Process Management and Sustainable Development in a Quality Perspective
- Implementation and Measurement Related to Small and Medium Sized Enterprises

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Process Management
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– Implementation and Measurement Related to Small and Medium Sized Enterprises

by

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Dissertation

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Process Management and Sustainable Development in a Quality Perspective

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Rickard Garvare
Förut tyckte jag att jag var villrådig,
men nu är jag inte säker längre.

La critique est aisée, et l’art est difficile.
P. Destouches

Betrakta språken! Vad visa de oss?
Ett galleri av förbleknade metaforer.
E. Tegnér

Proverbs 4:7-9 and Ecclesiastes 12:11-14
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Luleå, October 2002,

Rickard Garvare

Rickard Garvare
Abstract

This thesis aims at contributing to increased knowledge regarding sustainable competitive performance of small and medium sized enterprises in harmony with nature and society. The overall purpose has been specified in the following three parts: to explore implementation of statistically designed experiments, to describe experiences of introducing process management, and to contribute to the development of a conceptual framework for integration of business excellence and sustainable development, all with a focus on small and medium sized enterprises.

During the last few decades the interest and industrial use of systems, tools and methodologies related to quality has grown considerably. Some of these were originally developed with the large company in mind, but today many small and medium sized organisations also try to implement them. However, management strategies developed for large organisations do not generally translate well into small and medium sized organisations.

The research presented in this thesis has been divided into three research projects. An initial longitudinal study of two case companies within the industry of high performance ceramics resulted in a three step model for implementing statistical techniques, especially design of experiments.

The approach adopted for the second project was a quantitative-qualitative research design divided into three parts: a mail survey of 1,500 enterprises, followed by telephone interviews with representatives of 62 of these enterprises, and finally case studies of seven selected firms. The results indicate that the proportion of small and medium sized enterprises in Sweden that has introduced process management is in the region of 10 percent of the total population. The findings were that, in general, the studied companies had not changed directly from a functional orientated organisation to a process orientated organisation. Instead many were still in, or had recently passed through, an intermediate state characterised by a team and project based organisation where focus was shifted towards internal efficiency and shorter lead times. The transitions described have been summarized schematically in a model with three different stages: starting with functions, continueing via teams and projects, and ending with processes.

As a result of the third research project, suggestions are presented regarding how the requirements of critical global processes could be translated to areas of organisational concern. A conceptual business excellence model, including measurements of sustainable development, has been developed. The triple bottom line of economy, environment and ethics (3E) are proposed as main dimensions for measuring sustainable organisational performance.
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III Process Management in Small Organisations – Experiences of a Swedish Study
Accepted and presented at the 6th World Congress on TQM, St. Petersburg, (2001).

IV Case studies of Process Management in Small and Medium Sized Enterprises
Co-authored with Klara Palmberg.
Submitted for publication.

V Sustainable Development – Extending the Scope of Business Excellence Models
Co-authored with Raine Isaksson.
Published in Measuring Business Excellence, (2001), 5 (3).

VI Measuring Sustainable Development using Process Models
Co-authored with Raine Isaksson.
Accepted for publication in the Managerial Auditing Journal.

APPENDICES

1. Mail Questionnaire for the Second Research Project (In Swedish)
2. Interview Guide for the Second Research Project (In Swedish)
3. Case Study Agenda of the Second Research Project (In Swedish)
1 Introduction

This Chapter introduces the area of research, including a description of the background, a presentation of the problem area, the main themes and research questions, the scope of the thesis, the overall structure, and a summary of appended papers.

1.1 Background

Over time, customers tend to expect more but are prepared to pay less for their requirements. They want higher quality at a lower cost. Many companies\(^1\) look upon quality management as a way by which to sustain competitive advantage. During the last few decades the interest and industrial use of quality-related systems, tools and methodologies has grown considerably. Some examples are total quality management (TQM), standards such as ISO 9000, business excellence models such as the European Quality Award, methodologies such as Six Sigma and statistical techniques such as process capability studies. Some of these were originally developed with the large company in mind, but today many small and medium sized enterprises also try to implement them. The next five sections give a brief background to the area of research.

1.1.1 The Evolution of Quality Management

Theories of quality management have evolved considerably during the past century. In this section two different interpretations regarding the historical development of ideas in quality management will be presented, one based on a single path assumption and one based on a dual path assumption.

One common description of the quality evolution consists of four stages in one single cumulative path of development: inspection, quality control, quality assurance, and quality management, see Figure 1.1 and, for example, Garvin (1988) and Dale (1999).

Under the two first stages, inspection-based systems and systems of quality control, characteristics of products are examined and compared with specified requirements. Detection and reactive corrective actions are emphasised. The thinking is departmentally based and the first two stages of systems for quality management do not usually directly involve suppliers or customers. The third stage, quality assurance, directs organisational efforts towards planning and pre-

\(^1\) Unless otherwise indicated, the terms company, firm and enterprise are used interchangeably to describe a privately owned producer of goods and/or services.
venting problems occurring at source. Emphasis is shifted from mere detection to training, product design, process design, process control and motivation of people. The fourth stage, total quality management, is an all embracing, holistic approach involving the application of quality management principles to every aspect and level of the organisation. This also includes customers and suppliers, their integration with horizontal business processes and the need for the organisation to self-assess progress towards business excellence.

Figure 1.1 An illustration of the terms quality inspection, quality control, quality assurance and quality management. The figure also provides an often-used description of the development in the field of quality management. From Bergman & Klefsjö, 2002.

In contrast to the single path quality evolution described above, seminal work by Kroslid (1999) identifies two different schools of quality management: the "deterministic school of thought" and the "continuous improvement school of thought", see Figure 1.2.

Figure 1.2 Kroslid (1999) describes a dual path evolution in two different schools of quality management.

---

2 Unless stated otherwise, the term organisation is used to describe a private or publicly owned producer of goods and/or services.

3 The author uses the terms business excellence and total quality management interchangeably, aware that they have some slight differences in meaning.
The deterministic school has its origins in Taylorism and the idea that inspectors are responsible for the quality of the work. This was followed by British and American military standards for scrutiny of suppliers, which became the base for the ISO 9000 standards. The compliance of standards and specifications through procedures are emphasised in the deterministic school. The continuous improvement school is described by Kroslid (1999) as starting in the 1930s with a growing emphasis on monitoring the manufacturing process rather than inspecting each single produced unit. Core values, strategies, quality work and self-assessment shared by all divisions and employees of the company, not just the production department, are examples of subjects emphasised by the school of continuous improvement. In both of the schools focus of practice starts on product, continues via process, and ends with culture.

1.1.2 The Evolution of Process Management

Modern quality management is based on the idea that to remain competitive an organisation has to ceaselessly upgrade the way it fulfils the true needs of its customers. It is not enough to focus on the finished products that customers receive. How these products are produced, i.e. the processes, also needs to be addressed. Strong competition and forever-increasing customer demands lead to short product life cycles and rapidly changing product concepts. Combined with escalating product and process complexity this emphasises the importance of controlling and systematically managing the processes.

Shewhart (1931) was one of the first to argue for process control in favour of product control, and also for the use of statistical methods to enhance learning and understanding of manufacturing processes. Advancements in the field of mathematical statistics resulted in the development of problem solving techniques such as statistical process control, design of experiments and process capability studies (Montgomery, 1997; 2001). During the 1970s, process orientated methodologies were developed under labels such as Just In Time (JIT) and lean production (Schonberger, 1986). The process view was generally restricted to the areas of production and distribution. Cost reduction, through shorter lead times and reduced inventory levels, was the primary objective.

During the 1980s and 1990s the scope of process control was expanded to a corporate emphasis, including all functions of an organisation. Reflecting a general trend from “hard”, i.e. scientific and statistically orientated quality issues, to “soft”, i.e. behaviour and socially orientated quality issues, the term “process control” began to be replaced by “process management” and later “business process

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4 In this thesis the term product is used in the generic sense referring to both goods and services, and also to combinations of goods and services.
management" (Dale et al., 2000a). Lots of attention was also focused on "business process re-engineering" as described by Hammer (1990), Davenport (1993), Hammer & Champy (1993) and Al-Mashari et al. (2001). Approaches for organisational development through managing and improving cross-functional processes have formed one of the leading topics of recent management literature, see for instance Porter (1985), Harrington (1987; 1991), Melan (1992), Lee & Dale (1998), and Bergman & Klefsjö (1994; 2002). The widespread interest in organisational process development has generated many new concepts and methodologies. Most contemporary quality awards are based upon process orientated "excellence" or "performance excellence" models, see for example the European Quality Award, managed by the European Foundation for Quality Management (EFQM, 2002), the Malcolm Baldrige National Quality Award, the National Institute of Standards and Technology (NIST, 2002), and the Swedish Quality Award, the Swedish Institute for Quality (SIQ, 2002). ISO 9000 has recently gone through a major change and is now also placing emphasis on process management, see for instance CEN (2000), Bendell (2000), ISO (2002), and Tsim et al. (2002).

Lind (2001) discriminates between a transformation orientated process view and a communication orientated process view. The first view focuses on how results are produced for the external customer, while the second view focuses on the establishment, fulfilment and evaluation of agreements between an organisation and its suppliers and customers.

The early notion of process management used in this thesis is derived from Forsberg (1998), who broadly refers to the term as the ongoing management and improvement of processes. More detailed definitions of the process concept and process management are presented and discussed in Chapter 2.

1.1.3 The Evolution of Mathematical Statistics

Variation has been a problem since the beginning of industrialisation, perhaps even earlier. The introduction of mass production, assembly lines and exchangeable parts required consistency and high precision. This problem was initially handled by setting specification limits for important product characteristics. As time passed, focus moved away from the finished products towards improving the capability of production processes (Garvin, 1988). An illustration of this is the Six Sigma methodology, which could be seen as a pragmatic specification of quality management. The methodology was originally established by Motorola in the 1980s, and is, according to Klefsjö et al. (2001), to a large extent based on systematic use of statistical techniques.

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5 In this thesis the term process management is used in a broad sense, referring also to business process management and horizontal process management.
Short life cycles put focus on the efficiency and flexibility of product development. The general trend towards more complex products also calls attention to the need for a deeper comprehension of the underlying relationships between process and product variables. Figure 1.3 presents a generic production process transforming an input, such as raw materials and components, into a finished product that has several quality characteristics. Examples of controllable parameters are temperatures, pressures, and process time. Examples of uncontrollable, or difficult to control, parameters are vibrations due to play in bearings, varying air humidity, and inhomogeneous raw material.

![Figure 1.3 Illustration of a generic production process with a set of influencing factors. From Garvare (1998).](image)

The introduction and development of efficient statistical methods for structured observation and experimentation during the early twentieth century has given rise to many new possibilities of identifying relationships between variables; see for instance Shewhart (1931), Fisher (1960), Box & Bisgaard (1987) and Deming (1986; 1993).

1.1.4 Integration and Increased Scope of Management Systems

The prevailing view of the twentieth century quality management evolution is a shift of focus from assuring quality by examining results towards controlling causes of action producing the results. In the 1990s a new movement begun, away from specific, exclusively quality related, departments, programs, training, awards and culture towards incorporating quality issues with the normal day-to-day fabric of managing a business (van der Wiele & Brown, 2002). The former pursuit of quality almost as a religion is not apparent anymore. There are examples of terminological changes to avoid perceptions of fads or unsuccessful initiatives in the past, for instance from using the word "quality" towards using "excellence" (Dale et al., 2000b). According to van der Wiele & Brown (2002) some of the glamour
may be gone but the specific and fundamental principles of the quality management philosophy, like continuous improvement and customer satisfaction, have instead been established as integrated parts of general business strategies.

The new version of ISO 9000 is in alignment with business excellence models such as the European Quality Award and the Malcolm Baldrige National Quality Award (Bendell, 2000). Quality management systems are also increasingly being integrated with business management systems that also include health, safety and environmental issues (Wilkinson & Dale, 1999). The trend in modern business management points toward composite, comprehensive and complex management systems (Karapetrovic & Willborn, 1998). Karapetrovic (2002) states that today it is not enough to meet customer needs and expectations, adequate worth must also be provided to stakeholders such as employees, the local and global community, investors, and society in general, in terms of both financial and non-financial aspects of a company’s performance. Scipioni et al. (2001) state that:

“the concept of quality is destined to evolve significantly from being simply customer satisfaction towards including sustainable development and employee motivation and involvement.”

According to Johnson & Macy (2001) organisations exist within the context of society and nature. All organisations interact with aspects such as energy, air, land, water and living organisms. As actors, organisations also generate behaviour that impacts upon society and nature, affecting the wellbeing of many different stakeholders. Conflicts between stakeholders with contradictory economical, environmental and social interests have resulted in the emergence of the sustainability movement, see for example Pearce & Warford (1993). Sustainable development centres attention on combining economic prosperity with social equity and environmental protection, the so-called triple bottom line (Elkington, 1999). The World Commission on Environment and Development stated in the Brundtland report that:

“Sustainable development is development that meets the needs of the present generation, without compromising the ability of future generations to meet their own needs”

(WCED, 1987)

Issues of sustainable development are essential to all types of organisations (Edgeman & Hensler, 2001) and the requirements on organisations to measure not only their financial status but also their environmental and social status will most likely not lessen in the future.
1.1.5 Issues of Small and Medium Sized Enterprises

The importance of small firms is widely acknowledged, and their development is recognised as a vital factor contributing to national and global economic performance (Storey, 1994). According to Hillary (2000):

"Small and medium sized enterprises are the most important sector of a nation’s economy. They provide and create jobs, especially during times of recession; they are a source of innovation and entrepreneurial spirit; they harness individual creative effort; and they create competition and are the seed bed for business of the future. In short, small and medium sized firms are vitally important for a healthy dynamic market economy."

There is a range of definitions for small and medium sized enterprises (SME) available, see Chapter 4 for a further discussion. The operational definition used in this thesis is based on the scale of the work force; as companies with between 10 and 199 employees, see Table 1.1.

Table 1.1 Categories of organisations used in this thesis.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro</td>
<td>1 to 9</td>
</tr>
<tr>
<td>Small</td>
<td>10 to 49</td>
</tr>
<tr>
<td>Medium</td>
<td>50 to 199</td>
</tr>
<tr>
<td>Large</td>
<td>200 or more</td>
</tr>
</tbody>
</table>

Based on a life-cycle perspective, the growth of a firm could be described as various stages or phases that the firm passes through. According to Barth (1999) each of these stages could be characterised by the relationship between internal and external conditions, such as size of the organisation, internal culture, and growth rate of the industry. As these conditions change, the firm has to adjust its organisational structure in order to develop the firm further.

A definition of organisational structure presented by Hall (1996) is based on three structural characteristics: complexity, formalisation, and centralisation. Complexity refers to the degree of vertical, horizontal, and spatial differentiation. Vertical differentiation could be measured by the number of hierarchical levels within the organisation. Horizontal differentiation could be measured by the number of sub-units within the organisation. Spatial differentiation could be measured by the number of separate geographical locations where the organisation has sub-units. Formalisation refers to the use of rules and formal procedures within an organisation, and could be measured, for instance, by the number of some particular written documentation within an organisation. Centralisation refers to the distribution
of power within an organisation, and could be measured by the degree to which
decision-making is concentrated to certain points in the organisation. (Hall, 1996)

Barth (1999) argues that a dominant barrier to growth for small firms is lack of
appropriate changes of the organisational structure as the size of the firm increa-
ses.

According to Gray (2002) constraints associated with organisational size influence
the performance of SMEs; the smaller the firm, the stronger resistance to intro-
ducing changes. The lack of time to reflect and learn effectively from experiences
is supposed to reinforce SMEs’ reluctance to change. In contrast, based on a lit-
erature study, Ghobadian & Gallear (1997) state “the resistance to change is likely
to be greater and more significant in larger organizations than in SMEs”. Some of
the key factors described to be contributing to this phenomenon in large enter-
prises are: the prevalence of a strong departmental and functional mind-set, the
existence of a high degree of standardisation and formalisation, and communi-
cation difficulties.

1.2 The problem area

The discussion so far has argued that focusing merely on results and corrective
actions is not enough to remain competitive in today’s fierce business environ-
ment. Many companies, both large and small, are required to be working preven-
tively with some form of proactive quality management in order to stay in busi-
ness.

Many small firms face pressure from their customer companies to gain a quality
management system certification (Rayner & Porter, 1991; van der Wiele &
Brown, 1998; North et al., 1998; Chittenden et al., 1998; and Gustafsson et al.,
2001). Different types of quality management strategies, in particular the ISO
9000 standard, are as a consequence being forced upstream supply chains, from
customers to suppliers.

Most of the established quality management strategies have originally been
developed with the large organisation in mind, see e.g. Ghobadian & Speller
(1994). Management literature, education and research have primarily centred on
meeting the needs of larger enterprises (North et al., 1998). In several aspects, for
example in terms of structure, formalisation, and utilisation of resources, small
and medium sized organisations are not like the large ones (Bolton, 1971; Welsh
& White, 1981; Storey, 1994; Ghobadian & Gallear, 1996). Much of the
contemporary quality-related systems, tools and methodologies are therefore not
necessarily the most suitable for small and medium sized organisations.
Despite the potential benefits (Hendricks & Singhal, 1999) and advantages due to size (Neerland & Kvalfors, 2000) many small and medium sized enterprises have been slow to implement total quality management (Ghobadian & Gallear, 1996; 1997). According to Terziovski & Samson (2000) larger companies tend to gain greater benefits from total quality management than smaller firms, possibly due to greater availability of resources in larger companies. As shown by North et al. (1998) quality management strategies developed for large organisations do not translate well into small organisations. A study by Chapman & Sloan (1999), comparing large and small firms, shows a gap between the importance placed on specific quality related problem solving tools and their actual usage in the small firms. There are indications that this could be the case also regarding integration of management systems in small and medium sized enterprises. According to Scipioni et al. (2001) only a few examples of integration of the environment, quality and safety systems exist in small enterprises.

The preceding discussion has illustrated the need for modern quality management strategies specifically developed to fit small and medium sized organisations. In the following three sections additional problems related to the area of research will be introduced.

1.2.1 Process Management in Small and Medium Sized Enterprises

Due to the evolution of quality management, process management is a topical area of research that has become increasingly important in recent years. Introducing process management is seen as a movement from a non-process based organisation, for instance a functional or project based organisation, in the direction towards a process based organisation, see Figure 1.4.

![Figure 1.4 An introductory scale of process based organisations.](image)

In a study of 92 European organisations members of the European Foundation for Quality Management (EFQM) Pritchard & Armistead (1999) argue that the three main drivers for implementing business process management are the need to improve responsiveness, the competitive threat and the need to improve quality. Business process management is described as a logical progression for those companies that have been involved in total quality management. Lack of understanding of process management was identified as the biggest difficulty for organisations in the initial stages of adopting a process approach. Company size did also appear to be a factor in the study, with relatively few small organisations having much experience in process management. The authors state that process
management is most relevant for larger organisations, and may be less of an issue for small enterprises, given their proximity to the market and more narrowly defined product offerings.

In a study of quality award winners in Sweden, Hansson (2001) found that many small organisations perceive work with process orientation to be problematic. The introduction of the new 2000 version of the international quality management systems standard ISO 9000 was a major update, placing emphasis on process management and resource management rather than manufacturing related quality assurance (CEN, 2000). One of the biggest changes in ISO 9001:2000 is that the new concept of process approach is promoted (Tsin et al., 2002). The process approach is defined as “the application of a system of processes within an organisation, together with the identification and interactions of these processes, and their management”. In the new standard, organisations must recognize and establish processes together with their sequence and relations, monitor and analyse process performance, and manage and control the processes to compliance with the requirements. The pressure on small and medium sized enterprises to adopt a process approach will probably increase due to the update of ISO 9000.

According to Bendell (2000) the new version of ISO 9000 is a good development, but it will mean changes to the organisations involved and there may be de-registrations especially in the group of small and medium sized enterprises. Tsin et al. (2002) argue that the changes are resulting in much impact and concern to the currently certified organisations. Compared with large companies, small and medium sized enterprises are generally more highly specialised towards a specific product and a particular market, and possibly also towards a small geographic area (Storey, 1994). Therefore the small and medium sized enterprises are also more vulnerable to changes, not only in market trends and technological shifts, but also to changes in the context of requirements and legislation. Dramatically changing a quality management system, such as ISO 9000, is therefore likely to have a higher effect on small and medium sized enterprises, compared to large companies.

Boulter & Bendell (2002) argue that the implications of addressing changes in the quality standard may be particularly acute for small businesses, for which the impact of requirements and relative commercial costs of compliance can be greatest. In order for organisations to remain certified the standard has to be fully implemented before the end of year 2003. This will mean that many small and medium sized enterprises, regardless of their true needs, being devoted to process management.

Many small enterprises depend on one or a few customer relations (Westerberg, 1998). The loss of a single customer could therefore bring the organisation into a crisis. If the use of ISO 9000 is a requirement from one such major customer,
abandoning the management system is not an option to the enterprise. This further emphasises the importance of studying potential consequences of introducing and using a process approach in small and medium sized enterprises.

According to DeToro & McCabe (1997) a change towards process management requires not just the use of a set of tools and techniques, but a change in management style and way of thinking. Rentzhog (1996) finds that implementing process management involves both structural and cultural changes to the organisation.

