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Construction Projects as research objects – different research approaches and possibilities

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Abstract

Research as an activity can mean wide variety of different approaches and their dimensions. Researchers can act as rather passive observers and analyzers by having the current working practices as their research objects. The action research efforts are the ultimate other end. In such efforts researchers act as active change makers by implementing novel trials such as new working practices and their tools. Such trials can fail or be successful but nevertheless the targeted research data is collected as an evidence of the completed effort. Such failures are a real threat for companies and their projects involved in this kind of research. However, more risky action research can be a source for new kind of benefits and competitiveness compared with the more traditional, and wider used, passive observational research. In particular, a sound action research strategy can combine research and development, can speed up targeted changes and can actually mitigate the overall risk of change making. This paper presents a framework of project research strategy and method selection where attention is on degrees of different alternatives and their characteristics. The construction projects and their management represent the industrial context of this paper.

Keywords: pilot projects; construction; research methods; action research; university campus development

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1. Introduction

The project and particularly project management paradigm, its different appearances, development and resultant effects in industries and communities have provided fruitful sources for research that is of interest both to the academia and different lines of businesses. At the moment we can recognise the presence international project research community and its continuous development. The characteristics and nature of research itself within this community have also been objects of different analyzes and relating papers. Views from those are presented on the following.

Shenhar and Dvir (2007) have analyzed the development of project management research and the fundamental research viewpoints that seems to be present in the current research efforts. In general, the overall view of the project management research is rather heterogeneous and multi-disciplinary. Compared with several other well-established research disciplines project management is still lacking theoretical basis and a guiding set of concepts. Artto & Kujala (2008) have studied different themes of research that have appeared in journal papers. This work is showing that the research challenges start from single projects and end up in the management of business networks where the projects form companies' operative core. Blomquist et al (2010) have recognised that research on projects is a rather immature field and it seems to be insubstantial regarding to understanding what occurs in projects. They see need for project-as-practice research approach where the main focus is on things that are actually done in contemporary organizations. Cicmil (2006) is demonstrating in her paper how carefully designed and completed qualitative research can produce new kind of understanding over what goes on in projects and their management. Kwak and Anbari (2008) have recognised the increasing number of project research papers that are published in the leading management journals. This seems to be evidence that project management will step by step reach the status of an academic discipline.

The applications for research perspectives in project based research are diverse (Bredillet 2011). Majority of applied research methods and techniques have their origins in social sciences. However, several authors have recognised how complex is the world of projects and their management. This must be taken closer into account in research efforts and avoid anchoring the thinking in too narrow assumptions or in an inappropriate theoretical basis. Compared with traditional research approached where the main empirical focus is often on rather passive observations this paper has its focus on the possible contributions of different scientific approaches used in research efforts where the researchers act as change makers. This can be also categorised as a type of action research where a certain change is tried to be implemented and research data is then gathered from this experiment.

2. Research paradigms for project studies

2.1 General research paradigms

The term 'paradigm' is used to describe the ultimate framework within which a peace of research is located. Kuhn (1962) defines scientific paradigm as: "universally recognized scientific achievements that, for a time, provide model problems and solutions for a community of researchers", for example,

- *what* is to be observed and scrutinized
- the kind of *questions* that are supposed to be asked and probed for answers in relation to this subject
- *how* these questions are to be structured
- *how* the results of scientific investigations should be interpreted
- *how* is an experiment to be conducted, and *what* equipment is available to conduct the experiment.

The paradigm can so describe the beliefs of the scientific discipline and the way of finding and proving the scientific contributions of the research. Regardless of paradigmatic orientation, all research in project management represents an attempt to provide warranted assertions about projects and their management.

The research projects begin with defining the purpose and aims. In different fields one can recognize at least four main paradigms to study empirical world (1) positivism/post positivism, (2) advocacy/participatory, (3) contructivism, and (4) pragmatism (Fig. 1). The various paradigms have different kind of aims and mainly use different methods to find the empirical or other findings that the research efforts can produce.

Postpositivism Determination Reductionism Empirical observation and measurement Theory verification	**Advocacy/Participatory** Political Empowerment issue-oriented Collaborative Change-oriented
Constructivism Understanding Multiple participant meanings Social and historical construction Theory generation	**Pragmatism** Consequences of actions Problem-centered Pluralistic Real-world practice oriented

Fig. 1. The four research paradigms. (Creswell et al., 2003; MacKenzie and Knipe, 2006)

Postpositivist research paradigm uses mainly quantitative methods and the aim is to create knowledge discovery and verification through direct observations or measurements of phenomena independent of the researchers (Creswell et al., 2003; MacKenzie and Knipe, 2006). The research that uses this paradigm aims to observe, make questionnaires and process the data in an objective way, independent from the researchers' subjective interpretations.

