen by evolution of methodologies on project management, the number of certification programmes for project managers, awareness of the influence of projects on positive results of an organization. New approach to the topic brings the need for developing new methods, adequate to particular disciplines.

There is a good reason why the developed methodology of managing orders of a project type in conditions of uncertainty is dedicated to small and medium-sized companies (SMC). All project management methodologies created within the last several dozen years, such as PMBoK, PRINCE2, Agile, SCRUM or TenStep were made for large companies realizing enormous projects (involving large amount of resources, large costs and a lot of time). In times of omnipresent capitalism companies realizing orders of a lot smaller range, capital and time of realization than it would seem from the original destination of the methodologies are prevailing. Nevertheless, managing production or service processes realized according to individual and unique demands still bears characteristics of a project. Such orders serve as the ground for further research.

Analysis of common production practices shows that small and medium-sized companies are forced to cope with realization of orders of a project type alone and it usually resembles ad hoc action rather than systematized set of methods that constitutes coherent approach to project management or at least rules concerning particular work or course of action leading to a certain goal.

Project methodologies usually attempt to impose only general rules. This shows that they are developed in such a way as to have the widest possible application, which may make them too general for some projects. Therefore, for every project to be successful, it is essential to apply the right methodology as well as using its elements in accordance with the guidelines in order to increase efficiency of project realization. For instance, in case of PRINCE2 methodology, instead of choosing single elements, the whole methodology ought to be adapted to a project. Adapting the methodology may mean applying all principles, adapting topics and implementing processes, which is a big challenge for project managers.

This is the reason why consulting companies are responsible for implementing and providing training in the field. Only companies employing workers highly qualified in project management may implement new project methodologies on their own. Such course of action requires a lot of commitment from the management so that new working principles may be introduced. This approach is risky due to the fact that workers taking part in a project have little experience.

Small and medium-sized companies, whose goal is often minimizing all operational costs, usually do not implement new rules. A large cost of implementation, training courses and certification is usually too big an obstacle for small and medium-sized companies to overcome. A global crisis observed in the last several months is becoming the reason for organizations to apply more restrictions as far as costs are concerned, which in turn very often means reduction of management or production engineering costs in production and service practice.

Any failures in these fields significantly reduce modern company's competitiveness, while in the era of globalization success on the market often depends on abilities of precise management of production processes realized according to individual and unique customers' demands. Never before have business entities been forced so strongly by market competitiveness to achieving maximum efficiency in time of production realization, used resources and costs. Efficient production process management is undoubtedly the key to achieving superiority on the market and ensuring customer's satisfaction.

Small and medium-sized companies fulfilling orders of a project type is at risk of losing customers, because project management requires vast knowledge, experience and tools, methods and techniques in planning processes to meet or exceed customers' expectations. This requires coordination of many parameters, such as: time, costs, clients' needs and expectations, aims of a project.

3. The aim of the researches

Lack of methodology of managing orders of a project type dedicated to small and medium-sized companies with the need for increasing their competitiveness is the main premise for taking up the research. Adaptability of known project methodologies for small and medium-sized companies is plausible, but it involves too high financial costs (implementation with professional help of a consulting company) and/or hiring employees highly qualified in the field of project management. Known methodologies serve as compendiums, which are a selection of good practices so proper adaptation would mean identifying key areas of a certain project and choosing the right tools and techniques improving realization of the project within the framework of these areas. The task is complicated for companies realizing this type of orders due to a non-prescriptive character of the sets of knowledge and loose relations with other areas.

The analysis of production habits of small and medium-sized companies indicates that a rather bold hypothesis may be made that there is a possibility of developing a methodology of managing orders of a project type dedicated to small and medium-sized companies taking conditions of uncertainty into account.

The issue of planning realization of orders of a project type in conditions of uncertainty is still open and requires a solution. There have been no attempts of creating a universal methodology covering time and cost analysis of a project, limited access to resources, risk assessment, supplier selection and the like, dedicated to small and medium-sized companies dealing with production based on orders of a project type. Examining condition of knowledge on the subject of project management and establishing what the purpose of developing and implementing methodology of managing orders of a project type in small and medium-sized companies is will serve as a perfect workshop defining directions of the developed methodology. Consulting people responsible for managing orders will allow complex analysis of noticeable imperfections in implementations of known methodologies

for SMC, which in turn will enable development of guidelines and basics of methodology of managing orders of a project type dedicated mainly to small and medium-sized companies.

What is original is the approach to planning time, costs and risk of orders of a project type, considering conditions of uncertainty (e.g. modelling with the use of fuzzy sets theory, making different variants of realization of a project on the basis of a cost curve, managing buffers of a project in accordance with the concept of a critical chain) in a specific way. Developing such a work in detail will enable gaining a less general methodology than other commonly known ones, but it will provide management of small and medium-sized companies with ready-made methods of efficient managing of orders of a project type.