According to Hall (1996) effectiveness is not achieved by following one specific organisational model; “There is no one best way to organise for the purpose of achieving the highly varied goals of organizations with highly varied environments”. Hall denotes this as a contingency approach, which says that under some conditions one form of structure is more effective or efficient, while under other circumstances alternative forms would be more effective or efficient.

In contrast to the contingency approach presented by Hall (1996), many authors within the field of quality management seem to agree that implementing process management is generally leading to increased organisational effectiveness and efficiency, at least concerning large organisations. Could this be the case also regarding small and medium sized organisations?

![Diagram](image)

Figure 1.5  Is moving towards a process-based organisation generally beneficial for small and medium sized enterprises?

In a study of enterprises with up to 200 employees Barth (1999) found that organisational complexity, measured as a summation of organisational levels and functions, increased with growing size of the enterprise up to a certain point, about 100-150 employees. Building new hierarchical levels and functions seems to be the natural way for most small and medium sized enterprises to handle their growth. Introducing a process based management system is likely to affect the
organisational structure. Is moving towards the right hand side of Figure 1.5 generally appropriate for small and medium sized enterprises?

To aid the prevention of potential negative consequences, as well as to aid enhancing the utilisation of potential benefits, it should be of great importance to describe experiences of introducing and using process management in small and medium sized enterprises.

1.2.2 Process Improvement in Small and Medium Sized Enterprises

According to Montgomery (2001) there has been a profound growth in the industrial use of statistical methods for quality improvements in the United States since 1980. However, research made by Deleryd (1998) has shown that in many cases the industrial use of process capability studies does not follow the theoretical aspects of the methodology properly and hence a lot of decisions, made on the basis of these studies, are probably erroneous. In a study of more than 400 Swedish companies, most of them very small, Bäcklund et al. (1995) found that only about five percent used statistical techniques such as design of experiments, process capability studies, or control charts. This is an indication that small enterprises could be lagging behind in the utilisation of statistical techniques.

This discussion shows the importance of examining how techniques for process improvement could be implemented in small and medium sized enterprises, in order to increase the possibilities of success. The topic of statistically designed experiments is one of the important areas within this field of research.

1.2.3 Business Excellence Models and Sustainable Development

Over the years quality issues have evolved from being focused on product performance to comprehensively addressing the management of organisations. There has also been a new way of thinking and change in mind-set, from a narrow customer focus into the broader concepts of interested parties, human stakeholders in terms of future generations, environmental stakeholders and implications for societal sustainability, see for example Pearce & Warford (1993) and Rao (2000). Today’s business excellence models, such as the European Quality Award or the Malcolm Baldrige National Quality Award, do not to any large extent reflect this shift of focus.

Contemporary business excellence models measure organisational performance primarily with regard to total quality management. The general significance of sustainable development on all levels suggests that issues of the subject should to a high degree be included in models of organisational performance. This is usually not the case today. Sathindrakumar (1996) argues that traditional instruments on
a national level fail to take into account non-market benefits and costs of growth. A number of measurement systems have been presented, both on national and organisational levels, quantifying either some or all of the areas of sustainable development (Farrel & Hart, 1998; GRI, 2002). The very large number of proposed indicators could be a problem, especially for small organisations. According to Hillary (2000) the sector of small and medium sized enterprises is largely ignorant of its environmental impacts and the legislation that governs it.

Forsberg (1998) summarises critique against how traditional measurement systems have been used. Some of the concerns described are that:

- Functional specialisation is encouraged. Every department has its own set of measures, whose main purpose is to inform top managers about its activities and enable planning of actions. These result measures track what is going on within the functional units, not what happens across them.
- Focus is limited on monetary measures, which is not enough in a complex and dynamic world.
- Short-term efficiencies and cost reduction are supported at the expense of long-term considerations, for example quality, morale, innovation and effectiveness.

The importance of developing measurement systems in support of management systems is widely accepted, see for example Ljungberg (2001) and Najmi & Kehoe (2001). To base decisions on facts is also one of the core values of quality management (Dahlgaard et al., 1994; Hellsten, 1997; Bergman & Klefsjö, 2002).

This problem discussion shows the importance of exploring how the scope and practice of business excellence models could be widened to include a broader perspective and become integrated with the principles of sustainable development.

1.3 Main themes and research questions

The three main themes of this thesis are: implementation of statistically designed experiments, experiences of process management, and integration of business excellence and sustainable development. Of those three the second one is considered to be the central topic of the thesis. The first two themes have a strong focus on small and medium sized enterprises. In the third theme this focus is less established. The themes form three different levels of analysis, see Figure 1.6.

In the first theme of this thesis attention is focused on improvement and increased controllability of single processes within an enterprise, the “A” in Figure 1.6. Process management, a fundamental issue of the second theme, is a methodology to identify, control and improve organisational processes, the “B” in Figure 1.6.
The third theme, integration of business excellence and sustainable development, relates to the interaction and interdependence between organisations and their context of society and nature, the "C" in Figure 1.6.

Referring to the previously presented problem area and the themes of the thesis, three main research questions have been formulated.

1 How can statistically designed experiments be implemented in small and medium sized enterprises, in order to increase the possibilities of success?

A successful implementation means roughly that theoretical aspects have been grasped, that the implementation has resulted in a use of designed experiments in relevant parts of the organisation, and that the organisation can show quantitative results of this use. The first research question has been specified as:

1.1 Which key aspects are of importance when implementing statistically designed experiments in small and medium sized enterprises?

1.2 Which major phases can be identified when implementing statistically designed experiments in small and medium sized enterprises?

2 What are the experiences of introducing process management in small and medium sized enterprises?

The second research question refers to experiences made by managers and employees within organisations that have introduced process management. The pri-
mary level of interest is aspects within single organisations, not within populations of organisations or individual persons. The second research question has been specified as:

2.1 What are the main motives to start using process management in small and medium sized enterprises?

2.2 What are the influences on issues such as organisational structure, division of responsibility, and employee satisfaction when moving towards process management in small and medium sized enterprises?

2.3 How widespread is the use of process management among small and medium sized enterprises?

3 How can the scope of quality management be widened to include principles of sustainable development?

The third research question has been specified as:

3.1 How can organisational performance related to sustainable development be measured using process models based on total quality management?

3.2 How can the scope of business excellence models be widened to include principles of sustainable development?

Key aspects relating to small and medium sized enterprises are of special interest for this research. With business excellence models is meant models, based on total quality management, that are used for self assessment of organisational performance or as criteria for quality awards. With principles of sustainable development is meant issues such as a stakeholder perspective and a multiple bottom line, where economic considerations are balanced with considerations of, for instance, environmental protection and social equity.

1.4 Scope of the thesis

This thesis aims at contributing to increased knowledge regarding sustainable competitive performance of small and medium sized enterprises in harmony with nature and society. The overall purpose has been specified into the following three parts:

1 To explore implementation of statistically designed experiments within small and medium sized enterprises.

2 To describe experiences of introducing process management in small and medium sized enterprises.

3 To contribute to the development of a conceptual framework for integration of business excellence and sustainable development, with a special focus on small and medium sized enterprises.
The first and third parts of the purpose are of a prescriptive character, trying to find results proposing possible ways to improve the performance of organisations. The second part is of a descriptive character, trying to picture the existing state.

The intention of the thesis is to give contributions from an academic as well as from a practical perspective. The research is of relevance because it fills significant voids in the literature, in particular on the topics of introducing quality-related techniques and methodologies in small and medium sized enterprises, and on integration of quality management and sustainable development.

1.5 Delimitations

The research area is delimitated to Swedish enterprises only. The main reason for this is to avoid potential cultural disparities among organisations in different countries.

The research presented in this thesis is based on a quality perspective. This means that the literature studies performed, and the theoretical frame of reference chosen, have to a high extent been limited to the field of quality management.

1.6 Structure of the thesis

The three themes and research questions of the study are reflected in the structure of the thesis, see Figure 1.7 and 1.8.

![Figure 1.7](image_url)

*Figure 1.7  The three main themes of the thesis and their relations to the six appended papers. The abbreviation SME stands for small and medium sized enterprises.*

Firstly, the area of research is introduced including a description of the background, research questions, scope of the thesis, the overall structure and a summary of appended papers. In Chapter two to four fundamental concepts and theo-
ries regarding quality management, process management, sustainable development, and small and medium sized enterprises are presented and discussed, see Figure 1.8. In the fifth Chapter methodological questions including the research process, data collection and analysis, reliability and validity are discussed. The sixth Chapter presents an extended summary of the results from the research projects. In the final Chapter conclusions and implications are presented and discussed.

1. Introduction
2. Quality Management & Process Management
3. Sustainable Development
4. Small and Medium Sized Enterprises
5. Research strategy and methodology
6. Research results
7. General discussion

Figure 1.8 Chapter structure of the thesis. A theoretical frame of reference, based on the problem discussion and the research questions of the introduction, forms a foundation for the research strategy and methodology. This groundwork is then derived into a presentation and discussion of the research projects and their results.

1.7 Summary of appended papers

Paper I - Experiences of implementing statistical methods in small enterprises

This paper, co-authored with Mats Deleryd and Bengt Klefsjö, is based on research projects presented in Deleryd (1998) and Garvare (1998). The paper describes two studies of implementation of statistical techniques. One is related to the use of process capability studies in the Swedish industry, the other one is related to the use of design of experiments at two small enterprises within the high performance ceramic industry. From both of the studies we find recommendations and a model on how to implement statistical techniques in small and medium sized enterprises in order to increase the possibilities of success.
Paper II - Consequences of Implementing ISO 9000 in Small Enterprises

This paper discusses quality-related methodologies and tools, developed in the context of large corporations, which are increasingly being applied in small enterprises. The new edition of the widely adopted ISO 9000 standards for management systems obliges organisations to implement process management in order to get certified. The requirements of ISO 9000:2000 could primarily be reflecting the needs of large organisations, and a certification of a small enterprise could create constrains on its leadership. There are both potential benefits and potential problems with applying the new ISO 9000 in small enterprises. The standards may help to anchor fundamental cultural changes, like process management, within the organisation. Implementing a management standard as a reaction to external customer pressure could negatively inflect on the perceived dynamic of the corporate environment, leading to a decrease in growth and performance of the small firm. Suggested questions for further research are presented.

Paper III - Process Management in Small Organisations – Experiences of a Swedish Study

During the last decade process management has evolved as a widely used instrument for organisational change and improvement. This paper presents results of a research project where obstacles and possibilities when introducing process management in small organisations have been investigated. A questionnaire was sent to a total of 1,500 firms with 10 to 199 employees. The results show that general response from personnel when implementing process management was positive or very positive. Main problem areas included bureaucratic documentation procedures and difficulties when trying to involve older personnel and middle managers. At the companies where the use of process management had been initiated from within the organisation the likelihood of a successful implementation was improved.

Paper IV - Case studies of Process Management in Small and Medium Sized Enterprises

This paper, co-authored with Klara Palmberg, presents the results of case studies of process management in seven Swedish small and medium sized enterprises. Our findings were that, in general, the studied companies had not changed directly from a functional orientated organisation to a process orientated organisation. Instead they were still in, or had recently passed through, an intermediate state characterised by a team and project based organisation where focus was shifted towards a cost reduction emphasis. The transitions described by the case companies have been summarised schematically in a model with three stages: starting with functions, continuing via teams and projects, and ending with processes.
Paper V - *Sustainable Development – Extending the Scope of Business Excellence Models*

This paper, co-authored with Raine Isaksson, presents an example of how to integrate the values of sustainable development in a business excellence model. It discusses definitions and measures of sustainable development, integrating values of total quality management with global human and environmental stakeholder interests. Requirements, core values, main criteria and different concepts of measures for sustainable development are examined, discussed and defined. Existing methods and strategies for quality and business excellence are compared with definitions of sustainable development. Indicators for sustainable development in an organisational and business context are discussed and a rough framework is presented.

Paper VI - *Measuring Sustainable Development using Process Models*

This paper, co-authored with Raine Isaksson, presents a process model combining TQM-values and indicators of Sustainable Development. The intention is to find synergies in applying a process view on different systems for measurement of sustainable development. A global process is introduced and global sustainability is related to critical elements of production, resources and population growth. Indicators of organisational performance are classified, and sustainable development is described with the three dimensions of Economy, Environment and Ethics, representing a modified version of the Triple bottom line. Existing measurement systems for sustainable development are categorised according to the proposed organisational process model and positioned within the 3E dimensions. The use of indicators for sustainable development in different organisations, including small and medium-sized enterprises, is discussed.

1.8 Other papers presented by the author

The following papers have also been published within the framework of the author’s research but are not appended to the thesis:

- A paper presenting case studies of using production scale designed experiments and multivariate data analysis in the manufacturing process of silicon nitride wear parts, see Garvare (1997).
- A paper discussing possibilities, obstacles and tools for implementing total quality management in small and medium sized enterprises, see Deleryd et al. (1999a).
- A Swedish government official report presenting an evaluation of advanced vocational education, see Björkman et al. (1999).
2 Quality Management and Process Management

The central theme of Chapter two to four is to present the research area and define its boundaries. Although the scope of this thesis does not include a formal analysis of theories, it seems necessary to present some general concepts and definitions within the theoretical framework of the research.

2.1 Quality definitions and conceptualisations

As described in the first Chapter common portrayals of the quality management evolution culminate with total quality management (TQM). Underneath the umbrella of TQM there are several values, techniques and tools that can be used to improve product and process quality (Hellsten & Klefsjö, 2000). In this Chapter some of these will be presented and discussed.

2.1.1 Quality

Most people have a conceptual understanding of quality as relating to desirable characteristics that products should possess. However, the quality of a product is a multifaceted entity and can be defined in many ways. Garvin (1988) describes eight dimensions of quality, i.e. performance, reliability, durability, serviceability, aesthetics, features, perceived quality, and conformance to standards. Some often referred to key phrases defining quality include “fitness for use” (Joseph M. Juran), “conformance to requirements”, (Philip B. Crosby) and “quality should be aimed at the needs of the customer, present and future” (W. Edwards Deming). Bergman & Klefsjö (1994; 2002) define the quality of a product as “its ability to satisfy, or preferably exceed, the needs and expectations of the customers”.

Challenging universalistic and customer based notions of quality, where considerations of costs of production and price of products are seen as irrelevant, North et al. (1998) argue that product quality is relative and socially constructed through a process of implicit or explicit negotiation. It should therefore be defined as a joint construction of producers and others, especially customers, external to the enterprise. Customer satisfaction should not be the sole or prime criterion on which business performance should be assessed. The community or the general public may have interests regarding issues such as safety and the environment. In many countries managers are legally required to give priority to shareholder interests, and there are examples where shareholders’ and customers’ interests do not coincide. It is stated by North et al. (1998) that customers are often poorly informed and have vague ideas of what they want while businesses seek to shape
customers' ideas in order to maximize profit. Quality is therefore seen as dynamic, unstable and changing, a relative function of price, taste, technology, information and negotiation in the market.

2.1.2 Total Quality Management

Hellsten & Klefsjö (2000) describe total quality management (TQM) as "a continuously evolving management system consisting of values, techniques and tools", see Figure 2.1.

Figure 2.1 Total Quality Management (TQM) seen as a continuously evolving management system consisting of values, techniques and tools, the aim of which is to increase external and internal customer satisfaction with a reduced amount of resources. It is important to note, that the techniques and tools in the figure are just examples and not a complete list. In the same way the values may also vary a little between different organisations and over time. (From Hellsten & Klefsjö, 2000.)

In the, now expired, standard ISO 8402 it was stated that:

"TQM is a management approach of an organisation, centred on quality, based on the participation of all its members and aiming at a long-term success through customer satisfaction, and benefits to all members of the organisation and to society."

Principle norms and values related to TQM are presented in, for instance, ISO 9000 (CEN, 2000), the European Quality Award (EFQM, 2002), and the Swedish Quality Award (SIQ, 2002). Based on a comprehensive examination of literature Hellsten (1997) shows that fundamental core values of TQM are: focus on cus-
tomers, management commitment, everybody's participation, focus on processes, continuous improvement, and fact-based decisions.

According to Kroslid (1999) total quality management has not yet been fully accepted in general management theory, and there is little agreement on terminology and definitions. Hellsten (1997) states that the main part of published books on the subject of TQM stems from "consultant gurus", i.e. independent writers and advisers. As Dale (1999) puts it, quality management experts, both academics and consultants, have had a considerable influence on the development of TQM throughout the world. Examples include W. Edwards Deming, Joseph M. Juran, Philip B. Crosby and Armand V. Feigenbaum. Although many of them have not used the term total quality management their works have subsequently been recognised as relevant to the development of the theory (Ghobadian & Speller, 1994; Boaden, 1997). Consultants have to some extent driven ideological development within the field of TQM. Often, their main objective is to sell ideas and concepts, not to analyse and discuss existing theories. It is argued by Hellsten (1997) that this might be an explanation for the problem of vague definitions of TQM and the variety of concepts that are launched within the subject. Another plausible explanation could be the continuous and rapid development of the research area.

The description of TQM as consisting of values, techniques and tools, introduced by Hellsten & Klefsjö (2000), has created a basis for the division of quality related phenomena studied in this thesis. The core values of TQM identified by Hellsten (1997) have been used in the thesis to represent the philosophy of TQM.

For a further discussion on TQM, see, for example, Oakland (1995), Kennerfalk (1995), Boaden (1997), Krüger (2001) and Zain et al. (2001).

2.2 Process definitions and conceptualisations

There is no consensus in the literature regarding the definition of the term "process", and the word is used in many disciplines with different meanings. Organisational and cybernetics theorists speak in terms of human and social processes; see for example Lowe (1995) and Brozyna (1999). Processes are also discussed in the fields of systems thinking and system dynamics (Cusins, 1994). A review of differing opinions on what constitutes a "business process" is provided by Irani et al. (2000), who extrapolate the following definitions:

- "a set of activities that, taken together, produces a result of value to a customer" (Hammer & Champy),
- "a set of logically related tasks performed to achieve a defined business outcome" (Davenport & Short),
- "an ordering of work activities that for a known starting-point" (Ferrie),

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• “a cycle of activities, which taken together achieve a business objective” (Omrani),
• “the logical organisation of people, materials, energy, equipment, and procedures into work activities designed to produce a specified end result” (Pall),
• “a lateral or horizontal form, that encapsulates the interdependence of tasks, roles, people, departments and functions required to provide a customer with a product or service” (Earl),
• “a set of interrelated work activities characterised by specific inputs and value added tasks that produce specific outputs” (Saxena),
• “any sequence of pre-defined activities executed to achieve a pre-specified type or range of outcomes (Talwar).

Rentzhog (1996) discusses the multidimensional meaning of the word “process” and defines it as “an activity or a set of orderly linked activities transforming input to output for customers in a repetitive flow”.

Zairi (1997) defines a process rather broadly as “an approach for converting inputs to outputs. It is the way in which all the resources of an organization are used in a reliable, repeatable and consistent way to achieve its goals”.

The new ISO 9000:2000 standard defines the word “process” in relatively open terms. It states that “any activity, or set of activities, that uses resources to transform inputs to outputs can be considered as a process”.

Bergman & Klefsjö (2002) define a process as “a network of activities that are repeated in time, whose objective is to create value to external or internal customers.”

Egnell (1994) differentiates between processes, on the base of their function, into the following categories: main processes, support processes and management processes.

Different process definitions have been used during the three research projects described in this thesis, see Chapter 6 for a further discussion.

2.3 Process management

As described in the first Chapter the scope of process management was expanded during the 1980s and 1990s to a corporate emphasis, including all functions of an organisation. One of the difficulties with process management is its terminology and great variety of definitions. Although process management is a relatively new area of research the literature on the subject is abundant. Porter (1985) introduced
the concept of the value chain. Other commonly used terms associated with the management of processes, with somewhat differing definitions are business process management, business process re-engineering, process control, process improvement, process orientation and horizontal process management.

DeToro & McCabe (1997) describe the traditional organisation as hierarchically managed in a vertical chain of command. Information flows upward to functional managers who evaluate the data, make decisions and deploy policy and communications downward (see Figure 2.2).

In most organisations work moves across functional boundaries through a network of fundamental processes that are woven right through the organisation, see Figure 2.3.

Figure 2.2 Illustration of traditional organisational chart. From DeToro & McCabe (1997).

In most organisations work moves across functional boundaries through a network of fundamental processes that are woven right through the organisation, see Figure 2.3.

Figure 2.3 Illustration of future organisational chart on how process-focused organisations work. From DeToro & McCabe (1997).
DeToro & McCabe (1997) state that:

“By using horizontal management, the organization is viewed as a series of functional processes linked across the organisation. Policy and direction are still set at the top, but the authority to examine, challenge, and change work methods is delegated to cross-functional work teams.”

Zairi (1997) defines business process management as:

“a structured approach to analyse and continually improve fundamental activities such as manufacturing, marketing, communications and other major elements of a company’s operation.”

The new ISO 9000:2000 standard states that:

“For organizations to function effectively, they have to identify and manage numerous interrelated and interacting processes. Often, the output from one process will directly form the input into the next process. The systematic identification and management of the processes employed within an organization and particularly the interactions between such processes are referred to as the ‘process approach’.”

