

An investigation of qualitative research in a industrial engineering post graduate program

Paulo Augusto Cauchick Miguel (UNIMEP/USP) pamiguel@unimep.br

Abstract

One of the important stages in a research process is the definition of the research methodology. A methodological approach must be in place as well as its respective instruments and techniques for gathering data and analysing the results. This is particularly important in the practical field of industrial engineering within the operations management discipline. In this sense, this paper aims at presenting a content analysis in a sample of dissertations of a post graduate program in industrial engineering with regard to the qualitative research approaches employed. It firstly presents a brief review of approaches and methods used in qualitative research, and then describes the work carried out to analyse the dissertations. Finally, it compares the results with a similar work, draws some conclusions from the investigation in addition to recommendations for future work.

Key-words: operations management; qualitative research, case study, methodology.

1. Introduction

Operations management (OM) is a field that consists of very different academic disciplinary inputs and practical fields of application. One of these practical fields is industrial engineering (SLACK et al., 2004). According to Voss et al. (2002), most of the research conducted in the field of operations management is based on rationalist research methods, primarily statistical survey analysis. The main characteristics of rationalist research is that the phenomenon being studied exists “out there”, independent of the research context or beliefs and assumptions of the researchers (VOSS et al., 2002). Nevertheless, OM is very much an applied discipline, from the need to offer answers to the concrete problems that emerge within both industry and services to (FILIPPINI, 1997). In this sense, qualitative research can be considered as a powerful methodology since it attempts to increase the understanding of a phenomenon within its context. Qualitative research methods originated in the social and behavioral sciences: sociology, anthropology and psychology. As Drejer et al. (1998) point out, OM differs from most other areas of management research, in that it addresses both the physical and human elements of the organization.

Indeed, approaches within qualitative research methodology, such as case research and action research have been applied to OM. Relevant publications of these approaches within OM are offered by Voss et al. (2002) and Coughlan and Coughlan (2002), respectively. Additionally, empirical research makes an important contribution to the development of OM knowledge and theory which can bridge the gap between OM research and practice (FILIPPINI, 1997). For instance, Slack et al. (2004) actually propose a representation that articulated two different research processes, that seek to reconcile theory and practice. In any case, qualitative research and its approaches and methods surely can contribute to OM research. In this context, the aim of this paper is to discuss the application of qualitative research in the subject of OM, more specifically within the practice field of industrial engineering. In the first part of the article, aspects of the research methodology are discussed including a comparison between quantitative and qualitative approaches. Then, qualitative research

approaches and methods are described in order to establish the theoretical boundaries of this work. In its main part, the article explores some cases of qualitative research employed in a number of dissertations and some concluding remarks are drawn from it.

2. Research process and methodological approaches

Research can be defined as a process of systematic investigation of a subject for the purpose of adding to the body of knowledge about that subject. Contained in that definition are three key points (HANCOCK, 1998a): research is a process carried out in stages; investigation is carried out systematically, i.e. it is planned; and research is intended to add to the body of knowledge, i.e. its purpose is to inform.

In order to conduct a research, its process is made up of a number of stages that the researcher must proceed through for the research project to be completed satisfactory. The main stages in the research process are (adapted from HANCOCK, 1998a):

1. Identification of the research problem;
2. Review of the literature
3. Defining the methodology
4. Data collection or theoretical development
5. Data analysis (results analysis)
6. Drawing conclusions
7. Recommendations for further research

Since research is a process of systematic investigation of a subject, a methodological framework must be employed. Different approaches should take in place depending on the nature of the variables involved in the subject. According to Meredith et al. (1989), these approaches can be classified into two key dimensions. The first concerns the approach adopted to generating knowledge which has to extremes (FILIPPINI, 1997): on the one hand, the deductive approach and, on the other, the inductive approach. The second dimension concerns the source and kind of information used in the research which has, on one hand, direct observation and, on the other, subjectivism, i.e. artificial reconstruction of reality (FILIPPINI, 1997). Actually, research approaches can be grouped in some categories, according to:

- nature of the variables (quantitative or qualitative);
- relationship between the variables (descriptive or causal);
- level of knowledge of the research problem (exploratory or conclusive);
- way to gather data (communication or observation);
- control of the variables (experimental or *ex-post-facto*);
- research approach in terms of depth and amplitude (field/case study or surveys).

These approaches are not, however, mutually exclusive. A given research can be classified according to all categories, i.e. it might be, for example, qualitative, descriptive, exploratory, employing observation and field study through the use of multiple case study. In fact, there are broadly two approaches (HANCOCK, 1998b): quantitative research and qualitative research. These approaches are outlined next.