Introducing stages, such as: developing methods of evaluation and selection of suppliers of orders of a project type, developing the basics for CRM system for small and medium-sized companies and approach to multi-criteria evaluation of efficiency of realization of orders of a project type is the next novelty is the sphere of theoretizing about project methodologies. Fields of knowledge included in the stages have been almost entirely ignored in commonly known methodologies, but they play a significant role in holistic project realization, often deciding about success and failure.

The need for further research into the operationalization of the conceptual model of project driven orders for small and medium-sized enterprises in condition of uncertainty is the results of researches undertaken by Turney J.R., Ledwith A., Kelly J. [14, 17]. They developed researches in small and medium-sized enterprises in Ireland, Sweden, Austria, Romania. The researchers described the differences observed by size of enterprise, industry and country [17]. Another researches were developed in 280 companies. The companies were divided into micro, small and medium companies, and hi-tech, low-tech and service industries [14]. In paper [23] the results of the research of the extent to which small and medium-sized enterprises use project management are presented.

The purpose of the study is to develop a conceptual model to define the project driven order dedicated to small and medium-sized enterprises (SMEs), with particular emphasis on conditions of uncertainty, propose its operating model and in the context of the solutions show that it may constitute an additional dimension to the management of production processes or service implemented ordered by individual and unique customer requirements. The introduction of stochastic elements into the considered model is necessary. The stochastic model is less precise but more robust [24, 25, 26].

With regard to the formulated research objectives, the following research hypotheses:

- H1. Management of production processes or service undertaken at the request according to the individual and unique customer requirements has all the characteristics of the project.
- H2. Terms of uncertainty significantly influence the choice of how to plan a project driven order, as a consequence of projecting the obtained result and the fulfillment (or not) the assumptions.
- H3. There is no methodology of project driven order management dedicated to small and medium enterprises.
- H4. It is possible to develop a methodology for project driven order management dedicated to small and medium-sized enterprises to the conditions of uncertainty.

Arrangement of concepts, definitions and classifications related to the concept of a project driven order and consequently the definition of the project driven order in SMEs is a purely cognitive, which is enriched by the utilitarian aspect of the study of knowledge among the managerial staff of small and medium enterprises.

Desirability of further research to develop and implement a methodology for project driven order management in SMEs to verify the hypothesis concerning the lack of a dedicated to a group of SMEs methodology and validation of the conceptual model. A critical review of project management methodologies based on the available literature will serve domestic and international development objectives and guidelines approach to project project driven management dedicated to SMEs. This phase of research will also provide a basis for the formulation of a conceptual model of project driven orders design under uncertainty. Validation of the model is to say that the developed theories and assumptions are correct and that the model representation of the real system in which orders are carried out such a project, its structure, relationships, causal, logical, mathematical are reasonable in the area of intended use of the model.

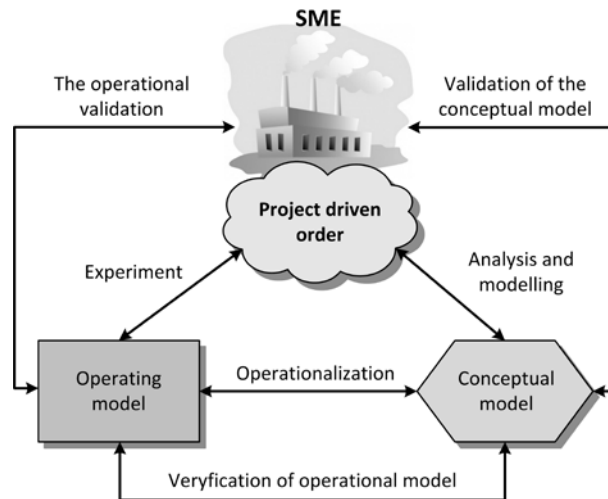


Fig. 2. The idea of the research

Operationalization of the conceptual model of the project driven order will consist of mapping the conceptual model and in an operating model and will be useful to design methodology including project type through the choice of methods and techniques, the source database and the decision as to whether the resulting analysis of empirical material. The need for a holistic approach requires the development of partial methods underlying the methodology. It is necessary to develop methods/techniques for the growing areas of project driven orders management: time management, cost management, risk management, supplier management, evaluation of effectiveness. Validation of operational, designed to test individual components such project driven order management in accordance with the conceptual model and assess their relevance and impact on the efficacy of the methodology in SMEs, will be held in the form of experiments and computer simulations. It will apply to determine the precision of the results of operational model for implementation of the specific purpose of research in the adopted experimental simulation environment to allow for the development of conditions for use of the methodology in practice the operation of SMEs.