Common features of business process management approaches are, according to Pritchard & Armistead (1999):

1. Analysis of external market value chain and identification of key business processes in relation to this.
2. Development of a process architecture as a means of understanding the organisation. This may involve process mapping.
3. Appointment of process owners.
4. Establishment of process metrics and effectiveness criteria.
5. Performance monitoring.
6. Planning, communication and training around the process model.
7. In some cases alteration of organisational structure taking account of the process architecture.

Hammer & Stanton (1999) find that the most visible difference between a process enterprise and a traditional organisation is the existence of process owners, i.e. senior managers with end-to-end responsibility for individual processes. They state that:

“The advent of process owners is a dramatic change for most organizations because it separates the control over work from the management of the people who perform the work. Traditionally, a geographical or functional manager oversees both the work and the people who do it. In a process enterprise, the process owner has responsibility for the design of the process, but the various people who perform the process still report to the unit heads.”

(Hammer & Stanton, 1999)
According to DeToro & McCabe (1997) process owners should have responsibility for optimising process efficiency through coordinating the efforts of a process improvement team. The team should map the process, document and analyse subprocesses, identify performance problems, select an improvement strategy, and implement changes to the process. This includes maximising performance by reducing cycle time, minimising costs, reducing output variation, streamlining procedures, redesigning work steps, automating activities, and ensuring that external customers’ requirements are met.

Lind (2001) describes two general approaches to process management; the “transformative” and the “communicative”. According to Lind examples of transformative approaches include business process reengineering, total quality management, and process management. These approaches apply a process-orientated horizontal view on business performance, which means a focus on activities that transform input provided by a supplier to output received by a customer. The actors of the process are its owner and its operational managers. In contrast to process management approaches based on a transformative view, communicative approaches are language and action-orientated, emphasising the acts of establishing, fulfilling, and evaluating commitments within processes. Processes are viewed as actions of speech on different levels of abstraction. A successful fulfilment is the goal of the communicative process approach.

As stated by Lind (2001) the two views, i.e. the transformative and the communicative, are in conflict with each other. Lind’s synthesis results in a model of transformation in an assignment context. Production and deliveries made during business performance should correspond to the commitments made by the producer. Assignments taken need to be deployed within the organisation. Processes can therefore not only be orientated towards the client. In order to satisfy present and future needs of the client, interactions need to be performed with other parties.

Figure 2.4  A reference model of different process types. From Lind (2001).
related to the organisation, for example providers and condition creators. By focusing on actor relationships, such parties can be identified. As maintained by Lind (2001) there is therefore a need to regard processes as both clients and producers. An asymmetric view on client satisfaction is not sufficient; reciprocal relationships between client and producer are described as a condition to emphasise satisfaction for both parties. Based on this developed notion of processes, Lind (2001) identifies three fundamental process types: delivery processes, providing processes, and condition-creating processes, see Figure 2.4.

The descriptions of process management presented above have been used to formulate criteria for categorising whether organisations have introduced process management or not, see Chapter 6.

2.4 Capability studies and design of experiments

Montgomery (1997) describes two general aspects of quality: design and conformance. Products differ in terms of size, appearance and performance, which are examples of intentional, or designed, variations in grades of quality. The quality of conformance is how well a product conforms to the specifications required by the design. Montgomery (1997) argues that “quality is inversely proportional to variability”, and “quality improvement is the reduction of variability in processes and products”. Since variability can only be described in statistical terms, statistical methods play a central role in quality improvement efforts (Montgomery, 1997).

Every system in operation generates information that could be used to improve it (Box, 1993). To be able to improve a system, measurements must be made and recorded data must be transformed into information by the use of statistical tools and techniques (Sandland, 1993). According to Shewhart (1931) the guiding principle behind quality control and improvement is the use of a scientific method of observation, experimentation and, in particular, statistics. Two important statistical techniques are process capability analysis and design of experiments.

Process capability studies are used to find out if a process can produce products which meet specifications (Deleryd, 1998). The objective is to receive information about the process that can be used to prioritise improvement efforts. A theoretical framework has been established to assess the capability of processes, see, for example, Vännman (1995), Deleryd (1998) and Kotz & Lovelace (1998).

Design of experiments is about performing tests using a minimum of resources to receive a maximum of information about a process or a system. A statistically designed factorial experiment consists of a sequence of tests where one, several, or all of the factors are changed at once between the tests according to a schedule, or run chart, designed prior to the experiment. The design is chosen so that the
impact of each factor can be evaluated when the experiment is completed, see for example Grove & Davis (1992), Schmidt (1994) and Montgomery (2001).

Statistically designed experiments have their origin in the work of Ronald Fisher. In the beginning of the 1920s he worked as a biologist at the Rothamsted Agricultural Experiment Station in Great Britain. There he sought ways of designing plant-breeding experiments so as to provide more amounts of useful information with less investment of time and money. Among Fisher's many important achievements are the concept of randomisation and the analysis of variance. (Encyclopædia Britannica)
3 Sustainable Development

This Chapter presents general concepts and definitions regarding sustainable development. Different multiple bottom line models are introduced and measurement of sustainable development is discussed.

3.1 Definitions and conceptualisations

The question of sustainable development seen from the perspective of limits to global growth has been an issue for more than 30 years (Meadows et al., 1972). The original topic has widened from a main direction towards limits of economic activity to the realisation that a balance must be found between economic prosperity, environmental protection, and social equity, see for example Pearce & Warford (1993) and Rao (2000). The World Commission on Environment and Development stated that:

"Sustainable development is development that meets the needs of the present generation, without compromising the ability of future generations to meet their own needs"

(WCED, 1987)

Sustainable development should include the building of constructive relationships between business and society. In addition to stockholders and customers there are several other groups that the enterprise is responsible to. Freeman & Reed (1983) define a stakeholder in the "wide sense" as:

"any identifiable group or individual who can affect the achievement of an organization's objectives or who is affected by the achievement of an organization's objectives, and includes public interest groups, protest groups, government agencies, trade associations, competitors, unions, customers and employees."

An implication of sustainable development is that economical activities are needed which add enough value to guarantee everybody a decent life without damaging the world in such a way that we endanger their quality of life, and possibly even the survival, of those to follow. According to Hediger (1999) an integrated approach is required that goes beyond traditional debates on economic development versus environmental conservation. He defines the term total capital as an economy's generalised productive capacity and the aggregate of natural capital, and proposes the classification of natural capital into non-renewable resources, renewable resources that are harvested, and those that are not used in production.

Sustainable development is sometimes divided into very weak, weak, strong, and very strong sustainability, representing major distinctions between economically
centred and physically centred positions in the research field, see for example Sathiendrakumar (1996) and appended paper 5.

As an alternative to traditional customer focused business excellence Edgeman et al. (1999) define organisational excellence as “a way of working that balances stakeholder concerns and increases the probability of long-term success through operational, customer-related, financial, and market place performance excellence”. In Edgeman & Hensler (2001) the definition is slightly changed towards:

“Organisational excellence is an overall way of working that balances stakeholder interests and increases the likelihood of sustainable competitive advantage and hence long-term organisational success through operational, customer-related, financial, and market place performance excellence.”

3.2 Multiple bottom lines of sustainable development

As a minimum criterion for sustainable development, the total value of aggregated economic activity and environmental quality should be non-decreasing from one generation to the next. Hediger (1999) maintains that this type of weak sustainability is not sufficient; the integrated approach should be based on a system perspective of development and preservation of the environment. This also needs to be suitably extended to the social context. Traditional theory on sustainable development emphasises the ethical imperative of intergenerational equity. Hediger argues that this must logically be extended also to requirements of intragenerational equity.

Measuring and reporting performance in the areas of economic prosperity, environmental protection, and social equity is often called triple bottom line (Elkington, 1999; Töpfer, 2000). Within the World Bank and the UN Economic and Social Council (ECOSOC), a division in driving force, state and response indicators is used for measuring sustainable development (Rao, 2000).

Edgeman (2000) introduces the “BEST” model, which addresses business excellence and sustainable development from four perspectives: Biophysical/environmental, Economic, Societal and Technological considerations. Biophysical/environmental sustainability centres on the notion that the environment is essentially a closed system and that consumption of non-renewable resources must be at a rate that is at or below replenishment through renewable substitutes. Economic sustainability is presented as crucial for the improvement of the human condition, particularly at the individual level. Social sustainability points to improvement of the human condition at the societal level.
Edgeman & Hensler (2002) continue the description of the BEST model by presenting a new approach to jointly optimise the issues of sustainability using technology as an enabler and cost as the constraint.

### 3.3 Measurement of sustainable development

According to Robèrt (2000) there are two levels of concepts and tools for measuring transition towards sustainable development. Firstly, metrics can be used to test the relevance, quality and quantity of activities to ensure they are aligned with sustainable development. Examples are rate of recycling and purity of recycled fractions. Secondly, metrics can be performed on specific impacts in nature. Examples are indices on global warming potential of gases and relative impact on the ozone layer from various chemicals. Due to the complexity of the system, metrics of the first kind are generally more relevant from a strategic point of view. In a simplified manner the first level could be seen as measuring process output, and the second level as impacts of the output or even stakeholder satisfaction.

In general, an indicator is something that provides useful information about a system. Indicators can be used to describe the state of a system, to detect changes in it, and to show cause-and-effect relationships (Miller, 2001). When attempting to measure sustainable development the indicators should be relevant, understandable for the users, limited in number and adaptable to future developments. Necessary data should be readily available, of known quality, adequately documented and updated at regular intervals (Compton et al., 1998). Ideally the indicators should also show links between the different goals of sustainable development (Farrel & Hart, 1998).

Rao (2000) describes a division in driving force, state and response indicators used for measuring sustainable development. The driving force could be interpreted as the process output, the state indicator as the result of the output and the response indicator as the measures taken to handle problems caused by the output.

### 3.4 Drivers of and barriers to change

Post & Altman (1994) describe three distinct forms of environmentalism that have appeared between the 1970s and the 1990s, emphasizing different mixtures of legal, market, value-based, and ethical considerations.

- **Compliance-based environmentalism.** During the 1970s extensive legal systems with laws and regulations were created in many western countries to enforce environmental performance goals and address problems with waste and pollution.
• **Market driven environmentalism.** During the 1980s the power of market incentives to induce and encourage behaviours that are ecologically beneficial was discovered. Cost savings through pollution prevention was highlighted and "green marketing" was used to persuade customers by offering environmentally friendly products.

• **Value-driven environmentalism.** During the 1990s communities would no longer accept major environmental damage as the price for economic opportunity. The promise of jobs could not overcome concerns that current and future generations would bear the price of health consequences. Jobs and safe environment, economic activity and environmental protection, would have to be achieved at the same time.

From a study of 40 micro and small enterprises in the UK and The Netherlands Rutherford et al. (2000) found that small firms still generally perceive environmentally beneficial activities as a cost. Therefore, it is argued, an over-reliance on voluntary approaches such as the promotion of win-win solutions, supply chain pressure, information and advice is unlikely to be effective. In the study, trade associations were found to play a key role in the process of securing the co-operation of the small firm sector in environmental policymaking.

Taken as a group, small and medium sized enterprises often have a significant economical, ecological and social impact but generally a very low awareness of environmental and social issues (Welford, 1994; Gerrans & Hutchinson, 2000). The improvement potential is high, but a serious problem is that individual small and medium sized enterprises are seldom able to directly measure the effect of their activities on the environment and society, and therefore have little motivation to change.

As discussed by Post & Altman (1994) there are two basic types of barriers that obstruct management efforts from transforming the way strategic decisions are made and operations are conducted within a company. **Industry barriers,** including technical information, capital costs, competitive pressures and industry regulations, reflect the special and unique features of the business activity in which the firm is engaged. **Organisational barriers,** such as employee attitudes, poor communication, past practice and inadequate management leadership, affect a firm's capacity to deal with any form of change, not just environmental problems.
4 Small and Medium Sized Enterprises

In the first Chapter a number of issues regarding small and medium sized enterprises were introduced. This Chapter addresses some additional aspects of this sector.

4.1 Definitions and conceptualisations

There is no single definition of small and medium sized enterprises (SME). The diversity of businesses is wide and what might be considered as an SME in size when compared to other sectors could be a large company in its particular niche market.

Bolton (1971) defines a small firm as:

- employing less than 200 people,
- having a relatively small market share,
- being managed by its owner or part owners in a personalised way, not through the medium of a formalised management structure,
- being independent in the sense that it does not form a part of a larger enterprise and that the managers are free from outside control in taking their principal decisions.

According to Bolton (1971) the majority of small firms face many competitors and do not have the power to affect their environment in terms of price levels or total quantities of goods and services sold. The owners themselves actively participate in all aspects of management of the business and there is rarely a formal management structure with general devolution of the decision-making process. Most small firms are managed by people with a stake in the firm, and the majority are managed by those having a controlling interest, usually the founder or members of his or her family. A small subsidiary of a large firm may have a very high degree of independence, but the ultimate authority lies elsewhere and it could not be considered a small firm. Bolton (1971) also gives statistical definitions of small firms based on measures such as number of employees and turnover specific to different trades.

The Commission of the European Communities (EC) defines SMEs according to number of employees, revenue and total capital employed (Papoutsis, 1996). To be classified as an SME by the EC the enterprise should have fewer than 250 employees, and have either an annual turnover not exceeding 40 million euro, or

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6 In this thesis the terms company, firm and enterprise are used interchangeably to describe a privately owned producer of goods and/or services.
an annual balance-sheet total not exceeding 27 million euro. Independence has also been established as a criterion by the EC and a company is only classified as a SME if it is not owned or controlled by more than 25 percent by organisations falling outside the definition of SME.

Storey (1994) makes the point that the most important criterion for defining SME is the number of employees. According to Lundström et al. (1998) the most widely used definitions of SME measure number of employees.

In this thesis SME is defined statistically, solely on the scale of the work force; as companies with between 10 and 199 employees. The values of the limits have been selected to fit the databases used as frames when sampling the population. A reason for introducing the lower limit of the population is that a substantial proportion of Swedish micro enterprises, with less than 10 employees, are forms of self-employment, where employees other than the owner are members of his family and the owner is not fully acting as a manager.

### 4.2 Characteristics of small and medium sized enterprises

Small enterprises generally display many characteristics, of which we have chosen to highlight a few. Based on an examination of literature, Ghobadian & Gallear (1997) present a summary of main differences between SMEs and large organisations in areas that are argued to be relevant to the design and actuation of total quality management. Size is found to be influencing on organisational behaviour. Large organisations usually rely on formal rules and procedures, specialisation, and standardisation in order to achieve co-ordination. They have a rigid structure and clear and extensive functional division of activities. In SMEs, on the other hand, working relationships are found to be loose and informal, the degrees of specialisation and standardisation are low, and both structure and processes are flexible and adaptable, see Table 4.1.
Table 4.1  A comparison between some characteristics of large, medium and small enterprises. From Ghobadian & Gallear (1997).

<table>
<thead>
<tr>
<th>Large organisations</th>
<th>Small and medium sized organisations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure</strong></td>
<td></td>
</tr>
<tr>
<td>Hierarchical with several layers of management</td>
<td>Flat with very few layers of management</td>
</tr>
<tr>
<td>Clear and extensive functional division of activities. High degree of specialisation</td>
<td>Division of activities limited and unclear. Low degree of specialisation</td>
</tr>
<tr>
<td>Rigid structure and information flows</td>
<td>Flexible structure and information flows</td>
</tr>
<tr>
<td>Many interest groups</td>
<td>Very few interest groups</td>
</tr>
<tr>
<td><strong>Procedures</strong></td>
<td></td>
</tr>
<tr>
<td>Activities and operations governed by formal rules and procedures. High degree of standardisation and formalisation</td>
<td>Activities and operations not governed by formal rules and procedures. Low degree of standardisation and formalisation</td>
</tr>
<tr>
<td>Rigid and unadaptable processes</td>
<td>Flexible and adaptable processes</td>
</tr>
<tr>
<td><strong>Processes</strong></td>
<td></td>
</tr>
<tr>
<td>Formal evaluation, control and reporting procedures</td>
<td>Informal evaluation, control and reporting procedures</td>
</tr>
<tr>
<td>Control-orientated</td>
<td>Result-orientated</td>
</tr>
</tbody>
</table>

4.3 Organisational change

Organisational change is a vast research area. As indicated in its title, this thesis investigates phenomena mainly from a quality perspective, and theories on organisational change are therefore only briefly discussed. The topic of organisational change was introduced in the first Chapter, and in this section a few additional aspects will be presented.

According to Macri et al. (2002), the literature has identified the following general drivers of change, not specific for any particular size of organisations:

- The entrance of new actors, especially top managers, into situation of crisis
- A decline in performance
- Changes of various sorts in the environment, for instance technological discontinuities and changes in the structure of an industry.
Neerland & Kvalfors (2000) argue that small and medium sized enterprises have both advantages and disadvantages, compared to larger companies, concerning the possibilities to succeed with a quality improvement programme. Advantages described are transparent organisations, simple communication across the hierarchy and consistent company culture. Disadvantages are the usually limited availability of resources and marginal organisational structure where a few persons have a wide variety of work tasks and responsibilities.

According to Hoag et al. (2002) most obstacles managers encounter in effecting organisational change are largely of their own making. In a study of human resources professionals they argue that the commonly described categories of cost, workload and legislation are not primary obstacles to effective organisational change. Instead it is cultural entrenchment, created by a dysfunctional management, which prevents organisations from experiencing positive change. Respondents in the study by Hoag et al. (2002) describe several characteristics of poor leaders and weak managers, such as: lack of vision, no support, obstructive senior team and victim mindset. This results in underlying obstacles of cultural factors in the emotional environment shared by members of an organisation, such as: uncertainty, turf protection and internal politics.

According to Cao et al. (2000) total quality management (TQM) is an approach to change management which adequately addresses only process change, with incidences of failure closely correlated to the application of process-based TQM techniques in change contexts characterised by structure, values or power. In order to apply TQM successfully this study suggests that either an approach is required which adequately addresses all types of change context, a so-called “systemic” approach, or its application needs to be restricted to those contexts where process dominates.
5 Research Strategy and Methodology

This Chapter presents the research strategies and methodologies of the studies performed. The problem area and the research questions introduced in the first Chapter set the stage for the choice of research designs and methodological approaches.

5.1 Introduction

The author of this thesis has a background within traditional natural science. During the initial stages of the research a positivistic science paradigm (Patton, 1990) and an analytic methodological paradigm (Arbnor & Bjerke, 1994) was embraced. Throughout the course of the research the author has came somewhat closer to the system methodological paradigm, described by Arbnor & Bjerke (1994) as a perspective where the components of a system are mutually dependent and hence cannot easily be summarised or analysed separately. The components and their relations give rise to synergy effects, and cause-and-effect relations are generally of minor interest. Instead, so-called finality relations are of importance, i.e. relations between purposeful forces and their positive or negative results. Examples of such forces include the structure and goals of a system and individual actions made by components in the system. Organisations can be described as social phenomena, with learning capabilities and culture, and they have to be studied in their own form, language, relations and emotions. It is the view of the author that organisations are parts of larger systems, and their relations to context and environment can be of importance to a study.

5.2 Choice of general research strategy

There are several alternative research strategies plausible for answering the research questions raised in the first Chapter. Notable examples include experiments, literature reviews, face-to-face interviews, mail surveys with questionnaires and case studies of selected organisations (Dane, 1990).

Yin (1993) argues that three factors should determine the choice of research strategy: the type of research question posed, the external control an investigator has over actual behavioural events, and the degree of focus on contemporary as opposed to historical events.

The degree of control over events in this study was negligible, and all kinds of experimental design had to be excluded. The purpose was to explore and describe contemporary events, which would suggest the use of surveys or case studies.
According to Dane (1990) the survey approach is mainly suited for descriptive research. Surveys require knowledge of what kind of information there is to be collected. They are for that reason inefficient for exploratory research, where instead case studies are more useful. Therefore, a combination of case studies and surveys was chosen as a main strategy for the research presented in this thesis.

5.3 Research design

Yin (1993) defines a research design as an action plan for getting from an initial set of questions to some set of conclusions (answers) about the questions.

![Diagram of research projects]

Figure 5.1 The three research projects presented in the thesis. The abbreviation SME stands for small and medium sized enterprises.

The research activities in this study were divided into three, partly parallel, research projects, see Figure 5.1. Uncertainties of future work made detailed long term planning difficult and the structures of the research designs were therefore specified separately for each of the projects. The next three sections discuss a number of issues raised during the design phase of the research projects.

5.3.1 Design of the First Research Project

The scope of the first research project was to explore implementation of statistically designed experiments within small and medium sized enterprises.

This project, originally named “Total quality management to increase controllability when manufacturing high performance ceramic products” was part of a large
Swedish research programme called "Powder technology 90", see Garvare (1998). In the application the purpose of the project was described as:

"To develop a work model making it possible for producers of high performance ceramic components to design a robust and dependable manufacturing (i.e. zero defects and improvement possibilities) that creates confidence among the users of ceramic components."