2.1 Qualitative versus quantitative approaches

Quantitative research should begin with an idea (usually articulated as a hypothesis), which then, through measurement, generates data and, by deduction, allows a conclusion to be

drawn (GREENHALGH and TAYLOR, 1997). In contrast, qualitative research begins with an intention to explore a particular area, collects “data”, and generates ideas and hypotheses from these data largely through what is known as inductive reasoning (MAYS and POPE, 1996). Table 1 summarises the differences between qualitative and quantitative approaches to research. In reality, there is a great deal of overlap between them, the importance of which is increasingly being recognised (ABELL, 1990).

Item	Qualitative	Quantitative
Social theory	Action	Structure
Methods	Observation, interview	Experiment, survey
Question	What is X? (classification)	How many Xs? (enumeration)
Reasoning	Inductive	Deductive
Sampling method	Theoretical	Statistical
Strength	Validity	Reliability

Table 1 – Quantitative versus Qualitative Research (Mays e Pope, 1996).

According to Greenhalgh and Taylor (1997), the strength of quantitative approach lies in its reliability in terms of repeatability, which is the degree to which a measure is free from random error components (VOSS et al., 2002) and should yield the same results time after time (GREENHALGH and TAYLOR, 1997). On the other hand, qualitative research lies in validity (closeness to the truth), i.e. is the degree to which a measure only reflects the desired construct without contamination from other systematically varying constructs (DEVELLIS, 1991). Good qualitative research, using a selection of data collection methods, really should touch the core of what is going on rather than just skimming the surface (GREENHALGH and TAYLOR, 1997).

3. Strategies and methods employed in qualitative research

Qualitative research is an investigation in which the researcher attempts to understand some larger reality by examining it in a holistic way or by examining components of that reality within their contextual setting. In this sense, by its very nature, qualitative research is non-standard, unconfined, and dependent on the subjective experience of both the researcher and the researched (GREENHALGH and TAYLOR, 1997). Particular strategies usually employed by qualitative research include: action research, case study, ethnography study, phenomenology, and grounded theory. These are outlined next.

Action research is a generic term which covers many forms of action-oriented research, and indicates diversity in theory and practice among action researchers, so providing a wide choice for potential action researchers as to what might be appropriate for their research question (REASON and BRADBURY, 2001). The outcomes is an action and research which, unlike traditional positive science, aims at creating knowledge only (COUGHLAN and COUGHLAN, 2002).

A broader view of ethnography consists of the art and science to describe a group or a culture (FETTERMAN, 1989). It has a background in anthropology and embraces the description of events that occur in the life of a group, with special attention to social structures and behaviour of the group members (GODOY, 1995).

Generally, case studies are the preferred strategy when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context (YIN, 1994). Case research is not only good for investigating “how” and “why” questions, but also it is particularly appropriate for developing new theory and ideas and can also be used for theory testing and refinement (VOSS et al., 2002).

Phenomenology literally means the study of phenomena, which may be events, situations, experiences or concepts. It is a way of describing something that exists as part of the world in which individuals live (HANCOCK, 1998b). The previous author adds that phenomenological research will not necessarily provide definitive explanations but it does raise awareness and increases insight.

The main feature of grounded theory is the development of new theory through the collection and analysis of data about a phenomenon. Actually, it goes beyond phenomenology because the explanations that emerge are genuinely new knowledge and are used to develop new theories about a phenomenon (HANCOCK, 1998b). Grounded theory is a longitudinal research methodology that intrinsically relies on gathering data taken at a given point in time (LEONARD and MCADAM, 2002). Wolfgramm et al. (1998) describe grounded theory as inquiring into the processual pattern of change at institutional, organizational, and strategic level.

To implement those strategies in qualitative research, a number of methods for gathering data can be employed. The main methods of collecting qualitative data are structured, semi-structured, and unstructured interviews; focus group; passive or participant observation; and documentary analysis.

The described strategies and their respective methods are broadly applied in operations management research. For instance, case research has consistently been one of the most powerful research methods in operations management (VOSS et al., 2002). According to Filippini (1997), research efforts have been made along empirical lines, particularly in the field of TQM – Total Quality Management, as shown by Leonard and Mcadam (2002).