The constructivist research paradigm uses mainly qualitative methods but the use of quantitative methods is also possible. Constructive research material and new knowledge is established through the meanings attached to the phenomena studied, researchers interact with the subjects of study to obtain data, the inquiry changes both the researcher and the subject and knowledge is context- and time dependent. (Creswell et al., 2003; MacKenzie and Knipe, 2006).

Constructivists often aim to create new theories that need to be tested with another approach. According to constructionist the interpretation of the situation might be different by different people and the 3mancipator33n of the results is not always important since the solutions are always case sensitive. (Creswell, 2003; MacKenzie and Knipe, 2006).

The research methods of constructive research can so be interviews, also the quantitative survey is possible. The main issue is that the building of the new method is done in collaboration with the researcher and the other stakeholders and the understanding of the pilot study is got in collaboration with the other stakeholders.

The advocacy/participatory research paradigm uses both quantitative and qualitative research methods. There are also various methods that can be used in the collection of data (Creswell, 2003; MacKenzie and Knipe, 2006). The advocacy/partisipatory research aims to activate the stakeholders in innovations. An example of this kind of research is a Soft GIS inquiry about the needs of the the overall aim is to activate the participants in the development of the environment. So the end result of construction project research could be for example a town planning research project that finds out the different viewpoints of the stakeholders and uses theoretical views to explain why the viewpoints are important.

The pragmatic paradigm uses real case studies as problem analysis. Quantitative and/or qualitative research methods are used. The research material collection methods used are similar to those used in connection with the

postpositivist and constructivist paradigms. These methods include for example interviews, observation and different kinds of tests (Creswell et al., 2003; MacKenzie and Knipe, 2006).

The research strategy may, for example, be action-analytical. This research may study the current practices and aims to improve the practices. The research philosophy of action-analytical research strategy is hermeneutics, in which the aim is to understand the research problem. Typical for this strategy is that there are no external, neutral observations of the research subject that could be measured. The research subject is examined in the light of history, practices and theory (Fig. 2). Also the close connection of the researcher and the subject is typical for this research strategy, though the tightness of connection varies (Olkkonen 1993).

According to Stringer (1999) in action research the researcher often aims to solve a problem with the practitioners. Action research is situational, collaborative and participative way of working, and self evaluative. In action research the researcher can select different approaches to study the intervention (Grudy 1983):

1. technical approach – test the theories with real life pilots
2. pragmatic approach – understand how things are in the pilots are and generate new theories
3. empowering approach – action research is 4mancipator, it leads not just to new practical knowledge, but to new abilities to create knowledge.

Fig. 2. View of the research subject according to action-analytical research strategy (Olkkonen 1993: 56).

Although there are many important paradigmatic differences between e.g. qualitative and quantitative, there are some similarities between the various approaches. According to Sechrest and Sidani (1995, p. 78) both methodologies "describe their data, construct explanatory arguments from their data, and speculate about why the outcomes they observed happened as they did." Additionally, both sets of researchers ensure that their inquiries have minimum confirmation bias and other sources of invalidity (or lack of trustworthiness) that have the potential to exist in every research study (Sandelowski, 1986).

2.2 Construction project as a research object

In project management profession like in the construction industry the research is close to the industry practices and often the projects themselves are the most interesting research objects. The projects might be just observed not

trying to change anything or the experiments with interventions can be in place (Fig. 3). The interventions can be either co-created with the industry or the researchers test new methods in practice (pilot project). The testing can be planned to be only temporary (pop-up demo) or they can be permanent (demo). The aim of the research project may be to show objectively the benefits of the tested method. The objectivity can be seen in the test arrangements.

Pilot project research can have participatory approach if for example a new project management methods needs to be developed. The new method can be developed in collaboration with the construction project participants. This kind of research is valuable the different viewpoints can be learned as constructing the new management system. This can be classified as a type of pilot project approaches. The observations and interviews or surveys might not aim to change the current practice but aim to test the theories (post positivism) or it can be pragmatic oriented by aiming at analyzing real life problems. This pragmatism approach can look for example how projects are managed currently and how management could be better or look for current benefits and challenges and so improve the understanding of the state of the art.