At the time when this project was initiated the Swedish high performance ceramics industry was at an early stage. Manufacturing of high performance ceramics is a very complicated process, which had lead to difficulties in trying to handle process and product variation. Reliability and quality issues were central both to producers and customers within the industry. The producers therefore wanted to be able to control the complex manufacturing process towards specified product characteristics and reduced variation.

The studied cases were the Materials Technology department at Permascand AB in Ljungaverk and AC Cerama AB in Robertsfors. Other Swedish companies involved in this project were IFÖ Ceramics AB in Bromölla and Volvo Aero Corporation in Trollhättan.

An early discussion with representatives of these companies resulted in the decision to try to increase the understanding of the relationships between different parts of the manufacturing process of high performance ceramic components, in order to reach a higher process yield. The causes of variation in product characteristics where partially unknown, and to discover relations between process parameters and product characteristics there was a need to carry out statistically designed experiments.

The Materials Technology department at Permascand AB is a producer of raw material in the form of ceramic powder. During the time of the study the department had four employees. However, due to its dependence on the mother company Permascand AB, which had about 200 employees in total, the case organisation could be categorised as a medium sized enterprise. AC Cerama AB is a producer of high performance ceramic components. During the time of the study it had 13 employees, and could therefore be categorised as a small enterprise. Together these two organisations form a supply chain. During a three year (1995-1997) exploration of the combined manufacturing process several designed experiments were carried out and analysed.

The methodological approach of the first research project was a literature survey parallel with an empirical three year longitudinal investigation and comparison of the two cases.
The choice of cases for this study was directed by the ambition to cover the entire manufacturing process of high performance ceramics, from the making of powder to the delivery of completed components. An ideal research situation would of course be to have an unrestricted liberty to select study objects. In this project the choice of case organisations was largely completed before the investigation was designed.

During the case studies mainly qualitative data were collected. The methods used were semi-structured interviews and direct observation, methods that have been principally described by Merriam (1994). Internal company documents and reports were also examined. The data collected during the first research project was analysed repetitively in discussions with the research group, by looking for patterns in the material gathered, and by iteratively testing tentative hypotheses. During this three year research project the author of the thesis was stationed at the case companies during longer periods of time. There were therefore many opportunities to collect and analyse and validate empirical material in a cyclic and iterative manner, see Figure 5.2.

The case studies were carried out in the form of action research (Gummesson, 1988; Dane, 1990), adding to the research goals of the project the requirement of finding solutions to previously identified problems present in the studied manufacturing process. The author of this thesis did actively participate in the improvement efforts performed at the two case companies. This was important as it enabled testing of different applications and solutions proposed by other research results. To the author the action research also became a valuable experience from
where to gain a deeper understanding of the studied phenomena. To the companies it was an opportunity to get additional resources and feedback able to aid and actively contribute to the problem solving within their organisations.

5.3.2 Design of the Second Research Project

The scope of the second research project was to describe experiences of introducing process management in small and medium sized enterprises. The second research question includes the term “experiences of introducing process management in small and medium sized enterprises”. The unit of analysis in this study was defined as process management, and the sampling unit was the enterprise. The population was defined as all enterprises in Sweden with between 10 and 199 employees. The reason for introducing the lower limit of the population was that a substantial proportion of Swedish small enterprises are forms of self-employment, where employees other than the owner are members of his family and the owner does not fully act as a manager. This type of micro enterprise, with less than 10 employees, has therefore been excluded from the study.

The approach adopted for the second research project was a quantitative-qualitative research design divided into three parts; mailed questionnaires, telephone interviews and case studies. This approach seeks to be able to claim statistical power for the generalisations drawn from the findings combined with deep understanding of central issues and phenomena, see Figure 5.3.

The mail survey was chosen to obtain descriptive information on a substantial and representative number of respondents. The telephone interviews were chosen to collect a considerable amount of data in relatively short interviews. The case
studies, including face-to-face interviews, were chosen to get more in-depth understanding of the motivations, logics and strategies of the human actors involved.

The general research approach of the second project is illustrated in Figure 5.4.

![Diagram](image)

**Figure 5.4** The general research approach of the second project as a continuous development of knowledge, initiated by the research interest, iterating between empirical data and tentative theories, ending with the resulting models and conceptualisations.

**Mailed Questionnaires**

A sample survey with mailed questionnaires was selected as the main research instrument for data collection during the initial part of the study. The survey was not primarily intended to verify a number of previously developed hypotheses but to generate contacts with enterprises claiming to use process management within their organisations, and also to measure the spread of use of process management among small and medium sized enterprises.

The target population was defined as managing directors of Swedish enterprises with between 10 and 199 employees. A random sample of 1,500 persons was selected from a frame of almost 26,000 names bought from PAR\(^7\). The design was chosen to facilitate the estimation of population parameters and sampling errors using statistical methods. The size of the sample was selected based on aspects of resource limitations, but also because 1,500 persons were presumed to represent the population sufficiently accurately, giving a tolerable bound on the error of

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\(^7\) Former "Postens Adressregister", (Swedish Mail Address Register).
estimation. The margin of error $E$ in the confidence interval for the population proportion $p$ is:

$$
E = t_{a/2} \sqrt{\frac{\hat{p}(1-\hat{p})}{n} \left(1 - \frac{n}{N}\right)}
$$

where $t_{a/2}$ is the standard normal critical value for the level of confidence, $n$ is the sample size, and $N$ is the size of the population, see for instance Moore (2000). With a confidence level of 95 percent $t_{a/2}$ will be equal to 1.96, assuming a normal distribution. If $p$ is conservatively estimated equal to 0.5, the sample size is 1,500 and the size of the population is 26,000 the margin of error will be less than 3 percent at a confidence level of 95 percent. However, inaccuracies as results of the response rate being less than 100 percent should be added to this margin of error.

After a pre-test on two managers from the target population and also on colleagues of the author the questionnaire was sent out to all persons in the sample, followed by a reminder to those who had not answered within two weeks. To obtain some information on the group of persons who did not respond to the survey a follow-up telephone survey was made on a random sample of the non-respondents. The survey was analysed using descriptive statistics, see results in Chapter 6.

**Telephone Interviews**

A second sample, consisting of 62 enterprises participating in the previous mail survey, was also studied using telephone interviews. The purpose of the telephone survey was to verify the answers received in the mail survey, and also to more deeply study the effects of process management within small and medium sized enterprises.

The choice of study objects was not made arbitrarily. All enterprises selected for the telephone interviews had previously answered that they had, or used to have, some sort of process management system within their organisation.

A preliminary interview guide with general definitions and open questions was tested on two of the enterprises in the second sample. After revision the guide together with an invitation to participate in the project was sent by letter to all enterprises in the sample. The respondents were then contacted by telephone before the interviews took place. The interviews were made according to the guide supplemented by additional questions formulated beforehand. The length of the interviews varied, with an average of about 30 minutes. Some interviews lasted longer because the respondent was communicative and interested in quality man-

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8 See Appendix 1.
9 See Appendix 2.
agement issues. In the cases where process management had clearly not been implemented the interviews were sometimes very short.

The telephone questionnaire was developed to cover a range of issues while minimising the time commitment of the respondents. The questions asked during the telephone interviews represent properties related to process management and could be looked on as quantitative and qualitative variables. The characteristics of the organisations were measured and analysed using variables structured into four categories: general company description, description of the process management system, motives and resistance, and results and experiences. The choice of these categories was made based on discussions with colleagues of the author.

The answers received during the 62 telephone interviews were primarily analysed using iterative grouping and sorting of the organisations based on quantitative variables such as number of employees and years of implementation, but also based on nominal and binary variables such as whether the enterprise had a certified quality management system or not. As a trial examination, the answers received during the telephone interviews were partly quantified by assigning ordinal values to some of the measured variables. A covariance matrix was tentatively calculated to study degrees of relationship among the variables. Results of this analysis were then used as a starting point for the manual grouping, sorting and search for patterns in the original data, of which the largest part was of a qualitative nature. Multivariate tests of correlation made on several variables simultaneously could easily lead to the findings of significant results by chance alone. There are also other limitations to this investigation. Several issues, both theoretical and practical, have not been accounted for fully in this statistical analysis of interview data, for instance multivariate normality, homogeneity of the covariance matrix, and linearity. Due to the limitations of the tentative multivariate analysis performed, the interpretation of the results has been done with caution. Conclusions regarding significant correlations between variables have not been based on the statistical analysis alone.

In order to analyse if process management had been implemented at the enterprises participating in the telephone interviews a model developed by Deleryd et al. (1999b) was used. In the model three criteria are considered: approach, deployment, and results. A successful implementation means that theoretical aspects of process management have been grasped and conducted, that the implementation has resulted in widespread use of process management within the organisation, and that the organisation can show some qualitative or quantitative results of the implementation.
Case Studies

The written questionnaires and telephone interviews were supplemented by a number of explanatory case studies intended to increase the number of studied variables but also to verify the results obtained in the previous research phases.

The selection of organisations for this study was based on a preliminary analysis of the telephone interviews but also on geographical location and the goal to cover different industrial branches. The total sample of the case studies consisted of seven enterprises.

The tape-recorded interviews normally lasted about one hour. To get valid and realistic pictures of the case companies, interviews were made with representatives of different hierarchical levels, both managers and other employees. Company specific written documentation was also collected during the visits\(^\text{10}\).

5.3.3 Design of the Third Research Project

The scope of the third research project was to contribute to the development of a conceptual framework for integration of business excellence and sustainable development, with a special focus on small and medium sized enterprises.

![Diagram]

**Figure 5.5** The general research approach of the third project as a continuous development of knowledge, initiated by the research interest, iterating between literature studies and tentative theories, ending with the resulting models and conceptualisations.

The primary methodological approach selected for this project was a literature survey, predominantly within the fields of sustainable development, the triple bottom line, and business excellence models. A great variety of existing systems for measurement of sustainable development were found as a result of this survey.

\(^{10}\) See agenda in Appendix 3.
The findings of theories and practical experiences resulted in the development of several conceptual process models. These models were then used to structure the measurement systems found. Different theories were discussed in the research group and tentative hypotheses were tested iteratively, see Figure 5.5. This project did not include collection of empirical data and therefore sampling units were not defined.

5.4 Reliability and validity

Various methods for data collection have been used during the course of the study in the two first research projects, which should strengthen the validity of the research. Yin (1993) states that using more than one method enables the researcher to study a broader range of subjects, makes it possible to develop multiple lines of inquiry and also addresses the problem of construct validity, i.e. the use of instruments and measures that accurately operationalise the constructs of interest in a study.

Most of the variables of interest in this thesis could probably be determined through many different kinds of measures. Some variables could not be measured directly and indirect indicators had to be used. Correlation was assumed between the indicators measured and the variables sought for, but the relation between indicators and variables could of course be complex. Lack of clearness and transparency of indirect indicators could have had a negative effect on the validity of the results.

5.4.1 Reliability and Validity in the First Research Project

Construct validity deals with the use of instruments and measures that operationalise the constructs of interest in a study (Yin, 1993). In the first project this was handled mainly by using multiple sources of evidence. During the three year case studies discussions were held with all members of the involved organisations.

The action research approach of the first research project has inflected on the reliability and validity of the results. During this project the author had dual roles: as researcher and as consultant. These two roles represent two different interests which could sometimes be contradictory. The researcher wants to contribute to knowledge and science by developing general theory, the consultant wants to make use of existing theory to solve client-specific problems. This conflict was handled in part by the elongated time-span of the project, which allowed both interests to thrive.

Due to the extended time-span, and also the fact that only two cases where studied, formal case study protocols were not used during the first research project.
5.4.2 Reliability and Validity in the Second Research Project

Formal protocols were used during the case studies of the second research project. These protocols helped to ensure that the same procedures were followed during the multiple cases, which, according to Yin (1993) should strengthen the reliability of the study.

In this project efforts were made to strengthen the construct validity by using multiple measures of the same construct as part of the same study. Redundant questions were deliberately asked during the telephone interviews and the case studies.

For the telephone interviews all enterprises were randomly selected within the specified frame. Therefore there was a wide contextual spread among the organisations, which should strengthen the reliability and generalisability of the results.

The fact that not everyone within the sample of the population responded to the mail survey inflected negatively on the validity and reliability of the results obtained. However, the special follow-up investigation and analysis of the non-respondents should have significantly reduced this negative effect.

The time lag involved in the second research project, where experiences from introducing process management were studied, could be expected to increase the risk of getting over-optimistic post-project rationalisations by the respondents. During the interviews particular attention was therefore paid to stress the fact that only experiences related to the implementation of process management were to be considered.

An alternative approach for this project could have been to ask the respondents to rate potentially influencing factors. By letting the respondent state not how things are at the present but how they would like them to be the results could have become more prescriptive. However, since the purpose of the study mainly was of exploratory and descriptive character this approach was not chosen.

5.4.3 Reliability and Validity in the Third Research Project

The purpose of the third research project was to contribute to the development of a conceptual framework for integration of business excellence and sustainable development, with a special focus on small and medium sized enterprises. Due to its conceptual nature this project did not include the collection of empirical data, and therefore reliability and validity is not discussed.
6 Research Results

This Chapter presents a summary of the results from the three research projects described in this thesis. For a more detailed discussion of the results and their relation to previously presented theory the reader is referred to Chapter 7 and to the individual appended papers.

6.1 Summary of the first research project

The scope of the first research project was to explore the implementation of techniques for statistical process improvement within small and medium sized enterprises. With a successful implementation was meant that theoretical aspects have been grasped, that the implementation has resulted in a use of designed experiments in relevant parts of the organisation, and that the organisation can show quantitative results of this use.

Throughout the experiments performed at the two case companies, the author of this thesis studied different aspects of implementation. The first case company, the Materials Technology department at Permascand AB, had a strong tradition and focus on reducing variation in product characteristics. During the time of the study sales were growing rapidly due to strong customer demand. This meant that experiments were not allowed to endanger the regular production of ceramic powder. No specific pilot study was performed. Instead a few experiments were carried out on central process stages, but separated from the normal production. Parts of the planned experiments were also changed to passive multivariate observations of the manufacturing process. As a result of this project the personnel involved, both managers and process operators, gained theoretical knowledge regarding statistically designed experiments, and the technique was also used in a few relevant parts of the organisation. However, regarding measurable process improvements as a direct result of these experiments only limited progress was made, which was not enough to clearly indicate that the technique of statistically designed experiments had been successfully implemented in the company.

The second case company, AC Cerama AB, had a long history of experimentation even before this research project was initiated. A substantial part of the activities at the company were development of prototypes and new manufacturing techniques. There was a strong culture of carrying out tests in order to increase understanding of underlying relations between different parameters of the process. It was therefore easy to introduce the basic concept of statistically designed experiments. A pilot project was carried out where the effects on product characteristics by both controllable and, normally, un-controllable variables were analysed. In addition to this pilot project all personnel at the company took part in a three-day
education programme concerning statistically designed experiments and quality management issues in general. Designed experiments were then performed at different parts of the organisation, which lead to the reconfiguration of various production parameters. The experiments made possible measurable improvements in the production, and the implementation of statistically designed experiments was considered successful. Also at this company the project continued with multivariate observations and analysis of the manufacturing process.

The findings from the case studies show that, in order to achieve a successful implementation of statistically designed experiments, educational efforts, a structured approach with kick-off and continuous support are some of the critical aspects that have to be addressed. To fully take advantage of the potential of the technique, detailed process knowledge is needed. In order to trust the results, and also to develop interest in further use of the technique, it is strongly suggested that process operators are involved in the planning of studies and experiments, and also in the analysis of the results.

Based on literature surveys and a comparison of the case companies, a model for implementing statistical techniques, especially design of experiments, in small and medium sized enterprises, has been developed, see Figure 6.1. The model consists of three major phases:

1. Planning and education of managers, where aim, strategies and selection of techniques are made
2. A pilot project, where techniques new to the organisation can be tested
3. Assessment, standardisation and improvement, where the use of the technique gets established in the company, as well as among suppliers and customers.

![Figure 6.1 Major phases and examples of activities when implementing design of experiments in a small or medium sized enterprise.](image-url)
When implementing design of experiments in a small company the managers that are involved should get special guidance early in the project so that they have a basic comprehension of the principles of quality management. Through an early kick-off in the form of a pilot project good internal examples are created where a team of employees is directly involved and the statistical technique is used practically within the organisation.

This is a suggested scheme for the pilot project:

1. Select members of the pilot team.
2. Train the members in the technique of design of experiments.
3. Select one or a few critical parts of a process that is essential to the organisation and is perceived as having great potential for improvement.
4. Identify problems present in the process.
5. Establish a measurement system that could determine the state of process variables before, during and after the experiments.
6. Carry out the experiments according to schemes presented by, for example, Olausson (1992), Schmidt (1994) or Montgomery (2001).

The pilot project should be assessed and experiences from the project should be spread within the organisation. Design of experiments could be applied in other parts of the process that was selected for the pilot study, and also in other processes within the organisation, for example the development of new products or marketing.

A simple but fundamental precondition to designed experiments is that it is possible to trace the individual studied objects through the whole process involved in the experiment. If this is not the case it will be difficult to discover relations between variations in product characteristics and variations in the control of the process. Even though this precondition could appear obvious and unsurprising it proved very difficult to fulfil in many of the experiments performed during the case studies.

### 6.2 Summary of the second research project

The scope of the second research project was to describe experiences of introducing process management in small and medium sized enterprises. A transformation-based definition of a process was used in this project:

"A network of activities that are repeated in time, whose objective is to create value to external or internal customers."

(Bergman & Klefsjö, 2002)

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\[1\] See section 2.2.
Fundamental processes within an enterprise, that use input from external suppliers or produce output to external customers, were considered as key business processes\(^{12}\), see Figure 6.2. Reactions are fed backwards from customers to the business unit and from the business unit to its suppliers. The business unit is affected by varying external factors such as technological development, competition, national legislation, and changing customer needs. The business process is affected by internal factors such as management decisions, use of information systems and competence among the employees.

![Illustration of the organisational model used in the second research project. Idea and design inspired by Rentzhog (1996) and Lind (2001).](image)

In order to analyse whether process management has been introduced in an organisation or not, the list\(^{13}\) of common features of business process management approaches presented by Pritchard & Armistead (1999) was transformed into six decisive factors and three levels of implementation. The first two decisive factors, corresponding to the first three features of the list, have been used in the thesis as criteria for having introduced process management within the organisation (the first level of implementation):

1. At least one of the key business processes of the organisation has been identified and mapped.
2. Process owners, responsible for major and strategic decisions regarding the mapped key business processes, have been appointed.

\(^{12}\) Often noted in the literature as \textit{core processes}, \textit{business processes}, \textit{main processes}, or \textit{fundamental processes}.

\(^{13}\) See section 2.3.
The second level of implementation corresponds largely to the fourth to sixth features of the list by Pritchard & Armistead (1999):

3. Process metrics and effectiveness criteria are established and used to monitor processes.
4. Improvement opportunities are identified and attended to.

The third level of implementation corresponds to the last two features of the list by Pritchard & Armistead (1999):

5. The organisation plans, communicates and trains around the process model.
6. Organisational structure is altered to reflect the concentration of processes.

Figure 6.3  Three levels of process management within an organisation, based on a list of features by Pritchard & Armistead (1999). Achievement of the first level has been used as minimum criterion for having introduced process management

In addition to the levels of implementation presented above (see Figure 6.3), three supplementary decisive factors were considered during the telephone interviews and the case studies of the second research project to determine if the methodology had been implemented successfully. These supplementary factors were: approach, deployment, and results. The factors are based on a model developed by Deleryd et al. (1999b). A successful introduction means that some theoretical aspects of process management have been grasped and conducted (approach), that the implementation has resulted in widespread use of process management within the organisation (deployment), and that the organisation can show some qualitative or quantitative results of the implementation (results).

The existence of process managers, in charge of day-to-day activities and ensuring that the processes meet the goals of the management, were not used as a criterion when categorising whether an organisation had introduced process management or not, i.e. as a dividing line between process-based organisation and non-process-based organisations.
The characteristics of the organisations were measured and analysed using variables structured into four categories:

1. General company description
2. Description of the process management system
3. Motives and resistance
4. Results and experiences.

The first two categories consisted of general information of interest to the study. Identifying main motives to start using process management was one of the specified research questions for this project, see Chapter 1. Resistance is a natural part of a change process and could therefore be expected, see for example Bovey and Hede (2001). Results were measured in order to find out if the implementation had been successful. Examining experiences of introducing process management was the over-all research question of this project, see Chapter 1.

![Mail survey, Telephone interviews, Case studies]

Figure 6.4  The design of the second research project was divided into three parts, mailed questionnaires, telephone interviews and case studies.

The approach adopted for the second research project was a quantitative-qualitative research design divided into three parts: mailed questionnaires, telephone interviews and case studies, see Figure 6.4 and section 5.3.2.

6.2.1 The Mail Survey

A sample survey with mailed questionnaires\(^{14}\) was used as the initial method of data collection for the study. The target population was defined as managing directors of Swedish companies with between 10 and 199 employees.

In the questionnaire it was stated that:

"A process is a network of activities that are repeated in time. It has a beginning and an end, and has customers (clients) and suppliers (providers). Examples of processes that are common in companies are purchase, manufacturing, demand payment, maintenance, and employment of personnel."