4. Multi aspects of the research

The proposed research together with main goals allow to form the following thesis: there is a possibility of developing the methodology of managing orders of a project type in conditions of uncertainty dedicated to small and medium-sized companies. Conducting the research requires accepting the following assumptions:

- make to order – type of production in small and medium-sized companies,
- analogy of production in SMC to project management,
- planning the realization of orders of a project type takes place without full access to information,
- information on an order is incomplete,
- information on production process is incomplete,
- information on the environment of production process is incomplete,
- access to complete information is limited,
- time of order realization is defined by a client,
- cost of realization of an order is defined by a client,
- selection of a supplier is related to taking a new order of project type,
- the risk of failure in realization of an order of project type is the result of both internal and external factors.

Realization of management methodology for orders of a project type in small and medium-sized companies requires solving the following tasks:

1. Assessing the knowledge in project management small and medium-sized companies.
2. Examining the purpose of developing and implementing methodology on managing orders of a project type in small and medium-sized companies.
3. Developing foundations and basics of methodology of managing orders of a project type for small and medium-sized companies.
4. Developing a method of time and cost planning as well as risk assessment for orders of a project type.
5. Developing a model of an order of a project type.
6. Modelling orders of a project type – analysing usability of available computer tools.
7. Developing a method of assessment and selection of suppliers for orders of a project type.
8. Developing basics of CRM system for small and medium-sized companies.
9. Developing the right approach to multi-criteria evaluation of efficiency of realization of orders of a project type.
10. Developing conditions of applying methodology in real conditions in which the examined companies function.
11. Developing a publication presenting effects of project realization.

Developing a given project methodology for a group of small and medium-sized companies will be preceded by two stage research. The main form of conducting such research will be a direct interview, which will aid surveys. The first part, concerning assessment of knowledge on project management in organizations realizing orders of a project type will consist in collecting basic information on awareness and preferences of using specific tools and techniques facilitating all fields of knowledge in project

management as well as defining stages during a holistic realization of orders of a project type. The second part, examining purposefulness of the elaboration and implementation of the methodology of managing orders of a project type in SMC, will concern analysis of responders' expectations on initially defined guidelines and solutions suggested in a developed methodology by a research team (in particular on a group of SMC). Originally defined guidelines are introduced to members of project teams in the form of questions about their acceptance. Open questions, however, enable getting acquainted with authorial proposals of examined entities, which will finally allow to develop a whole spectrum of desirable expectations. Presentation of research results will consist in confronting abilities of fulfilling certain suggestions with actual capacity, which is limited.

Final guidelines and the shape of the methodology of managing orders of a project type dedicated to small and medium-sized companies will be the result of the conducted research. The developed model of an order of a project type will serve as a foundation for other developments (method of planning time, costs and selection of suppliers, the concept of CRM system, approach to multi-criteria evaluation of efficiency of realization of orders of a project type), which, having been verified on practical examples will allow their further evaluation. Discrepancies between values obtained in projects realized in accordance with the model and guidelines and projects realized in real life will be defined by an expert method. This operation will enable developing conditions for applying the methodology in real conditions in which the examined companies function. Results of the research will be published in the form of articles in magazines of monographs, both in Polish and English.

5. Expected results of research

The final effect of the project will be the methodology of managing orders of a project type in conditions of uncertainty dedicated to small and medium-sized companies. The added value of the project will consist in developing an approach to managing orders of a project type in the following areas: time, cost, course, choice of suppliers, risk characteristic for orders of a project type realized in small and medium-sized companies. The next novelty in the field of theoretizing about project methodologies is introduction of the following stages: developing a method of evaluating and selecting suppliers for orders of a project type, developing the basics of CRM system for small and medium-sized companies and developing an approach to multi-criteria evaluation of efficiency of realization of orders of a project type. Fields of knowledge included in the stages have been almost completely ignored in the known methodologies. Nevertheless, they play an important part in holistic realization of projects and are often decisive for their success or failure.

Results of the research will be used to prepare scientific publications in the form of articles in magazines and monographs, presenting particular stages of research on developing a methodology of managing orders of a project type in conditions of uncertainty dedicated to small and medium-sized companies. A cycle of speeches to be given on conferences in the country and abroad is planned in relation to the prepared analysis. The final publication of a monograph presenting results of the conducted research will constitute a research material contributing to a new scientific discipline, production engineering in the field of project management. The scientific material will also serve as a valuable aid in the process of student education, mainly in the branch of management and management in production engineering on the first, second and third degree of studies.

6. Summary

The small and medium-sized enterprises play a significant role in the economy. Main orders undertaken by these kind of enterprises have project character. Small and medium-sized enterprises need project management of their new, innovation project driven orders. But the project management requirements should be different than the traditional forms of project management for larger projects undertaken in large enterprises.

Project management is different from manufacturing-type operations in that project management is the business process of producing a unique product, service, or result over a finite period of time. The special needs of small and medium-sized enterprises recognized by researchers will be adopted in the present research. Operationalization of the conceptual model of the project driven order seems to be a good idea for aiding the small and medium-sized enterprises. The results of the research will build up a literature of project management.

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