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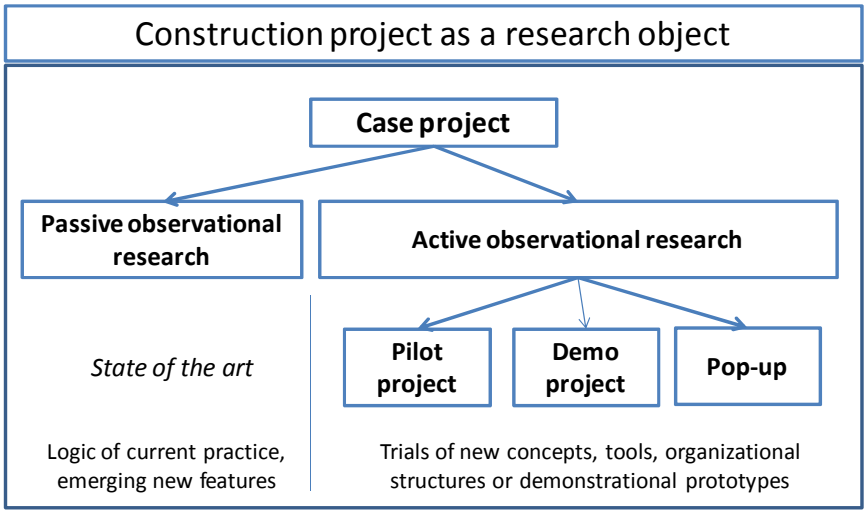

Fig. 3. Different research approaches for studying construction projects

3. Various approaches for research with interventions

3.1 Selection of research approach

When you are aware of the research paradigm to be used and the study questions have been established you can choose the research approach. Usually the first selection is made between quantitative or qualitative research methods.

Quantitative methods include measuring data or making questionnaires of a sample and studying the gathered data by using statistical methods. The method is powerful in proving whether the theories are true or not. For example, if the pilot building according to the measured data is as energy efficient as the theoretical calculations show we have strong evidence that the calculation method is near to correct. However, it cannot tell any detail information. In order to get more detailed information we have to make more detailed measurements.

Also the end-user behavior can be followed a long time in several locations and if the end-user behavior can be

shown to have a pattern the proof that the end-users behave in a certain way can be proved. However, the test arrangements need to be carefully planned in order to get the information of the reason for different behavior patterns. One can also make a survey of the experiences of the pilot project users and analyse the statistically.

Bogdan and Taylor (1975: ix) wrote about qualitative methods: "Over the past decade, there has been growing interest in the subjective, in meaning, and in commonsense understanding… The questions that the new approaches raise require methods that are descriptive and holistic. We call these qualitative methods". Still nowadays the reasons for using qualitative method are the same.

The most often used qualitative methods are interview and action research - the latter is often called constructive research in engineering studies. The interviews can be either theme or more structured. However the analysis of the interviews can be done either statistically (i.e. in quanttative terms) or in qualitative manner.

Action research can be seen as a research activity with an intervation. Thus is includes the viewpoint to impact on one way or another on the research object; i.e. the researcher is making an intervention over or within the used practices. Typically, interventions are made in co-operation with the people participating in the research (Eskola and Suoranta 1998). The aim is often to develop and test new ways of carrying out particular tasks.

3.2 Different research set-ups for action research in projects

Pilot projects are a common way for companies to test a new idea in live situation. In addition to that, a pilot project can act also as a show case for industrial implementation of new processes or relating tools. Research activities can address these pilot projects to test, analyze and develop new practices. More broadly, three different research set-ups for action research can be indentified for testing new concepts and for gathering empirical research data. These research set-ups differ from one another by their duration and scale (Table 1).

Table 1. Different research set-ups for action research

Type	Scale	Duration
Pilot project	complete construction project	project life-cycle
Demonstration project	phase of the project	a few months
Pop-up project	specific project task or part of end results	from a few days to one month

A pilot project is a project which is designed as a test or trial to demonstrate the effectiveness of a full construction project. A pilot project can last over the complete life-cycle of such project. Normally, in a construction project, it takes time from several months to a few years. A proper pilot project can provide a platform for the researchers to test new ideas and practices. This kind of effort can show evidence of the added value and reveal deficiencies before those ideas and practices are actually implemented. It provides an opportunity for more wide ranging testing of the new ideas produced in the two other research set-ups. Typically, the research effort is a pilot project is started by preparing a list of objectives engaged with relevant documents explaining how the project is going to be carried out. The documentation should also provide a time-line for the pilot and framework for measuring the resultant success (or failure).

Compared with pilot projects a *demonstration project* has different time scale and scope. Where a pilot project last even years, a demonstration project may lasts only a few months. Usually, a demonstration project is not a full scale construction project, rather it can be part of it. This research set-up provides an opportunity for researcher to test specific new ideas in practice in relative short time, e.g. for the duration of a single project phase. A specific challenge can be the overall continuity of the main project. In other words, it can be difficult to carry out a part of the project using a different practice and then after that to return back to the traditional way of project execution practice.

A pop-up project is a research set-up that can last only a few days up to one month. A pop-up project can also be called a feasibility study or an experimental trial. It is a small-scale, short-term experiment that helps the researcher learns how a large-scale project might work in practice. The core idea of a pop-up project is to commence a trial of new idea as quickly as possible, with resources that are affordable (inexpensive), easy to reach and use. Usually, a pop-up project does not mean carefully designed final solution with all details rather it means fast sketching and building of early versions for prompt testing purposed. Research can be then performed in three steps: within the pop-up preparation, during the actual pop-up implementation and after closing pop-up. The biggest advantage of the pop-up research is that it provides chance for collecting research data very fast. After analyzing the test results can be decided whether the new method or idea is good enough to be used in a larger scale maneuvers.