\(^{14}\) See appendix 1.
An illustration of a general process map was presented in the questionnaire, see Figure 6.5. In the questionnaire it was further stated that:

“Process orientation (also process management) means that the management of a company assigns persons responsible for mapping, controlling, and improving the processes of the company.”

A number of 1,500 questionnaires were posted. Eleven questionnaires were returned because the addressees were no longer working at the company. In total 511 answers were collected through fax and mail. Two of these were duplicates. The response rate for the survey was 34 percent, see Table 6.1.

Despite the fact that the questionnaires had been addressed directly to the CEOs about one third of the respondents were not the addressee but someone with another position at the company, for example owner, chairman of the board or quality manager. Almost without exception these positions represented roles within the senior management of the company.

Table 6.1 Frame, sample and number of respondents in the mail survey of the second research project.

<table>
<thead>
<tr>
<th></th>
<th>Number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame</td>
<td>25,985</td>
</tr>
<tr>
<td>Sample</td>
<td>1,500</td>
</tr>
<tr>
<td>Addressee no longer at the company</td>
<td>11</td>
</tr>
<tr>
<td>Total answers collected</td>
<td>511</td>
</tr>
<tr>
<td>Duplicates</td>
<td>2</td>
</tr>
<tr>
<td>Respondents</td>
<td>509</td>
</tr>
<tr>
<td>Response rate (percent)</td>
<td>34.2</td>
</tr>
<tr>
<td>Non-respondents</td>
<td>980</td>
</tr>
<tr>
<td>Sample of non-respondents</td>
<td>60</td>
</tr>
</tbody>
</table>

To obtain some information on the group of persons who had not responded to the mail survey a special follow-up telephone survey was made on a random sample of 60 of the non-respondents. The results obtained in this group differed from the
answers received in the group of respondents. Fewer of the non-respondents, about 20 percent compared to 42 percent in the group of respondents, answered that their enterprise was process orientated, i.e. that the management had appointed persons responsible for mapping, controlling, and improving the processes of the enterprise. The results presented for the mail survey are weighted sums of the answers collected in the two groups: respondents and non-respondents.

About 28 percent of the company representatives said that the organisation where they were employed was to some extent, process orientated, see Figure 6.6. Less than one percent answered that their organisation had previously been process orientated, but was no longer using this approach. About 68 percent said that the organisation where they were employed had never been process orientated. A total of 4.1 percent of the respondents and the interviewed of the non-respondents did not answer the first question.

Figure 6.6  The distribution of companies in the mail survey answering that they were process orientated, had previously been process orientated but were no longer using the approach, or had never been process orientated. The figures are based on weighted results between the 509 answers from the questionnaires and the follow-up investigation of 60 non-respondents.

About 30 percent of the representatives said that there had been efforts to identify and map processes within their company, see Table 6.2. About 16 percent of the company representatives said that employees had been trained in process management.

According to the answers in the mail survey, process owners, defined as “person responsible for major and strategic decisions regarding a process”, had been established in 22 percent of the companies, see Table 6.2. Also process managers, defined as “person in charge of day-to-day activities and ensuring that the process meets the goals of the management”, had been established in about 22 percent of the companies.
Table 6.2 Answers received on question 2, 3, 4 and 5 in the mail survey of the second research project. Answers by the non-respondents have been accounted for in the analysis.

<table>
<thead>
<tr>
<th></th>
<th>Alternative answers (percentages)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have processes been identified and mapped within your company?</td>
<td>Yes  29,8</td>
</tr>
<tr>
<td>Have employees within your company been trained in process management?</td>
<td>Yes  15,5</td>
</tr>
<tr>
<td>Have process owners been established within your company?</td>
<td>Yes  22,3</td>
</tr>
<tr>
<td>Have process managers been established within your company?</td>
<td>Yes  21,7</td>
</tr>
</tbody>
</table>

¹ The slight disparity between the figures presented in Table 6.2 and the figures presented in the appended paper number 3 is due to a changed classification of the category “Other” to also include respondents that had answered inconsistently to the questions in the questionnaire.

The criteria for having introduced process management were that at least one of the processes of the organisation had been mapped, and that process owners, responsible for major and strategic decisions regarding the mapped processes, had been assigned within the studied enterprise. A total of 19 percent of the enterprises in the mail survey were considered as having implemented process management according to these criteria.

6.2.2 The Telephone Interviews

At the start of the telephone interviews 50 enterprises were randomly selected from the group that had answered in the mail survey that they were fully or partly process orientated, had identified and mapped processes, and had appointed process owners within their enterprise. Two of these organisations chose not to participate in the telephone interviews. To compensate for this reduction 10 enterprises were added to the list of respondents, of which all chose to take part in the investigation. All of the five companies which had answered in the mail survey that they had previously been process orientated but were no longer using this approach were also selected for the telephone interviews. One of these five companies chose not to participate in the investigation.

The total of 62 organisations participating in the telephone interviews were almost equally distributed between manufacturing companies and service companies. A majority of the companies had some kind of quality management system imple-
mented within their organisation. On average the companies had 52 employees and had been using process management for about four years.

Categorisation
Of the 58 participating companies that had stated in the mail survey that they were fully or partly process orientated, almost one third were categorised during the telephone interviews as traditional functional organisations. The analysis below is only valid to the respondents who were categorised as process organisations at this stage. None of the participating companies were entirely horizontally managed. Instead they used different kinds of hybrid organisations with various divisions based on combinations of functions, processes and projects. Process owners and process improvement teams were managing and improving across functional units. Functional managers were used to provide specialised skills in areas such as marketing, product development and corporate finance.

Of the five companies that had answered in the mail survey that their organisation had tried process management, but was no longer using this approach, two respondents said the person(s) who had initiated and been driving the process orientation of the company had quit, where after the company had moved back to the original functional organisation. The third of the five respondents said his company had been reducing its personnel. From being about ten one year ago they were now only six employees left in the organisation. The old process organisation did not work due to the changes and they now used an informal organisation with no clear management or structure. One of the respondents who had answered that their organisation had tried process management but was no longer using this approach, turned out to be almost completely unknowing of any of the process and quality concepts described, and the interview was cancelled. The last of the five respondents in this group did not want to participate in any telephone interview.

Motives and resistance to introducing process management
About 20 percent of the companies participating in the telephone interviews said that the main motive to start using process management had been a pressure from external organisations such as customer companies and in some case parent companies, see Figure 6.7.

The most frequent answer, 27 percent, was that possibilities of order, structure and control had motivated the introduction of process management. Almost one fourth of the companies saw no alternative but to use process management if they were to remain competitive. Of the 62 companies participating in the telephone survey 10 answered that the implementation of process management was due to the changes in new versions of ISO 9000 or QS 9000.
Resistance to change was described as a major problem at a majority of the companies. Refusal to accept new or altered responsibilities caused by the introduction of process management was reported as mainly originating from personnel that had been working within the organisation for a long time. Some of the respondents also mentioned that there had been problems convincing middle managers of the possibilities with the new way of working. Fighting this resistance was perceived to be taking a very long time. However, many of the studied companies claimed there had been no resistance at all to the introduction of process management.

**Results and experiences of introducing process management**

At a majority of the companies participating in the telephone interviews, the general response from the personnel when implementing process management had been positive or very positive. About half of the companies reported that the commitment shown by the personnel had become higher due to the use of process management. About one fourth of the respondents said the number of managers had decreased due to the introduction of process management. Some also answered that the authority and influence of non-executive employees had increased substantially.

More than one third said process management had lead to better order and structure of the business activities. The engagement and commitment for quality issues among the personnel was perceived as having increased in many of the studied companies. Through the process orientation the respondents said they were able to
analyse their business in a more effective way, set goals and guidelines, identify problems and more clearly divide authority between different persons.

A majority of the studied companies claimed that they, since the introduction of process management, had improved their financial result, increased customer satisfaction, increased their customer base, became more efficient and had reached a higher level of delivery accuracy. No specific documentation to prove these claims could be presented by the company representatives, but the impression of progress and improvement due to the implementation of process management was strong among many of the respondents.

Main problem areas due to the implementation of process management included bureaucratic documentation procedures and difficulties when trying to involve older personnel and middle managers. Only a few companies reported lack of resources as a main problem when implementing process management.

**What could have been done better, according to the respondents?**

The respondents participating in the telephone interviews were asked about what they thought should have been done differently knowing what they now know about implementing process management within their organisation. The most common answer to this question was that the company should have worked harder and more focused towards a predefined goal already from the start. Among the improvements that were asked for were a more comprehensible description of the intentions and the purpose of the changes, specific examples of what had to be done, and clear motivations to why things had to be changed within the organisation. It was thought this could have facilitated the implementation by reducing the anxiety and concern felt by the personnel. By involving more processes and also more people already from the start it was thought the importance and implications of the changes would have been more obvious to many of the employees.

Many of the respondents in the telephone interviews said they wished that their company had made the changes a lot earlier than was the case. Underestimation of the resources needed, mostly in terms of time and efforts, was also a usual comment among the respondents. Some of the companies thought they had been focusing too much on details and therefore got stuck when mapping their processes. A few of the respondents said that special efforts trying to involve and get acceptance among informal leaders of the organisation early in the project would have made things much easier for them. Instead of letting external consultants do all the hard work but to a greater extent train and educate personnel within the company was also recommended by a few of the respondents. However, many of the persons participating in the interviews said they had experienced good help from external consultants during the implementation of process management.
Correlations between studied variables

Results of the telephone interviews show correlations between some of the measured indicators. In general, the medium sized enterprises (50-199 employees) had established some kind of ownership of their key business processes. This was not the case in many of the small enterprises (10-49 employees). Also the system of process improvement was generally more developed and had a higher level of coordination in the medium enterprises than in the small ones. Examples of process improvement in the medium sized enterprises include key business process improvement teams commissioned by the process owners and meeting at regular intervals, assessing the performance of each process.

At the companies that had a system for regular assessment of process performance there was also a tendency of higher commitment among the personnel. At the companies where the use of process management had been initiated within the organisation the response from the employees had been very positive. When the initiative had come from external customer companies, or if process management had been implemented due to the demands of the new ISO 9000 standard, the response from the employees had been a bit less positive. If the initiative to start using process management had come from within the organisation the chances were higher that a clear ownership of the processes had been established. The tendency to follow up and use results from measurements in the processes were also higher when the initiative to start using process management had come from within the organisation.

6.2.3 The Case Studies

To evaluate the effects of implementing process management in small and medium sized enterprises case studies have been performed at seven of the companies participating in the telephone survey, see descriptions in appended paper 3 and 4. Organisations were selected based on a preliminary analysis of the telephone interviews, geographical location, and the goal to cover different branches.

Our findings were that, in general, the studied companies had not changed directly from a functional orientated organisation to a process orientated organisation. Instead they were still in, or had recently passed through, an intermediate state characterised by a team and project based organisation where focus was shifted towards cost reduction. The transitions described by the case companies have been summarized schematically in a model with three different stages: starting with functions, continuing via teams and projects, and ending with processes, see Figure 6.8.

In all seven cases, the studied companies had originally been production orientated, using a functional approach mainly focusing on stability and control of
products and activities. Cost pressure had generally been low with a stable environment and long planning horizons. In the investigated manufacturing companies, produced goods were often delivered to stock, and improvement efforts were primarily concentrated on enhancing product quality. With the exception of the manufacturing process, process responsibility was generally not defined at this stage.

![Diagram of process implementation stages](image)

**Figure 6.8** Stages of process implementation in studied small and medium sized enterprises. Idea and design inspired by Hertz et al. (2001).

Due to various contextual changes, such as the entrance of a new top manager, or challenging competition leading to a decline in relative performance, five of the seven studied companies had been forced into the second stage of the model. Focus shifted towards improving internal efficiency and resource effectiveness regarding supplies and inventory levels, and a main part of the organisations became cost orientated. In manufacturing companies inventory levels of both incoming and outgoing goods were lowered, and the planning horizon had to be shortened. Pressure was put on external suppliers to shorten their delivery times. In many of the companies the change was initiated by a manager or owner having discovered new ideas regarding organisational structure or improvement based on a process view. Even when intentions were to directly develop a horizontal and process based organisation, the companies often transited into an approach of teams and projects, focusing on improving distribution and resource utilisation, and on minimising delivery times. Typically, a few administrational processes were briefly mapped at this stage, but process responsibilities were informal and at a low hierarchical level, and process performance was not measured. A majority of the employees had not obtained a clear process view on their organisation. During this stage one or a few key individuals became familiar with viewing the organisation in terms of horizontal processes.

Four of the seven companies had, at the time of the case studies, progressed into the third stage of the model. In these companies the process view had been gradually acknowledged by a majority of the employees, and the organisations had slowly become more process orientated. Central organisational activities were
mapped and defined in terms of processes and sub-processes. Process owners were appointed at high levels within the organisations. In one of these companies, process managers with responsibilities for day-to-day operations had been formally appointed. Cost pressures were still high, sometimes even higher than before, but the focus had shifted towards improving flexibility and process performance, and towards forecasting customer demands. A new horizontal structure was superimposed on the organisation, with frequent interactions between individuals at all positions of the company. Process performance was being continually measured in processes with designated ownership. No external driver was identified between stage two and three, and the change was seen as endogenously driven. However, despite any transition towards process management the organisational charts of all studied companies still reflected the old functional organisation, with no clear identification of customers, suppliers, process owners or process managers.

6.3 Summary of the third research project

The scope of the third research project was to contribute to the development of a conceptual framework for integration of business excellence and sustainable development, with a special focus on small and medium sized enterprises.

6.3.1 Global Process Model

It was assumed that in order to reach true sustainable development organisational performance needs to be related to global performance. The use of critical elements that present limits to global growth as reported by Meadows et al., (1972), is suggested in this thesis. The elements are pollution, industrial production, food production, population growth and use of non-renewable resources.

The main stakeholders of the global process have been identified as Humanity and Nature, and the assumed interest of these stakeholders is a good life and a healthy nature. This is an enlargement of the stakeholder concept presented by Freeman & Reed (1983), who mainly focus on human stakeholders, see Chapter 3.

Processes related to the critical elements could be considered as support for the operative processes that produce the value added for the main stakeholders. Industrial production and food production have been combined into a process called producing goods and services (see Figure 6.9). The problems of pollution and use of non-renewable resources have been transformed to two support processes called limiting pollution and limiting use of non-renewable resources. Global management processes should define these limits. This is in accordance with the

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15 In this thesis the terms humanity and society are used interchangeably to describe one part of the organisational context.
model of transformation in an assignment context presented by Lind (2001), where processes are orientated towards clients, providers and condition creators, see section 2.2.

Population growth has been converted to a support process called maintaining a sustainable population. Obviously the size of the sustainable population depends on many factors, such as political, societal and technological levels of the world. One supplementary process, compared to the five critical elements, has been added to the support processes — measuring and monitoring performance. This is the process that feeds management processes with required information. Probably many more support processes could be added to this list, but measurement should be principally very important in order to assess progress towards sustainable development. Management processes on the global level are currently run by organisations such as the United Nations, the European Union, and the World Bank.

![Global Resources Diagram](image)

**Figure 6.9** The global process model of the third research project, based on elements critical to global growth and a generic process template. The model is derived from Isaksson (2001).
In order to lead change for sustainable development, management commitment is crucial. Organisations producing goods and services need clear directives for their activities. Global limits and guidelines are transformed to national directives that become drivers for organisations.

It should be important that organisations have reliable and agreed upon processes for measuring and monitoring performance. Many of the measurement systems for sustainable development found in the literature relate to national performance and some to global performance. This thesis focuses primarily on measurement of organisational performance. However, the existence of national systems for measurement forms an external enabler for the national organisations, and in that context some of the national systems for measurement are mentioned.

6.3.2 Organisational Process Model

The support process of producing goods and services found in the global process model (Figure 6.9) is built up of networks of organisations forming linked value chains. The processes of these individual organisations could schematically be described in a model (Figure 6.10). This organisational process model illustrates different types of measurements: drivers, input, enablers, output, and process outcome.

![Organisational Process Model Diagram](image)

Figure 6.10 The organisational process model developed in the third research project.

The model combines the division of enablers and results used in many business excellence models with the idea of dividing\textsuperscript{16} indicators into driving force, state and response. In an organisational context both process input and external demand

\textsuperscript{16} See Chapter 3
for process output could be seen as driving forces pushing or pulling the flow through the processes of the organisation. Customer demand, management values, and national legislation are some examples of internal and external drivers for the organisational processes. Examples of internal enablers are the structure of the organisation and its processes, causing resistance or smooth flow of goods and services from input to output. A society with the support and infrastructure to aid organisations moving towards sustainable development could be a strong external enabler. Stakeholders include, among others, customers, suppliers, shareholders, employees, current and future societies and the nature in general. The impact of the output is stakeholder satisfaction, which in the case of Nature could be measured with indicators such as loss of species or degraded biotype. Stakeholder responses to the outcome, including side effects such as social problems or pollution, are management issues, for instance affected by societal demands and requirements of the owners of the organisation – external and internal drivers.

6.3.3 Indicator Structure

Creating a single figure effectively covering all aspects of performance with regard to sustainable development was found to be very difficult. Using the indicators of the triple bottom line\(^\text{17}\) should make the task easier, even if adding up each area is a challenge in itself. Each category could have measurements that relate to different steps in the studied processes, from drivers to outcomes.

In the proposed organisational process model\(^\text{18}\) process input, in the form of goods or services, is separated from drivers, that stand for demand related to the goods and services produced as well as the side effects caused. Drivers are both demand for the products and requests for restrictions regarding undesired output such as social problems and pollutants. The state indicators correspond largely with what is in this thesis named outcome or stakeholder satisfaction. Response indicators are the measures taken to handle problems caused by the output. The response could be further divided in two parts, active and reactive response. As an example, a reactive response for a process producing waste is to improve the re-use of the waste produced. An active response would be to reduce the quantity of waste produced.

Proposed dimensions of measurement

The concept of the Triple bottom line is often used to arrange different types of organisational performance measures and includes the financial, environmental and social performance, see Chapter 3.

\(^{17}\) See section 3.2.
\(^{18}\) See Figure 6.10.
Instead of the terms Social Equity or Social Responsibility, Ethics has been chosen to describe the social part of organisational performance. Ethical behaviour includes issues such as corruption, payment of taxes, wages and employee safety. The authors believe that the term Ethics more clearly describes what is required than the commonly used Social Equity. This results in a proposal to use the triple E:s of Economy, Environment and Ethics (3E) as main dimensions for measuring organisational performance with regard to sustainable development (see Figure 6.11).

![Figure 6.11 Proposed dimensions for measuring organisational performance with regard to sustainable development.](image)

The BEST\textsuperscript{19} model for sustainability expresses the same main dimensions as the proposed 3E, with the addition of the technological sustainability. Based on a process view, technology could arguably be seen as an enabler more than an output. With sound technical solutions the process output for the chosen three dimensions will be improved. The advantage and contribution of the 3E-model should be its closer alignment to the management of processes.

The 3E measurement dimensions and the five types of measurements in the organisational process model have been integrated into a matrix for classifying existing measurements of sustainable development (see Table 6.3).

**Systems for 3E indicators**

The literature survey for measurements of sustainable development has not been exhaustive but serves more as an example to test the proposed measurement model. The systems for 3E indicators that have been found can be divided into two main groups; national and organisational indicators. The national indicators enter into the organisational process model mainly as drivers. A good national performance acts as a driver through stakeholder demand, competition, culture and legislation but also as an enabler in providing infrastructure and support. In the organisational process model, enablers are mainly defined as processes that help organisations to work with 3E in a structured way. In both main groups of indicators the majority cover only one of the dimensions, but there are also those that cover two or even all three dimensions.

\textsuperscript{19} See section 3.2.

ESI divides indicators into five phenomena, 22 core indicators, and 67 indicators. The five phenomena are environmental systems, reducing environmental stress, reducing human vulnerability, social and institutional capacity and global stewardship. Even though the objective is to focus on environment, indicators from other areas affecting the environment are also used.

In the ESI 2001 report, the best correlation between any of the 67 individual indicators and environmental performance is found with the indicator of corruption reduction. The level of corruption is one of the most important ethical indicators. National level of corruption defined by Transparency International (2002a) as the Corruption Perceptions Index (CPI), see also their Global Corruption Report (Transparency International, 2002b).

Another national measure of the ethical level is the Human Development Indicators (HDI) from the United Nations Development Program (2002) that combines life expectancy, educational attainment and income. The Commission of Sustainable Development (CSD) at the UN Economic and Social Council (ECOSOC) presents a set of indicators covering the themes of Social, Environmental, Economic and Institutional Sustainability (Commission of Sustainable Development, 2002).

On the organisational level the Global Reporting Initiative (GRI) covers the 3E-dimensions (Global Reporting Initiative, 2002). GRI includes almost 100 indicators but also proposes that smaller organisations could use a more limited set of measurements. Currently mentioned economic indicators include typical performance measures such as net profit, gross margin and return on average capital employed (ROACE).

Quality related indictors such as lead-time, yield, capacity utilisation and customer satisfaction are not mentioned in the GRI. Quality indicators for services and products represent process results that have a profound effect on the economic performance. There seems to be a lot of synergy to be gained in combining the process view and basic values and methods from TQM with sustainable development. According to the theories of the Balanced Scorecard, internal process efficiency and customer satisfaction drive the economic performance (Kaplan &
The existing economic improvement potential could probably be measured by using theories of Costs of Poor Quality, see for instance Dale & Plunkett (1995).