4. Research methodology in operations management

Operations management (OM) is very much an applied discipline, from the need to offer answers to the concrete problems that emerge within both industry and services (FILIPPINI, 1997). Slack et al. (2004) complement this by arguing that the genealogy of operations management is an amalgam of different disciplinary academic inputs, e.g. systems theory, and practical fields of application, e.g. industrial engineering. Actually, the field of operations research is relatively new if compared to more technical areas. The issues dealt with OM are diverse and call for theoretical bases and methodologies from many different areas and school of science. As a consequence, it results in a vast scope of research approaches, usually classified as modelling, survey, theoretical/conceptual, simulation, field study, case study, and laboratory experimentation (FILIPPINI, 1997).

4.1. Research methodology in the field of industrial engineering

In order to illustrate some initiatives of investigating methodological approaches used in industrial engineering, the work of Berto and Nakano (1998; 2000) is highlighted.

Firstly, the authors analysed dissertations and thesis of a post graduate program according to the research methodological approach (BERTO and NAKANO, 1998). Master dissertations and Ph.D. thesis produced by the Industrial Engineering Department of the Polytechnic School of the University of São Paulo produced from July 1990 and June 1998 were analysed and classified according to the methodological approach employed. The results are outlined in Table 2. As can be seen in Table 2, theoretical/conceptual studies correspond to more than 60% of the total work, most of them M.Sc. dissertations. The authors (BERTO and NAKANO, 1998), however, have not pointed out the reasons for this relatively high proportion. They claim that this is to be analysed in a future work (BERTO and NAKANO, 1998). The remaining work is case study and survey approach, with a similar figure. Action research approach is a relatively low proportion. Different from expected all work are part of

M.Sc. projects. In addition, the authors pointed out a number of questions to be answer with regard to the adequacy and application of these kinds of approach in the field of industrial engineering.

Ranked Approach	Ph.D. Thesis (34.6% of the total)	M.Sc. Dissertations (65.4% of the total)	Total
Action research	0%	1.3%	1.3%
Case study	6.4%	12.8%	19.2%
Survey	9.0%	10.3%	19.3%
Theoretical/conceptual	19.2%	41.0%	60.2%

Table 2 – Methodological approaches employed (adapted from Berto and Nakano, 1998).

Then, the authors (BERTO and NAKANO, 2000) investigated the proceedings of a major conference in industrial engineering in Brazil (*ENEGEP – Encontro Nacional de Engenharia de Produção*), from 1996 to 1998. The authors use a typology developed by Filippini (1997) for classifying 1610 papers. Then, a comparison is made with the results found in Filippini (1997) who analysed the proceedings of the Decision Science Institution conferences (1986-7 and 1996). Table 3 summarises the results of the investigation by Berto and Nakano (2000).

Ranking	Type of Research	Accumulated Percentage (1996-1998)
1	Theoretical-conceptual ¹	45.4%
2	Field study ²	16.8%
3	Case Study	15.1%
4	Modelling	13.7%
5	Survey	4.2%
6	Simulation	3.3%
7	Experiment	1.5%

Notes: ¹ Include conceptual discussions and literature review; ² Other research methods (mainly with qualitative focus without the deepness of a case study).

Table 3 – Research approaches - 1996-1998 ENEGEP proceedings (based on BERTO and NAKANO, 1998).

The authors claim that the large frequency of theoretical/conceptual studies can be to the existence of a large number of discussion papers, papers that were in the initial stages of research (BERTO and NAKANO, 2000). The authors also pointed out that there were a large quantity of papers that had a lack of structure in order to have a precise identification of the methodological approach employed. For instance, many papers claim that case study is chosen as the research approach. However it seems a incorrect use of the term. These are actually just a terminology with no implication in terms of research methods (BERTO and NAKANO, 2000). The conclusions indicated the necessity of deeper methodological concern and better use of research methods.

5. Analysis of qualitative research in a sample of dissertations

This is an on-going investigation from which the previous work was reported elsewhere (MIGUEL, 2004). In order to obtain an approximate measure of the research activities in a Industrial Engineering post graduate program in Brazil, 60 M.Sc. dissertations were examined with regard to the methodology employed.

The post graduate program was established in 1994. There are 13 academic staff working in four main areas of research (the number of research subjects is by brackets): environmental management (2); production and operations management (6); quality management (3) and strategies and organizations (2). A total of 32 research projects are developed within the research subjects.

The students are divided into two segments: professionals from industry and lectures from universities and colleges. It is estimated that the 70% of outcome students are employed by industry, 25% work in academia, and the remaining in other areas (e.g. consulting, government, etc.).

Before outlining the results of this work some initial remarks are needed. These are:

- The dissertations were available in the library for the time when the study was completed. It covers the period from March 1998 to September 2003. The sample corresponded to 71% of the total dissertations of the program at that time;
- The research topics were within the all following main areas of study: environmental management/policy, production management, quality (assurance and management), and strategy & organizations. These are the main research areas of the program.