4. The ongoing research

4.1 The Indoor Environments research program

The ”Indoor Environments” (IE) research program is a highly ambitious research program coordinated by the Strategic Centre for Science, Technology and Innovation for Built Environment (RYM). The overall target of this four year research effort is built around a rather radical vision where we see conditions, where humans will go from outdoor spaces into the indoor environment to grasp fresh air, to refresh themselves and to get inspired. The IE research program consists of four work packages. The main objectives of those are user-centric spaces and their energy-efficient management, revenue models for good indoor environment, and design and implementation of inspiring learning environments.

The IE program’s research agenda through far-reaching, collaborative and multidisciplinary research work is carried of jointly by companies, universities and research centres. The research work will be carried out by 31 industrial partners and 13 research partners, included with the coordinator RYM there are totally 45 partners in this research consortium. Within the IE program the authors’ research activities are focusing on university campus renovation and development projects. The way towards novel inspiring learning environments is an important viewpoint of this research. Particularly the main interest is focusing on possible new organizational innovations for temporary organizations i.e. for projects that may facilitate cross-organizational and cross-disciplinary collaboration.

The research includes design of pilot projects, demonstration projects and pop-up projects for testing possible organizational solutions. The present practices, their characteristics and outcomes are forming research baseline and point of departure for comparative studies. Currently the design of learning environments seems to be strongly anchored to the needs of traditional learning processes, industrial standards and recommendations and restrictions of old facilities. (OPM, Neufert 2008). The implementations are driven by cost efficiency, traditional administrative boarders and personal perspectives of architects. The processes are often linear, the solutions are static and they do not provide flexibility in terms of transformation according to the organizational changes. (Nair & Fielding, 2007).

4.2 Current campus pilot projects

Major renovation and new building projects are under way in the campus of Tampere University of technology (Fig. 4).
These projects provide opportunities to arrange different research set-ups. Examples of current projects and research set-ups within those are:

- “Kampusareena” building: The target of Kampusareena is to be jointly a location for integrative operations of the Tampere University of technology, and to be an innovative business centre that can be

an ideal location for research-intensive enterprises and companies engaged in the development and production of new technology, services and products. The construction of Kampusareena has been started in the 1st quarter of 2013 and the building will be completed on 2015. Size of the building will be around 12 000 square meter. Kampusareena is a important large scale pilot project for various research actions.

- R-building renovation: R-building is the home for the department of civil engineering and school of architecture. The renovation of R-building has been stated on year 2010 and will be completed on end of the year 2013. Totally size of the project is 13 500 square meters. As a whole this renovation project is a target of research where e.g. cooperation and communication between different stakeholders is studied together with possible changes for improving current practices.
- Extension of "Café Motivaattori": This short-term project was fully completed in 2012 including the needed design, renovation and final hand over. The research addressed new kind of functional spaces and arrangement.
- Casual space for students and faculty, S-building: This pop-up project was implemented on spring 2012. A new casual environment was built to the second floor of S-building. Size of the project was 150 square meters and building time was one day. The pop-up project lasted one week.

Fig. 4. New building and renovation projects for developing further the campus of Tampere University of Technology are the objects of the current action research efforts.

Variety of research themes are present inside the different projects listed above. Examples of those are:

- Working processes: Participatory design where end-users have a new kind of active role in the design process, Knowledge management and sharing practices as enablers for cooperation and communication.
- Organizational structures: Trials with new kind of formal or informal organizational solutions. Look at Kähkönen et al. (2013).
- Design solutions: How new innovative design solutions for university campus spaces can be designed, how they are received and what kind of benefits can be achieved by those.

5. Conclusions

Scientific evidence from the construction projects can be extracted in different ways. In this paper we have tried to unwrap research approaches where interventions, i.e. changes addressing traditional business practices, are part of the actual research effort. In a rather provocative manner we have categorized different research efforts to passive observational research and active observational research. Most of current research efforts can be classified

to represent passive observational research where researchers are observing current practices and have as a target to end up valuable insights and understanding that can help to develop the profession further. The world of active observational research is very different from that. In these efforts the researchers work as inside observers who are trying to make change by certain a kind of trial. Research data is then extracted from this experiment.

Active observational research has certain benefits that are not in place regarding passive observational research. In particular, the time can be shortened that is needed for the realization of innovations and gaining the relating competitive advantage. However, active observational research and action research represent school of thinking that has relative small importance in the world of project management research.

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