The environmental indicators of the GRI include stakeholder satisfaction (impact on nature) and enablers. However, management systems such as ISO 14000 and EMAS are not specifically mentioned. There are several measures for environmental organisational performance such as the Innovest EcoValue’21 rating and the Ecological footprint. These seem to be geared for larger organisations. Other measures for environmental performance are eco-labels such as the Green Dot, the Blue Angel, the EU Flower, the Swedish “Good Green Buy“, “The Nordic Swan“ and “Krav“ (SSNC, 2002). Ethical labelling has also started, but is not as developed as the Green labelling.

GRI proposes 37 different indicators for social performance, dealing with areas such as health and safety, wages, training, discrimination, freedom of association and suppliers. The indicators mostly fall within the categories of results and enablers, but suppliers are also monitored.

Stakeholder demand is a primary driver of 3E performance. To a certain extent the stakeholder demand can be controlled by the organisation through the use of information. In order to specify ethical performance, indicators for wages and taxes paid, as absolute figures and as ratios, could be important. Economic surplus is needed for sustainable development but this surplus is of little value if not distributed fairly. This is a complicated issue since fair distribution is a value that is often viewed rather differently by different groups. Income distribution can be monitored by different indices, such as comparing the income of the wealthiest 20% to the poorest 20%. An important ethical indicator is the level of corruptive behaviour. The SA 8000 standard, published by the Social Accountability International (SAI, 2002), covers some of the areas, as does the standard AA1000 of the Institute of Social and Ethical Accountability (ISEA, 2002). Still another area of ethical indicators is gender equality.

An organisational enabler is the World Business Council for Sustainable Development (WBCSD, 2002). This is a coalition of 150 international companies advocating sustainable development. WBCSD provides a guide for companies to report performance and is closely aligned with GRI.

Table 6.3 presents a rough framework combining the organisational process model, the proposed 3E dimensions and examples of existing measurements. The table does not reflect all measurements currently in use, and those appearing here should be considered as illustrations intended to form a starting point for the discussion. An important observation is that in most measurement systems issues
of organisational excellence and quality are almost non-existent. Economic indicators do not seem to take up the Cost of Poor Quality, which should be an important indicator of progress towards sustainable development. A good economic result is not enough, but waste should also be minimised.

Indicators for organisational economic performance in the context of sustainable development quite often focus on the output, to some extent on the input and very little on stakeholder satisfaction, enablers or drivers. The suggested framework should be able to aid finding gaps in the current pattern of indicators within an organisation.

**Initiating 3E measurements**

In improvement projects one of the first objectives is often to define the actual performance of the organisation. Commencing work for sustainable development could begin with determining the level of performance for the 3E dimensions\(^{20}\).

Today's organisations seem to have rather varying levels of awareness regarding sustainable development. When looking at the situation globally most organisations, both small and large, have only started on the road towards sustainable development. According to Hillary (2000) small and medium sized enterprises are largely ignorant of their environmental impact. Ideally profits should push companies towards sustainable development. A start could be to quantify the organisational level on a 3E scale, where measuring the output could be a first step.

It is important for the organisation to have an appreciation of its level of 3E-performance, and indicators should be chosen within all of the three dimensions. Information should be gathered from main stakeholders and transformed into a list of priorities. In many cases average country and branch performances could work as levels of reference.

Fundamental issues of economic performance are whether the organisation is doing what the customers want, and if it is doing it in the right way. The first question requires some kind of a customer survey giving a Customer Satisfaction Index, and the second question could be measured with the Cost of Poor Quality where this is defined as the difference between actual and best possible performance. Additional economic indicators are the use of non-renewable energy and material.

Suggested environmental indicators are quantity of main pollutants to air, land and water. Suggested ethical indicators are employee safety and employment security, and the level of taxes and wages paid compared to total company earnings.

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\(^{20}\) See Figure 6.11.
Table 6.3  Examples of organisational performance indicators classified according to the organisational process model and positioned within the 3E-dimensions.

<table>
<thead>
<tr>
<th>Economy</th>
<th>Drivers¹</th>
<th>Enablers²</th>
<th>Output</th>
<th>Outcome³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost and CPQ of raw-materia and services, GRI</td>
<td>WCY, WDI, CSD, Legislation, org. policy</td>
<td>WBCSD Business Excellence, Level of ISO 9000 Educational level</td>
<td>Cost of Poor Quality, ROACE, Level of Business Excellence, Effect on level of natural capital, New products</td>
<td>Customer Satisfaction Indexes Customer loyalty Repurchase rate</td>
</tr>
<tr>
<td>Environment</td>
<td>ELU GRI Green labels</td>
<td>ESI, CSD Legislation and company policy</td>
<td>WBCSD, Level of ISO 14000 Educational level The Natural Step</td>
<td>Environmental behaviour Environmental projects Pollution Environmental labelling</td>
</tr>
<tr>
<td>Ethics</td>
<td>GRI Ethical labels</td>
<td>CPI, CSD, HDI Legislation and org. policy</td>
<td>Level of A-8000, Educational level Fair trade policy</td>
<td>Social behaviour Average earnings Employment security Ethical labelling</td>
</tr>
</tbody>
</table>

¹ Internal drivers include corporate and management norms and values. Common external drivers for all dimensions are legislation, culture and national levels of competitiveness, and stakeholder demands such as customer preferences.

² Internal enablers include processes and systems that make work with the 3E-dimensions easier. Examples of external enablers are branch organisations and the general level of education within a region or a country.

³ Process output leads to various outcomes for different stakeholders.

AA 1000 – AccountAbility 1000, ISEA (2002)
CPI – Corruption Perception Index, Transparency International (2002a)
CPQ – Cost of Poor Quality
CSD – Commission of Sustainable Development (2002)
EMAS – Eco-Management and Audit Scheme, Standardised approach offered by the EU
ESI – Environmental Sustainability Index, World Economic Forum (2002)
HDI – Human Development Index. Combined indicator of life expectancy, educational attainment and income
SA 8000 – Social Accountability 8000, SAI (2002)
WDI – World Development Indicators, World Bank (2002a)
6.3.4 Extending the Scope of Business Excellence Models

A change in the Malcolm Baldrige National Quality Award (MBNQA) model is proposed in such a way that business excellence more clearly supports global sustainable development based on the suggested 3E dimensions. Using five additional core values, the triple bottom line, and an assumption that excellence is needed on individual, organisational, and societal levels, new criteria have been chosen and tentatively introduced in a modified model based on the MBNQA (Figure 6.12, Table 6.4). The model includes notions of personal and societal excellence, issues which could be considered analogous to organisational excellence. However, these issues are beyond the scope of the thesis and therefore not further discussed here.

![Diagram](image)

Figure 6.12 The structure of the proposed sustainable development model for organisations.

Compared with the MBNQA the distribution of points associated with different criteria in the new model stresses the importance placed on enablers, representing a shift of focus from results to enablers. Out of the maximal 1000 points 750 are for the enablers and 250 points for results. This shift is caused mainly by the following issues:

- a new criterion, called “Supporting societal excellence” (6)
- an emphasis on knowing the stakeholder needs, not only customer and market needs (3.1-3.3)
- a stronger emphasis on process excellence (7)
- a stronger emphasis on developing human resources (5)

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21 The suggested core values are: sustainable stakeholder balance, learning excellence, process excellence, stakeholdercracy, and transparency. See appended paper 5 for a further description.
Table 6.4   Extending MBNQA with a proposed model integrating sustainable development.

<table>
<thead>
<tr>
<th>MBNQA criteria</th>
<th>Pts</th>
<th>New criteria</th>
<th>Pts</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Organisational leadership</td>
<td>85</td>
<td>1.1 Leadership for sustainable development</td>
<td>50</td>
<td>Mission and vision aligned with values corresponding to sustainable development. Proposed guiding values are: Sustainable stakeholder balance, Learning Excellence, Process excellence, Stakeholderocracy and Transparency</td>
</tr>
<tr>
<td>1.2 Public responsibility and citizen</td>
<td>40</td>
<td>1.2 Support for societal excellence</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3 Support for personnel excellence</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>2.1 Strategy development</td>
<td>40</td>
<td>2 Development and deployment of strategy</td>
<td>75</td>
<td>Strategies are set to comply with 3E. Systemic thinking is essential.</td>
</tr>
<tr>
<td>2.2 Strategy deployment</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Customer and market knowledge</td>
<td>40</td>
<td>3.1 Knowledge of the value adding process</td>
<td>50</td>
<td>Special focus on the paying customer</td>
</tr>
<tr>
<td>3.2 Customer satisfaction and relationships</td>
<td>45</td>
<td>3.2 Knowledge of the process of managing natural capital</td>
<td>50</td>
<td>Special focus on the (critical) natural capital</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3 Assessing priorities of stakeholder needs</td>
<td>50</td>
<td>Looking at all stakeholders, economic prosperity, social equity and environmental protection.</td>
</tr>
<tr>
<td>4.1 Measurement of org. performance</td>
<td>40</td>
<td>4. Process control and information system</td>
<td>75</td>
<td>Measurement processes track both stakeholder needs and outcome in terms of stakeholder satisfaction.</td>
</tr>
<tr>
<td>4.2 Analysis of org. performance</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1 Work systems</td>
<td>35</td>
<td>5. Developing the human resources</td>
<td>100</td>
<td>Personnel are trained and continuously learning in order to attain personal excellence.</td>
</tr>
<tr>
<td>5.2 Employee education</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3 Employee well-being and satisfaction</td>
<td>25</td>
<td>6. Supporting societal excellence</td>
<td>100</td>
<td>Strong co-operation with society</td>
</tr>
<tr>
<td>6.1 Product and service processes</td>
<td>55</td>
<td>7. Process management excellence</td>
<td>100</td>
<td>Process excellence both in design and results</td>
</tr>
<tr>
<td>6.2 Support processes</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.3 Supplier and partnering processes</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.1 Customer focused results</td>
<td>115</td>
<td>8.1 Results from customer satisfaction</td>
<td>50</td>
<td>Measurement of quality</td>
</tr>
<tr>
<td>7.2 Financial and market results</td>
<td>115</td>
<td>8.2 Economic results</td>
<td>50</td>
<td>Results of organisational excellence</td>
</tr>
<tr>
<td>7.3 Human resource results</td>
<td>80</td>
<td>8.3 Personal results</td>
<td>50</td>
<td>Results of personal excellence</td>
</tr>
<tr>
<td>7.4 Supplier and partner results</td>
<td>25</td>
<td>8.4 Social results</td>
<td>50</td>
<td>Results of societal excellence</td>
</tr>
<tr>
<td>7.5 Organisational effectiveness results</td>
<td>115</td>
<td>8.5 Results from managing resources</td>
<td>50</td>
<td>Impact on the environment</td>
</tr>
<tr>
<td>Total</td>
<td>1000</td>
<td></td>
<td>1000</td>
<td></td>
</tr>
</tbody>
</table>
7 General Discussion

This Chapter presents a supplementary discussion on conclusions and implications from the results of the research. For a further discussion of the research results the readers are referred to the individual appended papers.

7.1 Introduction

This thesis has attempted to contribute to the understanding of sustainable competitive performance of small and medium sized enterprises in harmony with nature and society. In the first Chapter three main research questions were formulated:

1. How can statistically designed experiments be implemented in small and medium sized enterprises, in order to increase the possibilities of success?
2. What are the experiences of introducing process management in small and medium sized enterprises?
3. How can the scope of quality management be widened to include principles of sustainable development?

Three research projects have been performed. An initial study of two case companies focused on aspects of the relations within single processes by the use of statistically designed experiments. The implementation of this technique was then studied and analysed in order to develop a model of implementation. The second research project provided descriptions of experiences of introducing process management in small and medium sized enterprises, which could be seen as aspects of relations between processes of an organisation. The third research project focused on integration of issues of quality management and sustainable development, which could be seen as aspects of the relations between organisations and their context.

The discussion has been divided into three sections that reflect the research questions and projects of the study.

7.2 Implementation of design of experiments within small and medium sized enterprises

The statistical technique of design of experiments proved valuable to improve the performance of the manufacturing processes of the studied case companies. Experiences from the project indicate that close cooperation between employees of different roles within the organisation was enhanced by implementing design of
experiments. In general, the results of the research are consistent with earlier findings, and agree by and large with those reported in other studies.

The model developed as a result of this project has been based on core values of total quality management. Fact-based decisions and the focus on processes are central issues of statistically designed experiments. Continuous improvement relates to the iterative nature of the model. Focus on customers should be represented by improvement projects being prioritised according to their impact on customer satisfaction. Management commitment is represented in all phases of the model. Everybody’s participation is represented by involving all employees in the suggested basic education programme.

Experiments aim at finding relations between input and output variables of a system or a process. In this project the tracing of test objects throughout the extended manufacturing process became a difficulty. The solution selected to solve this problem was the development of a database and a system for logging and tracing of individual units and batches of units through the process. This system was then also used for passive multivariate observation and analysis of the manufacturing process during normal production, a technique that proved valuable for finding correlations between process parameters and product characteristics.

This research project has strengths and limitations. One of its major strengths is that the research was conducted in the field, which allowed understanding of the complexity of fully implementing statistically designed experiments as an established way of working within an organisation. A limitation of this research is that it is grounded in a specific setting of two organisations within one particular industry. It would be interesting to see whether the suggested implementation model could be of assistance in other settings as well. However, the fundamental ideas of design of experiments are probably universal, therefore using the implementation model in other organisations than the studied ones should most likely not be very difficult.

Regarding the use of action research in the first project, the author would like to point out the potential risk in letting the action part become more important than the research part. In this research project the company usability aspects have been emphasised, maybe sometimes even at the expense of some academic rigour. On the other hand, the experience and knowledge obtained during the course of the project has become an indispensable input when designing and managing the subsequent research projects.

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22 See Chapter 2.
7.3 Process management in small and medium sized enterprises

The study of experiences of introducing process management in Swedish small and medium sized enterprises were divided into three parts; a mail survey of 1,500 randomly selected enterprises, telephone interviews with representatives of 62 of these enterprises, and finally case studies of seven of the organisations participating in the telephone interviews.

The initial mail survey assessed the spread of use of process management in this sector, and according to the answers almost 30 percent of the companies were process orientated, i.e. the management had appointed persons responsible for mapping, controlling, and improving the processes of the enterprise. About 19 percent of the respondents stated that they had actually performed process mapping and had appointed process owners responsible for major and strategic decisions regarding the mapped processes within their enterprise. The theoretical margin of error for these estimates would be less than 3 percent at an individual confidence level of 95 percent. However, inaccuracies due to the existence of non-respondents must be added to this error. Because of the difficulties involved in estimating the effect of non-respondents, a total margin of error has not been determined. The results should therefore be treated with caution.

In the second part of the research project, the telephone interviews, almost one third of the enterprises that had previously claimed to have performed process mapping and have appointed process owners, were categorised as non-process based organisations. This would imply that in total about 13 percent of the enterprises in the study had introduced the methodology in accordance with the criteria selected for the first level of process management within an organisation. However, the results of the subsequent case studies revealed that even this adjusted estimate of the proportion could be too high. It may therefore be argued that the proportion of small and medium sized enterprises in Sweden that have actually introduced process management is somewhere in the region of 10 percent of the total population.

During the studies, a gap between the official emphasis placed on process management, and the actual level of process orientation visible within many of the studied organisations, was observed. This result closely match those found by Chapman & Sloan (1999), see section 1.2.

The telephone survey and the case studies assessed the impact of process management on employee satisfaction, organisational structure, organisational perform-

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23 See section 6.2 and Figure 6.3.
ance, and several other characteristics of the studied enterprises. This research has demonstrated that when small and medium sized enterprises introduce process management there can be a positive impact on critical outcome variables, i.e. organisational and employee related. However, when the use of process management is perceived as caused by pressure from outside factors, such as demand from customer companies or requirements of ISO 9000, the impact on both the organisation and the employees seems to be neutral or less positive.

The data collected during the second research project would suggest that the use of consultants could be an efficient way to quickly gain momentum when introducing process management. Many of the organisations studied express regrets that they did not use consultants more, or that they should have begun using them at a much earlier stage. Others found the work of consultants to be of limited long-term value for the organisation. In some cases the consultants became company experts on process management and when they left there was very little knowledge in-house to build on. Transfer of knowledge appears to be critical when introducing process management, and there should be few short cuts to take here. In general, the act of learning could probably never be outsourced. Similar results were found by Pritchard & Armistead (1999), suggesting that lack of understanding is the biggest difficulty for organisations in the initial stages of adopting a process approach.

The results of this research do not show that introducing process management in small and medium sized enterprises will lead to a higher profit or more satisfied customers. On the other hand, more than a third of the studied companies which had introduced process management report that the methodology had made an improved order and structure of the business activities possible. Introducing process management also appears to have strengthened the personnel’s engagement and commitment for quality issues in general.

Many of the studied enterprises had, during the introduction of process management, merged different functional departments and thereby reduced their organisational complexity in terms of horizontal differentiation\(^{24}\). However, the vertical differentiation seems to have been unaffected by the introduction of process management. Effects on other forms of organisational complexity have not been measured.

Process management, like any major organisational change programme, is not easy. Fundamentally changing an organisation will indisputably cost many people a lot of time, but it will also cost some people their position and status. Therefore, according to the results of the telephone interviews and the case studies, the change needs to be driven from the top of the organisation by visionary leadership.

\(^{24}\) See section 1.1.5.
Also it calls for personal adherence to attitudes and beliefs by formal and informal leaders of the organisation rather than just procedural usage of tools and methods.

The language used in most process literature appears to take for granted a structured business, where there are lots of employees performing separate roles linked to the main processes. Small and medium sized enterprises are not often organised in this way, and it may therefore be difficult to add and integrate distinct process owners and resource managers to existing managerial responsibilities. In the studied enterprises the persons appointed as process owners were often the functional managers of the old organisation. The question whether this is advantageous or not is beyond the scope of this investigation, but there is a need to rework theories and literature in order to better fit the needs of small and medium sized enterprises.

Presumably, no single quality strategy could be generally superior to all others; different strategies are useful in different contexts. The great variety of business sectors in which small and medium sized enterprises operate makes it unlikely that generic solutions, such as process management, could be appropriate for all. It is the view of the author that any implementation programme, brought from a well founded theory or proclaimed by gurus or specialists, must be customized into a tailor-made system to suit the organisation trying to apply it.

The methodologies used in the second research project have several limitations that need to be discussed. These limitations are mainly related to the breadthness of the topic under investigation, respondents choosing not to participate, lack of homogeneous organisational experiences, time constraints, and the limited access to data and information. A dependent variable of interest, for example results in terms of performance improvement on a company level, can rarely be easily attributed to the implementation and use of process management alone, other factors both within and outside of the company may have made significant contributions to the final result. Different variables may have high correlation without being causally related. Also the relationship between variables cannot always be assumed to be of a linear type. The results of the study must therefore be treated with caution. However, the analysis has been based on a sample of 1,500 enterprises in total, which should not be considered small. Also, given the strict methodology followed and the precautions taken therein, every effort has been made to minimise the limitations noted above. This could, for instance, be illustrated by the special follow-up investigation of the non-respondents in the mail survey, or by the fact that employees with different positions and roles were interviewed during the case studies. Even so, further research is needed to test the findings and the models developed, in order to validate their usefulness.

There are clearly many problems and dangers in generalising about such a diverse group as small and medium sized enterprises. However, the chosen research
approach of designing cases to be heterogeneous, representing different sectors, cultures and management configurations, should enable a high emergence of research findings. Since this research has been based on a random sample of small and medium sized enterprises in Sweden, there should be no special hindrance impeding the general results from being valid for most business sectors in this country.

In this study small and medium sized enterprises were defined solely on the scale of the workforce: as companies with between 10 and 199 employees. There is no criterion of legal independence. Where a business unit is not independent because it is a branch of a larger company or a business which is controlled by another business, this is likely to affect how quality issues are handled. When a small unit is part of a larger company rather than independent it is more likely to be associated with formal standards such as ISO 9000, and also with quality management strategies such as quality awards and business excellence. Not using a criterion of legal independence has therefore probably resulted in an over-representation of enterprises committed to formal quality standards.

The studies of process management in small enterprises have been conducted during the years 2001 and 2002. The sample data used in the studies are therefore snapshots at a few specific points in time, and do not account for changes over time. Implementing process management could extend over considerable time spans. When the activities of the implementation are finished it often takes additional time until the outcome can be fully measured and assessed. To study experiences of organisational change is like trying to correlate today’s performance with independent variables of the past. It could be likely that longitudinal research approaches are the most suitable to study such phenomena.

7.4 Quality management and sustainable development

Traditional quality management has its drivers and its enablers in the weak sustainability context. The driver is the paying customer and the enabler is the organisation. The strong impact of the quality movement has lead to the development of various business excellence models such as the MBNQA or the EFQM. These models primarily focus on economic results and basically support very weak sustainability. Little is mentioned about restraining growth, both on the organisational and national levels. Most quality management standards, for instance ISO 9000, are other examples of very weak sustainability. The systems essentially aim at assuring consistent quality of delivered products, which is a strategy to keep customers satisfied and support the economic success of the organisation. However, there has been an evolution where the external customer

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25 See appended paper 5.
becomes one in the larger group of stakeholders. This change represents a shift from very weak sustainability in the direction of strong sustainability.