Analysis of these dissertations firstly involved a categorization in qualitative or quantitative research. From the total, 82% of the research applied a qualitative approach. This demonstrates a relatively high application of qualitative research in this studied case. Then, further classification of the dissertations was conducted based on the research approaches proposed by Filippini (1997). This is shown in Table 4, in rank order, considering the qualitative approach employed. Note that Table 4 only shows the results of the approaches related to qualitative research. Other approaches (quantitative research) resulted as follows: survey and experiment with 3% each and none for modelling and for simulation. Nevertheless, the methodological approach was unclear for 12%. This indicated a strong need to put more efforts in the research methodology design.

An assessment of the robustness of the research methodology for each dissertation was also carried out by using a Lickert five-point scale. This result is also presented in Table 4.

Ranked Approach	Dissertations (n=60)	Assessment (modal result)^{1,2}
Case study	55%	1
Action research	12%	3
Theoretical/conceptual	12%	1
Field study	3%	2

Notes: ¹ Assessment of the methodology the dissertations using a five point Lickert scale: 0- none; 1- poor robustness, 2-moderate robustness, 3-robust, 4-very robust;

² The result shown in the table corresponds to the most frequent.

Table 4 – Dissertation analysis with regard to the approach employed.

As Table 4 illustrates that case study is receiving more attention as the chosen methodology approach. Usually, case studies have been used to provide examples and, in the earlier stages of research, for describing the phenomena and related variables. The proportion on this kind of approach reflects the profile of the students. Most of them are part time middle-managers from industry and they usually uses their organization as a scenario for development their research projects.

When comparing these findings with those from Berto and Nakano (1998), the result is quite different as shown in Table 5. This difference should be viewed with caution since the classification used is not exactly the same. Another factor that should be taken into account is with regard to the difference in the time frame when the studies were conducted (1990-98 against 1998-2003). This certainly restrains the validity of this comparison. Therefore, there are limitations when comparing the two studies. Nevertheless, the results indicate a difference in the nature in the methodological approach. While the present investigation indicate the

development of a more empirical work, the study by Berto and Nakano (1998) suggested the use of a more theoretical approach.

	Dissertations of this Investigation (n=60)	Dissertations in Berto and Nakano (1998) Investigation (n=51)
Case study	55%	19.6%
Action research	12%	1.3%
Theoretical/conceptual	12%	62.7%
Survey	3%	10.3%

Table 5 – Comparison between dissertations in this investigation with the work of Berto and Nakano (1998).

When assessing the methodology employed, Table 4 also showed that the robustness of the dissertations, in terms of modal results, is “moderate” for “field study” and “poor” for “theoretical work” and “case study”. Although, case study approach was more frequently employed, its results in terms of robustness was not as good as for action research. Since action research requires intervention as well as it is participative, concurrent with action, and employs a sequence of events and an approach to problem solving (COUGHLAN and COUGHLAN, 2002), this might lead to a more robust methodology in order to achieve effective research results. Nevertheless, in all approaches, the results indicated that a methodological improvement is needed.

It is worth observing that there are some limits in terms of validity and reliability of any findings from this analysis – especially with respect to the interpretative nature of the dissertation research methodology classification and contents as well as the use of this narrowly-based sample. The objective here was to illustrate some experiences of qualitative research in a traditional area of operations management, i.e. industrial engineering. Of course, merely analysis of this sample is not enough if one is seeking to understand fully research practice of qualitative work in this field. Nevertheless, it might provide a general and, perhaps, preliminary view of its application in industrial engineering as a particular field of operations management.

5. Concluding Remarks

The analysis of a sample of dissertations could provide some hints about what is going on in terms of selecting qualitative research in addition to the approach employed. Furthermore, it provides a classification of the most common approaches being case study the most applied based on the analysed sample. Nevertheless, there are clear limits to the validity and reliability of any findings in this analysis. They can be considered as, at best, indicative findings and another task is required, especially for examining Ph.D. work since they usually tend to be more methodological robust. This is the next step in this investigation.

When comparing the findings in this investigation with a similar work, the result pointed out a difference in terms of the typology of research methodology employed. Yet, attention should be paid when comparing these investigations due to a number of aspects such as the time when the studies were completed, the difference in the approach categories, etc. Nevertheless, this comparison can be considered as a starting point to have a better understanding about the methodological approaches applied to industrial engineering.