In the third research project suggestions have been presented regarding how the requirements of critical global processes could be translated to areas of organizational concern, and how organizational performance with regard to sustainable development could be measured using adapted business excellence models. Several initiatives to measure sustainable development have been found and categorized. There seems to be an opportunity for synergy in combining sustainable development indicators to a process framework based on total quality management (TQM).

During the work with the third research project the perspective were changed from a transformation orientated process view towards a communication orientated process view, consistent with the findings of Lind (2001). The strong customer focus of TQM has been widened to include a broader stakeholder view, also aiding the TQM core value of everybody’s participation. The core value of fact-based decisions emphasises the importance of actively measuring organisational sustainable development performance. Management commitment is an obvious requirement to succeed with sustainable development. The stronger feedback of stakeholder satisfaction measured as a response to process output should be able to enhance the work with continuous improvements in the organisations using indicators of sustainable development.

With the ongoing integration of quality and environmental management systems it seems logical to go a step further and also include considerations of ethical performance. Many buyers at all levels want to make a choice that fully harmonizes with sustainable development. However, today very few, if any, products and services are labelled in credible terms of 3E.

Process input has an important effect on the total organisational performance. Goods and services supplied for the organisation come with a 3E history, which should be monitored. Generally accepted measurements for the 3E would help people make a sustainable choice. This would lead to a raised awareness on sustainable development aspects, hopefully starting a chain reaction, which centres attention on the 3E. The main stakeholders on a global level are defined in the thesis as Humanity and Nature. Today these often have minor influence on organisations, which primarily focus on shareholders and customers. A better balance between the influences of different stakeholders is needed, and this can only be achieved by improvements in the process of managing global sustainable development-performance.
One very interesting issue, which has not been covered in this thesis, is the ethical value of products. When resources become scarce it should be important that what is produced goes to satisfy the basic needs first. It might be possible to construct a product value scale based on for example the Maslow pyramid of needs. Changing existing models that are normative for Business Excellence, such as the MBNQA, and developing ethical standards based on initiatives, such as the SA 8000 and AA1000, are probably prerequisites for a good integration of the 3E into a truly Integrated Management System for sustainable development. Given their economical, environmental and social impact, global sustainability also requires the involvement of SMEs.

Measuring performance in all the outlined areas of sustainable development requires levels of capital and expertise that small companies do not normally have. Different types of standards are increasingly being forced along supply chains and the pressure of competing demands could result in small and medium sized enterprises being retroactive to change. Even when managers have a personal commitment to sustainable development they often end up focusing on everyday operational issues. Therefore one should be careful when suggesting new innovative approaches and agendas. Global and national measurement policies with respect to small and medium sized enterprises need to deal with impediments to progress, such as lack of local forums for cooperation and networking where small firms can get guidance and company-specific advice. Given the diversity of small firms detailed developments of measurements are needed for each industrial sector. However, many small and medium sized enterprises see a growing demand for eco-friendly products from their customers. Small and medium sized enterprises should follow the same strategy as other companies of quantifying the effects and importance of organisational activities measured with relevant indicators within the 3Es.

It seems that many companies do not have accurate process measures. Instead their measurement systems often conform very precisely to the functional boundaries that divide the organisations. Process owners need to determine what aspects of process performance are most directly linked to the overall objectives of the organisation. But this is not enough; interests of stakeholders outside of the organisation must also be considered.

The work presented regarding integration of quality management and sustainable development is still in an early conceptual stage. The proposed strategy for introducing basic 3E-measurements needs to be elaborated and tested, but should offer a basis for further development.
7.5 Implications for further research

The findings of this thesis point to several areas of future research. As it covers broad subjects, there are many courses in which required research could be directed.

There is a general need for further investigation of success factors for implementing methodologies related to quality management in small and medium sized enterprises. Through the review of literature, and during the numerous data collection activities performed, it has been found that the process concept has not yet been fully comprehended by many organisations, both small and large. There seems to be a lack of common and standardised terms and definitions for processes as well as process management. Therefore there is a need for research that develops terms based on opinions of both academics and practitioners of process management.

Effects of process management on the structure\(^{26}\) of enterprises in terms of vertical and spatial differentiation, as well as in terms of centralisation, should be interesting topics for further research.

The telephone interviews and case studies of enterprises using process management resulted in a model of stages of process implementation, see Figure 6.8. It should of course be compelling to explore what will come after the third stage, process management. There are indications that a new, system orientated, approach of network interaction is being developed by some small and medium sized enterprises focusing on sustainable competitive advantage and organisational excellence. One example of methodologies that could probably be used in this fourth stage is the extended business excellence model that was proposed in section 6.3 of the thesis. Hopefully the main driver of change at this stage is not exogenous, such as legislation and regulations limiting the actions of the organisations. With regard to the importance of initiative found in the research endogenously driven change will probably be a more efficient force in guiding the companies towards a situation with balance between the interests of economic prosperity, environmental protection and ethics.

It should be very interesting to study organisations actually implementing the conceptual models developed in this thesis for integrating issues of quality management and sustainable development.

\(^{26}\) See section 1.1.5.
References


Paper I

Experiences of implementing statistical methods in small enterprises

Case studies
Experiences of implementing statistical methods in small enterprises

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Keywords
Process management, Design of experiments, Implementation, Small-to-medium-sized enterprises, Sweden, Ceramics industry

Abstract
In order to stay competitive most small and medium-sized enterprises (SMEs) need to make decisions and improve their processes in a more efficient way. To manufacturing companies this is crucial not the least within the design and production phases. This means that a deeper understanding of the concept of variation, identification of causes of variation, and handling of these causes are important factors within SMEs. This paper presents two studies of implementation of statistical methods. One is related to the use of process capability studies in Swedish industry. The other one is related to the use of design of experiments at two small enterprises within the high performance ceramic industry. From both the studies we find recommendations how to implement statistical techniques in SMEs in order to increase the possibilities of success.

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Background
One of the cornerstones in total quality management (TQM) is to base decisions on facts. In order to do so, it is important to observe and analyse data and to use different statistical techniques to draw conclusions. Accordingly, statistical methods have a central position within TQM. This message was emphasized already by Shewhart (1931) and even more by Deming (1986; 1993). Furthermore, the use of statistical tools for decision making will certainly increase from requirements within quality systems such as ISO 9000 and QS 9000 and also by future international competition.

This means that there is a large need in many SMEs to use different statistical tools. Several of these established tools are not necessarily very advanced. Investigations show that the use of statistical tools is rare in the group of SMEs. However, several researchers have shown that statistical methods are not used to their full potential. See, for instance, Sandvik Wiklund (1992), Hoerl (1995), or Bajaria (1995). A study of more than 400 companies in the northern part of Sweden indicated that only about 5 per cent utilised statistical techniques such as design of experiments, process capability studies, or control charts (Bäcklund et al., 1995).

There are several reasons for this rare use of statistical methods in SMEs. Management in small companies, in general, does not have the sufficient theoretical knowledge to see the potential of using statistical tools. In many cases they, and their employees, even become frightened when statistical tools are discussed. Small companies also lack resources in form of time and personnel. Small organisations tend to have a lean organisation and therefore they find it difficult to appoint a facilitator or co-ordinator for the implementation process. In addition, they also have limited resources to provide internal training. Lack of resources in these aspects leads to a need for a careful analysis of which strategy to use when implementing statistical methods in order to succeed. Furthermore, many companies do not have the computer support which would facilitate the use of statistical tools. These statements are supported by, for instance, Lee and Oakes (1995), Ghobadian and Gallear (1996), and Noci (1996) and Garvare and Wiklund (1997).
This paper presents two studies of implementation of statistical methods in Swedish industry. One is related to the use of process capability studies in Swedish industry, see Deleryd (1998a). The other is related to the use of design of experiments at two small enterprises within the high performance ceramic industry, see Garvare (1998). Although the study by Deleryd et al. (1999), of why and how industry used process capability studies and the relation between implementation, method and success, was not primarily focused on SMEs the experiences from that study in several ways were similar to the experiences in the study by Garvare (1998).

Implementation of process capability studies

One statistical method which is frequently used in industry is process capability studies. The increased use can partly be explained by the rapidly growing interest in the quality system QS 9000, where use of process capability studies is requested. Since process capability studies is an efficient improvement method that many organisations fail to implement satisfactorily the implementation process is of interest to study. Another reason to study what factors are vital for successful implementation of process capability studies is that the findings will probably, to a large extent, be applicable for implementation of other improvement methods based on statistical methodology, such as design of experiments or statistical process control.

Background

The existence of variation has been a stumbling block for mankind ever since the early days of the industrial revolution, and perhaps even earlier. One produced part will never be an identical copy of another. Traditionally, industry has tried to handle this problem by setting specification limits for important characteristics of a product. If a characteristic of the product is within the pre-set specification limits, then that specific product is claimed capable. As time has passed, focus has moved from studies of the capability of products to studies of the capability of production processes. Since the 1980s a theoretical framework has been established to judge whether a process is capable or not. These studies are called process capability studies or process capability analysis. Process capability studies is defined as "an improvement method where a product characteristic is measured and analysed in order to determine the ability of the process to meet the specifications for the characteristic studied" (Deleryd, 1998b).

The concept of process capability studies has received both positive and negative comments during the last decade. Many supporters point out the possibility of overall goal setting, based on the concept of process capability studies. For instance, the six sigma concept, originally established by Motorola, is to a large extent based on using process capability studies systematically, although also other statistically based improvement methods are used, see Harry (1994). Many other international companies, as for instance General Electric, IBM, ABB, NEC, and Whirlpool, have also focused on six sigma projects or similar approaches.

Specific measures, called capability indices, that compare the actual process output with the specification limits for a certain characteristic, have been developed. The very first index was introduced by Juran et al. (1974). It is called $C_p$ and is defined as the ratio between the tolerance interval USL-LSL and the variation of the process in the form of $6\sigma$.

Since then a number of other indices have been suggested, for instance $C_{pk}$ (Kane, 1986), $C_{pkm}$ (Pearn et al., 1992), and recently, $C_{p}(u,v)$ introduced by Vännman (1995).

Theoretical aspects on process capability studies

When reading literature concerning how to conduct process capability studies, six fundamental theoretical aspects appear, which all reflect the reliability of the results from a process capability study in one way or another. The aspects and their relations are illustrated in Figure 1.

Experiences from Swedish industry

In a rather thorough study of 97 Swedish companies (see Deleryd 1998b), it was investigated to what extent Swedish industry today is using process capability studies on a regular basis. The study revealed a gap between theory and practice since the adherence to the majority of the theoretical aspects in Figure 1 was much lower than 50 per cent, see Figure 2.
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Figure 1 Six theoretical aspects and their relations

Note: The figure describes how the six theoretical aspects, which are emphasized in literature, influence the reliability of the result from a Process Capability Study. In order to receive reliable results both the data and the data analysis have to be properly performed. The abbreviation PCIs stands for Process Capability Indices.


After the first survey a second one was performed in order to find barriers when using process capability studies. A total number of 60 respondents, all of them participated also in the first study, answered the questionnaire and their opinions have been categorised into 21 different barriers, see Figure 3.

Figure 2 Adherence to theoretical aspects

Note: The adherence to the theoretical aspects of how Process Capability Studies should be performed. The results are based on how 97 Swedish organisations use Process Capability Studies. The figure shows that the adherence to several of the theoretical aspects is quite poor. The abbreviation PCIs stands for Process Capability Indices.


From the study it was found that the barriers can be divided into the four categories:

1. management issues;
2. conservative personal attitudes;
3. practical problems;
4. methodological aspects.

In order to investigate which factors together accomplish a successful implementation of process capability studies, a case study was performed, see Deleryd et al. (1999).

When designing the implementation model, six vital factors, necessary for a successful implementation of statistical improvement methods was identified and incorporated. The six factors were extracted partly from literature on implementation of TQM and was partly based on the author's own experience. The implementation model is described in Figure 4.

Based on the implementation model three different interview questionnaires were designed. One for the management level, one for the quality professional level and one for the operator level. Then nine different case organisations were selected. Each one of the selected organisations either supports or contradicts the model in one way or another. For instance, some organisations had a weak management support while others had stronger management support and so on. All the organisations started their implementation process between 1987 and 1992. This means that they have had a reasonable amount of time to conduct the implementation and also have been able to measure results.

The basic idea was to compare the way the organisations have worked with how successful the implementations within each organisation have been. A successful implementation means roughly (for details see Deleryd et al., 1999) that the theoretical aspects have been grasped and conducted, that the implementation has resulted in an extensive use of capability studies in relevant parts of the organisations (deployment), and that the organisation can show quantitative results of process improvement (results); see Figure 5.

This comparison was made for each factor in the implementation model. In the analysis the three criteria: approach, deployment, and results have been used.

To sum up, the analysis of successful implementation describes to what extent process capability studies are used and what results have been achieved.
Figure 3 Ishikawa diagram

Note: An Ishikawa diagram showing different reasons why it sometimes can be hard to implement and conduct Process Studies. The barriers most frequently mentioned by the respondents have been written in italics in the figure.

Source: From Deleryd (1998a)

Figure 4 Implementation model

Note: The critical aspects for a successful implementation of Process Capability Studies have been arranged in an Ishikawa diagram which represents the implementation model tested in the study. In the figure, the abbreviation PCS stands for Process Capability Studies.

Source: From Deleryd et al. (1999).
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The analysis showed that the most successful organisation has worked hard on everyone of the six factors in the implementation model. This statement is based on the observation that the lines for the more successful organisations circumscribe the lines representing the less successful organisations; see Figure 6.

In order to make the results more easy to interpret, the organisations were categorised into three groups with respect to how successful the implementation was, the top-category, the middle-category, and the low-category. It is even more clear from Figure 7,
in which the three categories are illustrated, that every factor in the implementation model seems to have an effect on how successful the implementation will be. This can be claimed since the line representing the organisations that have experienced the most successful implementations, the top-category, clearly circumscribes the middle-category which in turn circumscribes the low-category. The only factor that is important but not decisive in order to establish a successful implementation is the structured approach.

Since every factor in the implementation model seems to have a significant effect on how successful the implementation is, there has been no need to revise the model in Figure 4. The case study from the nine organisations confirms that the factors and the model seem to be appropriate. In order to connect the factors in the implementation model in a structural sense as well as in some sort of chronological order an implementation strategy has been derived as in Figure 8.

The results from the investigation suggest that it is the factors that involve human aspects that are most important and really

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**Figure 5 Successful implementation**

<table>
<thead>
<tr>
<th>Approach</th>
<th>Deployment</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Management support</td>
<td>Theoretical application, deployment</td>
<td>Results hard/soft</td>
</tr>
<tr>
<td>2. Kick-off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Educational efforts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Structured approach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Continuous support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Communication</td>
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</table>

**Note:** The basic principle behind the analysis was to compare the way organisations have worked with each factor in the implementation model (approach) with how successful the implementation has been within each organisation (deployment, results).

**Figure 6 Analysis of all case-organisations**

**Key**
- Organisation A (4.3)
- Organisation B (3.7)
- Organisation C (3.6)
- Organisation D (3.2)
- Organisation E (3.0)
- Organisation F (2.3)
- Organisation G (1.8)
- Organisation H (1.1)
- Organisation I (0.9)

**Note:** The polar chart shows how each case-organisation has worked with each factor in the implementation model. The more successful the implementation has been within an organisation the thicker the plotted line. Organisation A has been most successful and organisation I least successful. The quantification of the criteria for successful implementation is on a scale from 0 to 5, where 5 means that the application is in accordance with the theory and covers all relevant parts of the organisation and that superb results have been achieved. That is, the higher the grade, the more successful the implementation.

**Source:** From Deleryd et al. (1999). For more details, see Deleryd (1998b)
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Figure 7 Analysis for categories of case-organisations

Note: The polar chart shows how the three categories top, middle and low have worked with each factor in the implementation model. The top category has been most successful and the low category least successful.

Source: From Deleryd et al. (1999).

Figure 8 Implementation strategy

Note: The figure shows how the identified factors, vital for successful implementation of Process Capability Studies, have been arranged into a sort of chronological order in an implementation strategy.

Source: From Deleryd et al. (1999).

Implementing design of experiments in small enterprises

Background
At the Division of Quality Technology and Statistics at Luleå University of Technology a project has been carried out during 1995-1998 with the overall aim to develop an implementation model to improve the process of manufacturing high performance ceramics. Companies in the sequence from powder production to use of final components were involved. An essential part of the project was to focus on the possibilities of facilitating implementation of statistical techniques, especially design of experiments, in order to decrease variation in the process.

larger organisations there is nothing indicating that some of the factors in the implementation strategy in Figure 8 would not be applicable in small organisations. On the contrary, factors like communication and continuous support should be easier to handle within small organisations compared to larger organisations.
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powder to products" and in that way increase customer satisfaction.

The participating companies
The project was carried out at two companies, one is producing powder and the other manufactures high performance ceramics components. The powder producer is a small and specialised unit producing high-profile silicon powder and silicon nitride powder for the European, Asian and North American markets. The whole company had about 200 employees during 1997 and the Materials Technology Department had four employees. There are no domestic powder-producing competitors and about 95 per cent of the sales are exported. The company has been certified according to ISO 9001 since 1992.

The business at the component producer is based on a patented method of manufacturing structural ceramics. Such high performance ceramics are in an early industrial stage with some commercial breakthroughs. Different prototypes are being tested and the production of wear parts is gradually increasing. The customers are found within the process and engineering industries in Europe and in the USA. Half of the output is exported. At the time of the study 13 persons were employed.

The basis of the implementation model was some earlier suggested models for implementation of quality improvements; see Table I. Juran (1995) describes differences between management strategies depending on whether the organisation is striving to prevent change or to create change. He means that all managerial activities are directed either to breakthrough or to control, and most of the time both of these activities simultaneously. He presents a univarying sequence of events by which organisations break out of old levels of performance and into new ones. Based on case-studies of eight different companies, Newell and Dale (1991) present basic stages of the introduction and development of a quality improvement process. The third model was presented by Egnell (1994) as a model for implementing process management; see also Egnell and Klefsjö (1995). The model is based on literature studies and analysis of experiences from a large Swedish company.

All the three models contain similar parts and follow the same chronological order. Change within the organisation is initiated by someone's awareness that a problem exists and a belief that a change is both desirable and feasible. A phase of education and a problem analysis by the management are followed by organising, planning and developing new knowledge. Juran alone describes explicitly a phase of resistance to change and change of cultural patterns. A phase of implementation followed by assessment or a control system to maintain the achieved progress in performance.

Another study of why some companies succeed with implementing statistical techniques is presented by Sandvik Wiklund (1992) and is based on 20 Swedish manufacturing companies. Sandvik Wiklund (1992) has identified factors critical to the implementation of design of experiments:

- company culture;
- management;
- adaptation of education;
- information;
- practical experimentation.

Sandvik Wiklund (1992) also claims that re-organisation in the company; fear of changes and new methods; resistance to attacking larger problems are factors which have a restraining influence on the implementation.

The models in Table I together with the experiences by Sandvik Wiklund (1992) and those at the same time arising from the study by Deleryd (1998a) and Deleryd et al. (1999) were the basis for the implementation study.

The case study
Here the case study is just briefly described. For more details we refer to Garvare (1998).

Design of experiments was presented to the management of the companies and problems existing in their manufacturing processes were discussed. In both the companies there were some awareness of possible interaction effects. However, none of them had tried to design experiments in order to measure interaction effects. The only experience of experiments was of one-factor-at-a-time.

In order to introduce design of experiments to the project team and to participating companies a pilot study was carried out at the component producing company. Members of the pilot team were the production manager at that company and four persons working with different steps of the manufacturing of a ceramic thread guide. The project leader
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Table I A comparison between the models for quality improvement described by Juran (1995), Newell and Dale (1991) and Egnell (1994)

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Attitude that a breakthrough is desirable and feasible</td>
<td>Awareness that a problem exists</td>
<td>A process view on the organisation replaces a vertical view</td>
</tr>
<tr>
<td>2</td>
<td>Feasibility study and problem analysis by the management</td>
<td>Education and training, commitment of senior management</td>
<td>The management identifies important processes</td>
</tr>
<tr>
<td>3</td>
<td>Organisation for breakthrough in knowledge</td>
<td>Consolidation</td>
<td>Process owners and improvement groups are appointed and educated</td>
</tr>
<tr>
<td>4</td>
<td>Fact gathering, analysis and breakthrough in knowledge</td>
<td>Planning, problem identification, employee involvement</td>
<td>Planning, measurements and analysis lead to new knowledge</td>
</tr>
<tr>
<td>5</td>
<td>Resistance to change, changes of cultural patterns</td>
<td>Implementation</td>
<td>Changes are implemented in the chosen processes</td>
</tr>
<tr>
<td>6</td>
<td>Breakthrough in performance</td>
<td>Assessment</td>
<td>Control and improvement, audit</td>
</tr>
<tr>
<td>7</td>
<td>Control</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Garvare (1998)

... (Garvare) took part in the team as an observer.