Another conclusion that can be drawn is that the methodology used in the analysed sample is not as robust as it should be. Besides the identification of more than 10% of the work with no methodological definition whatsoever, the assessment of those dissertations in which the research methodology was present indicated that an improvement is needed. An effort should be put in enhancing research methodology in the studied post graduate program.

This work raised a number of questions beyond the capability to be answered in this paper with regard to qualitative research, and its relevance and legitimacy of this approach in the field of industrial engineering. It is believed that an attempt to respond those questions in the future may contribute for qualitative research consolidation in this field.

References

- ABELL, P. (1990) Methodological Achievements in Sociology over the past Few Decades with Specific Reference to the Interplay of Qualitative and Quantitative Methods. In: Bryant, C., Becker, H., eds. *What Sociology Achieved* – London: Macmillan.
- BERTO, R.M.V.S. e NAKANO, D.N. (1998) Métodos de pesquisa na Engenharia de Produção. CD ROM do XVIII ENEGEP, Niterói.
- BERTO, R.M.V.S. e NAKANO, D.N. (2000) A Produção Científica nos Anais do Encontro Nacional de Engenharia de Produção: Um Levantamento de Métodos e Tipos de Pesquisa. *Produção*, Vol. 9, n. 2, p. 65-76.
- COUGHLAN, P. and COUGHLAN, D. (2002) Action Research for Operation Management. *International Journal of Operations & Production Management*, Vol. 22, No. 2, pp. 220-240.
- DEVELLIS, R.F. (1991) *Scale Development: Theory and Application*. Newbury Park, CA: Sage Publications.
- DREJER, A. BLACKMON, K. and VOSS, C. (1998) Worlds apart? – A Look at the Operations Management Area in the US, UK, and Scandinavia. *Scandinavian Journal of Management*, Vol. 16, pp. 45-66.
- FETTERMAN, D.M. (1989) *Ethnography Step by Step*. Newbury Park, CA: Sage Publications.
- FILIPPINI, R. (1997) Operations Management Research: Some Reflections on Evolution, Models and Empirical Studies in OM. *International Journal of Operations and Production Management*, Vol. 17, No. 7, pp. 655-670.
- HANCOCK, B. (1998a) *An Introduction to the Research Process*. Nottingham, UK: Trent Focus Group, Division of General Practice, University of Nottingham.
- HANCOCK, B. (1998b) *An Introduction to Qualitative Research*. Nottingham, UK: Trent Focus Group, Division of General Practice, University of Nottingham.
- GODOY, A.S. (1995) Qualitative Research: Basic Types. *Revista de Administração de Empresas*, Vol. 5, No. 3, pp. 20-29 (in Portuguese).
- GREENHALGH, T. and Taylor, R. (1997) Papers that Go Beyond Numbers (Qualitative Research). *BMJ*, Vol. 315, No. 7110.
- LEONARD, D. and MCADAM, R. (2002) The Strategic Dynamics of Total Quality Management: A Grounded Theory Research Study. *Quality Management Journal*, Vol. 9, No. 1, pp. 50-62.
- MAYS, N. e POPE, C. (1996) Eds. *Qualitative Research in Health Care*. London: BMJ Publishing Group.
- MEREDITH, J.R., RATURI, A., AMOAKO-GYAMAPAH, K. and KAPLAN, B. (1989) Alternative Research Paradigms in Operations. *Journal of Operations Management*, Vol. 8, No. 4, pp. 297-326.
- MIGUEL, P.A.C. (2004) Metodologia de pesquisa em engenharia de produção: análise de dissertações de um programa de pós-graduação em relação às estratégias de pesquisa utilizadas. Paper submitted to the XXIV ENEGEP, Florianópolis, SC.
- REASON, P. and BRADBURY, H. (2001) *Handbook of Action Research*. Sage, Thousand Oaks, CA, USA.
- SLACK, N., LEWIS, M. and BATES, H. (2004) The Two Worlds of Operations Management Research and Practice - Can They Meet, Should They Meet? *International Journal of Operations and Production Management*, Vol. 24, No. 4, pp. 372-387.
- VOSS, C., TSIKRIKTSIS, N. and FROHLICH, M. (2002) Case Research in Operations Management. *International Journal of Operations & Production Management*, Vol. 22 No. 2, pp. 195-219.
- YIN, R.K. (1994) *Case Study Research – Design and Methods*. London: Applied Social Research Methods Series, Vol. 5, Sage Publications,.
- WOLFGRAMM, S., BOAL, S. and HUNT, J. (1998) Organizational Adaptation to Institutional Change: A Comparative Study of First-order Change in Prospector and Defender Banks. *Administrative Science Quarterly*, March, pp. 87-127.