The experimental design of the pilot study was performed according to the following steps by Olausson (1992):

- state the problem;
- complete literature review and collect historical data;
- select factors to be varied and suitable levels for each of them;
- select a suitable type and matrix;
- conduct the experiment according to the plan;
- analyse recorded data and present the result graphically;
- draw conclusions.

The pilot test was focused on a small part of the production process and performed as a design of the type $2^5-2$. Possible interactions were discussed in the group and analysed by using an Ishikawa diagram. During the pilot test a number of new factors were suggested, which might be interesting to study. The evaluation of the pilot study was made by hand using calculator and probability plotting. The pilot project was then assessed through interviews with the participants in the pilot team. The evaluation showed that the participants had got a larger understanding for interactions and how interactions can influence the result. Most of them also agreed that the experiment stimulated co-operation between people in different parts of the process.

A confirmatory test was made immediately after the first experiment. The choice of factors and levels were based on the pilot study. For instance, the possibilities to study interactions resulted in the fact that some main factors from the pilot study were cancelled.

The project then continued with further experiments and analysis of the manufacturing processes at both the companies. Today, computer software is used for the analysis.

The implementation model

Based on literature reviews (see Table I) and the case-studies a model for implementing design of experiments was developed consisting of four phases; see Figure 9. The phases two and three in Table I correspond to "planning and education" in Figure 9, number four to six correspond to the phase "pilot project" and the last phase "Assessment, standardization, and improvement" represents the phases seven and eight in Table I.

A prerequisite of successful implementation is that somebody within the organisation becomes aware of the fact that problems exist and is convinced that changes are necessary.
and feasible. The choice of technique is dependent on whether the organisation is striving to achieve control or to achieve breakthrough. To be able to choose, the management should be educated about values, techniques and tools in TQM before design of experiments is implemented. All investigations point at the importance of management support. To get that support it is necessary that management has sufficient knowledge about the technique and its usefulness. Our experience is that a couple of half-day seminars are suitable in a small organisation.

Through a kick-off in the form of a pilot project it should be possible to create a good internal example, where a team of employees is directly involved and design of experiments is used practically within the organisation. Education of other employees should preferably be offered in connection with that pilot study. It is important not to use too many factors in the pilot study. A design of the type $2^5-1$, $2^4$, or $2^3$ might be suitable.

The pilot project should be assessed and experiences from the project should be spread within the organisation. Design of experiments could be applied in other parts of the process that were selected for the pilot study, and also in other processes within the organisation, for example in the development of new products or marketing.

Networks of enterprises exchanging experiences of implementation of different tools or techniques could facilitate the continual improvement.

Factors that should be noted and which appear to have facilitated the implementation of design of experiments during the case studies, but which are not explicitly mentioned in the models described above are:

- The management should make long-term plans for the implementation.
- Process performance should be documented not only after, but also before an implementation.
- Both knowledge about the method and knowledge about the studied process should be present in the project team.

Based on the result from the case studies, design of experiments appears to be a well suited technique to structure the development of manufacturing high performance ceramics. In every organisation it is of course important to carry out some kind of problem identification and analysis before choosing methods to solve them, rather than trying to adjust existing problems to new and fascinating techniques based on the theoretical studies. However, design of experiments is to be preferred in most cases where one would want to perform an experiment. We also believe that the same conclusion holds for many other types of SME.

Experiences aim at finding relations between input and output variables of a system or a process. An obvious and general condition is that the experimental material used in the individual runs or trial should be traceable and identifiable when analysing the results. However, this became a difficulty during the project when experiments were designed and extended over the whole production process from powder manufacturing to finished ceramic parts. The answer to the problem was to develop a database and a system for logging and tracing of individual units and batches of units through the manufacturing process.

Finally, design of experiments is often misleading if presented as a technique where all input factors are changed at the same time. Many people find it hard to understand how any meaningful information could be obtained from such experiments. It should be pointed out that only one variable at a time is changed.
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between each run during a designed experiment. The idea is instead to change the levels of the variables so that many or all of the possible combinations are tested in a series of runs.

Conclusions

The findings from the two studies show that, in order to achieve a successful implementation of statistical methods, educational efforts, a structured approach with kick-off and continuous support are some of the critical aspects that have to be addressed. To fully take advantage of the high potential of statistical methods like process capability studies and design of experiments, thorough process knowledge is needed. In order to trust the results, and also to develop interest in further use of the methods, it is strongly suggested that process operators are involved in the planning of studies and experiments, and also in the analysis of results.

As a final recommendation we would encourage SMEs to start using scientific problem solving methods. Even if the implementation may be a little bit hard at the start the rewards will come. Statistical methods are not just meant to be used by specialists in larger organisations.

References


Commentary

A welcome study of quality techniques in small organizations.

Consequences of Implementing ISO 9000 in Small Enterprises

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Abstract
Quality-related methods developed in the context of large corporations are increasingly being applied in small enterprises. The new edition of the widely adopted ISO 9000 standards will require organisations to implement business process management in order to get certified. The requirements of the new ISO 9000 could primarily be reflecting the needs of large organisations, and a certification of a small enterprise could create constrains on its leadership. There are both potential benefits and potential problems with applying the new ISO 9000 in small enterprises. The standards may help to anchor fundamental cultural changes, like business process management, within the organisation. Implementing a quality assurance standard as a reaction to external customer pressure could negatively inflect on the perceived dynamic of the corporate environment, leading to a decrease in growth and performance of the small firm. Suggested questions for further research are presented.

Introduction
Quality-related models, methods and programmes developed in the context of large corporations are increasingly being applied in small enterprises. Business process management, one of several methods within the framework of total quality management (TQM), has during the last decade evolved as a popular movement for organisational change, restructuring and improvement (Zairi, 1997; Forsberg, 1998; Hammer & Stanton, 1999). The new edition of the ISO 9000 standards will require organisations to implement business process management in order to get certified (ISO, 1999). The focusing on processes is also one of the corner stones within TQM (Bergman & Klefsjö, 1994).

The theoretical frameworks that exist today within the fields of TQM, quality systems and business process management are based mainly on studies of large corporations. Theories, concepts and definitions developed with the large organisation in mind are not necessarily applicable on smaller organisations (Storey, 1994). Therefore there is a need to complement existing theories with research and empirical investigations of smaller companies.

Small firms account for a large proportion of the total business in most of the European countries. They have a critical role in the economy and great impact on the creation of new jobs. Many of today’s small firms face a pressure from their customer companies to gain an ISO 9000 series quality system certification. This is especially true if they are suppliers to larger organisations and governments. Research findings suggest that customer pressure is the main reason for embarking on ISO 9000 (Rayner & Porter, 1991; Wiele & Brown, 1998; Gustafsson et al., 2000). Due to costs and in some cases limited benefits, the implementation and certification of management systems according to the standards of ISO 9000 has been criticised, particularly from small enterprises.

Growth and performance in small firms are delicate matters depending on factors like ability to adapt to sudden changes, degree of formality and perceived dynamic of the corporate environment (Westerberg, 1998; Wiklund, 1998). An ISO 9000 certification, requiring process management and increased formality with documented descriptions of all activities in the company, could be negatively inflecting the flexibility, adaptability and perceived dynamic environment of the company and thus create constrains on the leadership. A certification could also be positively inflecting the formal management structure and delegation of authority.

As the ISO 9000 standards are so widely adopted it is important to foresee consequences of changes in new versions. This paper presents a discussion on the complex of problems arising when implementing the new ISO 9000 with business process management in small firms. The aim is to generate questions for further research.

Principles of small organisations
There are many definitions of a small organisation available, based upon factors such as sector, market, owner-type and number of employees. This paper does not intend to place finite figures on small firms, but refer to The European Commission that uses the categories micro (0-9 employees), small (10-49 employees), medium (50-499 employees) and large (500 or more employees) to classify companies.
Many small enterprises generally display the following characteristics (Vickers, 1990):

- A ‘flat’ management structure
- Low profit margins and cash flow problems
- Little emphasis in training and development of staff at any level
- High turnover of key personnel
- Informal and/or irregular quality controls
- Dependence on a single client or narrow customer base
- Lack of purchasing ‘muscle’
- Vulnerability to competition
- A scepticism of outside help
- A potential to change rapidly

(Chittenden et al., 1998) add to the list:

- Lack of long term strategic focus
- Lack of in depth resources.

The advantage of high flexibility and flat management structures should make small enterprises more able to respond quickly to changing customer needs. Lack of resources limits the number of feasible initiatives that a small organisation can take. Small organisations often also find it difficult to appoint a full-time facilitator or co-ordinator (Lee & Oakes, 1995).

**Principles of business process management**

Business process management can be described as (Zairi, 1997):

> A structured approach to analyse and continually improve fundamental activities such as manufacturing, marketing, communications and other major elements of a company’s operations.

(DeToro & McCabe, 1997):

> By using business process management the organisation is viewed as a series of functional processes linked across the organisation, which is how the work actually gets done. Policy and direction are still set from the top, but the authority to examine, challenge and change work methods is delegated to cross-functional work teams.

Business process management is a long-term approach. Managers are appointed to process owners, given authority over work and budgets. The focus of the measurement systems is shifted from unit goals to process goals. Whole processes are emphasised rather than narrow tasks. Business process management is a subtle but fundamental change of the organisation’s culture, stressing customers and teamwork over hierarchy. The measuring and follow-up must also be created, making sure that the process is attaining the new goals and is in line with the business strategy (Harrington, 1991; Hammer & Champy, 1993; Egnell, 1994 and Lee & Dale, 1998).

**Principles of ISO 9000**

A documented quality system forms a basis for quality assurance in the organisation. ISO 9000 is a series of widely adopted quality assurance standards with requirements and recommendation for the design and assessment of management systems. To ensure that product and service quality consistently conforms to predetermined standards ISO 9000 involves documentation of the processes of design, production and distribution (Bergman & Klefsjö, 1994).

The series was established by the International Organisation for Standardization in 1987, originating from some American military standards, e.g. MIL-Q-9858, and the NATO-standard AQAP-1 (Bergman & Klefsjö, 1994). Drafts of a new and more progressive version of the ISO 9000 series are being circulated. The new standards are supposed to be used from the end of the year 2000. Among the changes comparing to the 1994 version are requirements to implement process management within the certified organisations, requirements on customer focus and requirements on continuous improvements (ISO, 1999). The intention of the new system is to take a large step towards TQM.

The main benefits with a quality system according to ISO 9000 is that it should assist in eliminating errors. Customer satisfaction should be improved, and as an ISO 9000 certificate demonstrates an international recognised level of quality it is claimed to provide marketing benefits (McAdam & McKeown, 1999).

The costs and benefits of an ISO 9000 system could be difficult to quantify. A majority of small firms using ISO 9000 say that the advantages of the standard outweigh the disadvantages. Reported areas of benefit are ‘greater control and discipline’ (Rayner & Porter, 1991), ‘reduced scrap and downtime’ and ‘increased and wider sales’ (Chittenden et al., 1998) and ‘fewer customer complains’ (McAdam & McKeown, 1999). Still only a minority of small firms have registered for ISO 9000.
Discussion of the new ISO 9000 in context of small enterprises

In large companies, many of the core processes are not completely within a functional unit. Instead they cut through different departments. Lack of responsibility and supporting systems in the horizontal dimension of a large company easily lead to overlaps and sub-optimisation. Usually small firms do not experience these problems to the same extent and the potential benefits of business process management are therefore smaller. The requirement of the new ISO 9000 to transform the organisation from vertical and functional oriented to horizontal and process oriented could hence primarily be reflecting the needs of large organisations.

Most successful emerging companies are continuously changing and adapting to meet new demands from their markets and customers. The formal structure created by the new ISO 9000, supporting the continuous improvement of pro cesses, may strengthen the ability of small enterprises to produce more efficiently and effectively. By strengthening the formal controls and documenting ‘the way we do things around here’ the implementation of ISO 9000 may help to anchor changes firmly. Fewer levels of management might also give smaller organisations an advantage over larger organisations. Barriers such as lack of management commitment and lack of communication between departments should be less significant for smaller organisations. The high turnover of key personnel may also make it easier to rapidly change company cultures.

The flat management structure in most small enterprises may also be a handicap in times of change. Lack of management skill and management ‘spare’ time creates a need for external consultants. Small enterprises usually do not have the management structure and foresight to develop a vision and a strategy directing the change efforts. There is then no strong internal structures watching over and allowing the change to occur over long periods of time.

The establishment of written documentation of all current activities within the organisation can become an obstacle to further change and improvement of the processes. The work needed to continually update all documentation is often perceived as laborious and can thus lead to a decrease in flexibility and adaptability. Certification is generally relatively more expensive for small enterprises. The average time from initiation to certification of the quality management system is reported at between 12 to 16 months, engaging at least one person full time for this period. Due to the rapidly changing markets many small companies cannot afford such long iteration times. The implementation of process management, including fundamental changes of the organisation’s culture, will take even longer time.

A scanning of the literature on quality systems in small enterprises shows that the implementation of ISO 9000 has seldom signalled the start of a journey towards TQM. At best the implementation is seen as a means of improving internal efficiencies and becomes a framework for quality assurance, but often it just means ‘Business as usual’. In those cases ISO 9000 only provides a badge of quality to reassure purchasers. The new version of ISO 9000, with stronger focus on process management, customer focus and continuous improvement, will hopefully lead to a better understanding of the potential benefits from a certification.

Conclusions

There are both potential benefits and potential problems when the new ISO 9000 quality assurance standards will be applied in small enterprises. The strong formal organisation created by the standards may help to anchor fundamental cultural changes firmly within the organisation. Strategy formulation is a highly dynamic process in most small firms, reflecting the market turbulence. Small firms that have an entrepreneurial strategic orientation and that face an environment with increased dynamism tend to perform well and grow faster. Implementing ISO 9000 and process management as a reaction to external customer pressure could be negatively inflecting the perceived dynamic of the corporate environment, and hence lead to a decrease in growth and performance of the small firm.

As business process management and systems like ISO 9000 are developed with the big company in mind they can sometimes be difficult to implement for the small firm, and even become obstacles for growth and high performance. There is therefore a great need to complement existing theories in the fields of TQM, quality systems and business process management with research and empirical investigations of smaller companies.

Suggested questions for further research are:

- What influences have an implementation of a new ISO 9000 system on the flexibility, adaptability and perceived dynamic environment of a small enterprise?
- Will the new version of ISO 9000, with its strong focus on processes, result in process improvement or only set a focus on process mapping?
- To what extent are models of business process management able to link business goals to TQM in small enterprises?
- How can the ISO 9000 series be adopted to better fit the needs of small enterprises?

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References


Paper III

Process Management in Small Organisations – Experiences of a Swedish Study

Abstract

Stronger competition increases the importance of quality improvement. To solve their quality-related problems many small firms adopt procedures from the framework of Total Quality Management (TQM). One of these is Process Management, which has evolved as a widely used instrument for organisational change and improvement during the last decade. The importance of Process Management is further stressed by the fact that the new ISO 9000:2000 standards will demand organisations to be process-oriented in order to get certified. However, the theoretical framework that exists today within the field of TQM is based mainly on studies of large corporations. Theories, concepts and definitions developed with the large organisation in mind are not necessarily directly applicable in smaller organisations.

This paper presents results of a research project where obstacles and possibilities when using process management are being investigated. The focus is on enterprises with between 20 and 200 employees. The research consists of different phases; a survey of 1500 Swedish firms followed by an extended survey and two case studies.

Introduction

During the last decade process management, one of several methods within the framework of Total Quality Management, has evolved as a widely used instrument for organisational change, restructuring and improvement (Bergman & Klefsjö, 1994; Zairi, 1997; Hammer & Stanton, 1999). The importance of process management is also stressed by the fact that the new ISO 9000:2000 series strongly promotes the adoption of a process approach when developing, implementing and improving the effectiveness of a quality management system (CEN, 2000).

However, the theoretical framework that exists today within the field of TQM is based mainly on studies of large corporations. Theories, concepts and definitions developed with the large organisation in mind are not necessarily directly applicable on a smaller organisation (Storey, 1994).

Small enterprises have a critical role in the economy of many countries (Holliday, 1995) and are important as a mechanism for job creation, innovation and long-term development of the economy (Storey, 1994). Growth and performance in small enterprises are delicate matters depending on factors like ability to adapt to sudden changes, degree of formality and perceived dynamic of the corporate environment (Wiklund, 1998). Implementing process management within small enterprises could be inflecting these factors (Garvare, 2000).
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Process Management

The traditional organisation is managed hierarchically in a chain of command. Information flows upward and decisions are deployed downward. Cross-functional issues are rarely addressed effectively and the performance of the organisation is sub-optimised. By using horizontal, or business process, management the organisation is viewed as a series of functional processes linked across the organisation, which is how the work actually gets done. Policy and direction are still set from the top, but the authority to examine, challenge and change work methods is delegated to cross-functional work teams. (DeToro & McCabe, 1997)

A series of linked activities that repeatedly transforms input to output could be considered as a process. A process has a beginning and an end, and has suppliers and customers. The suppliers and customers may be internal of the organisation or external. Often, the output from one process forms the input into the next. (Egnell & Klefsjö, 1995)

To function effectively organisations have to manage numerous interrelated and interacting processes. According to Zairi (1997) process management can be described as a structured approach to analyse and continually improve fundamental activities such as manufacturing, marketing, communications and other major elements of a company’s operations.

Some fundamentals of process management are to establish ownership of the processes and to listen continuously both to current and potential customers as well as to the suppliers. In this study process management was defined as systematic identification, monitoring, control and improvement of the processes employed within an organisation.

Survey one – mailed questionnaires

The first aim of this survey was to get in contact with managers in small enterprises in Sweden who claim they use process management within their companies. The second aim was to investigate how widespread the use of process management is in small Swedish enterprises.

A sample survey with mailed questionnaires was used as the method of data collection for the study. The target population was defined as managing directors of Swedish companies with between 10 and 200 employees. A list of sampling units was bought from the Swedish company PAR, consisting of 25 985 names. A random sample of 1 500 persons was selected from this frame. This design was chosen to facilitate the estimation of population parameters and sampling errors using statistical methods. The size of the sample was selected based on aspects of time and cost, but also because 1 500 persons were presumed to represent the population accurately enough, giving a tolerable bound on the error of estimation.

The questionnaire was constructed with five questions. After a pre-test it was sent out to all persons in the sample. The questions were closed and had three response options each:
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1. The organisation where I am employed
   A. is using process management, completely or to some extent
   B. has tried process management, but does not use it any more
   C. has not used process management

2. Have processes within your company been identified and mapped?
   A. Yes  B. No  C. I don't know

3. Have personnel within your company been trained in process management or other similar management concepts?
   A. Yes  B. No  C. I don't know

4. Is there process owners established in your company? (Person who has the strategic responsibility for a process)
   A. Yes  B. No  C. I don't know

5. Is there process managers established in your company? (Person who is responsible for the daily work in a process)
   A. Yes  B. No  C. I don’t know

Two weeks after the first posting reminders were sent to those who had not yet answered. The sampling frame did not match perfectly with the target population, leading to an error of coverage. Eleven questionnaires were returned because the addressees were no longer working at the company. In total 511 answers were collected through fax and mail. Two of these were duplicates. The response rate for the survey was 34 percent, see table 1.

Table 1. Frame, sample and number of respondents.

<table>
<thead>
<tr>
<th></th>
<th>Number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame</td>
<td>1489</td>
</tr>
<tr>
<td>Sample</td>
<td>1500</td>
</tr>
<tr>
<td>Addressee no longer at</td>
<td></td>
</tr>
<tr>
<td>the company</td>
<td>11</td>
</tr>
<tr>
<td>Total answers collected</td>
<td>511</td>
</tr>
<tr>
<td>Duplicates</td>
<td>2</td>
</tr>
<tr>
<td>Respondents</td>
<td>509</td>
</tr>
<tr>
<td>Response rate (percent)</td>
<td>34.2</td>
</tr>
<tr>
<td>Nonrespondents</td>
<td>980</td>
</tr>
<tr>
<td>Sample of nonrespondents</td>
<td>60</td>
</tr>
</tbody>
</table>

Despite the fact that the questionnaires had been addressed directly to the CEOs about one third of the respondents were not the addressee but someone with another position at the company, for example owner, chairman of the board or quality manager. Almost without exception these positions represented roles within the senior management of the company.
To obtain some information on the group of persons who had not responded to the mail survey a special telephone survey was made on a random sample of 60 of the nonrespondents. The data analysis below is a weighted sum of the answers collected in the two groups; respondents and nonrespondents.

About 28 percent of the company representatives said that the organisation where they were employed was to some extent using process management. Less than one percent answered that their organisation had tried process management, but was no longer using this approach. About 68 percent said that the organisation where they were employed never had used process management. A total of four percent of the respondents and the interviewed of the nonrespondents did not answer the first question.

About 30 percent of the companies claimed to have been identifying and mapping processes within their company (see table 2). About 16 percent of the company representatives said that employees had been trained in process management. According to the answers process owners had been established in 22 percent of the companies. Also process managers had been established in about 22 percent of the companies.

Table 2. Collected answers on question 2, 3, 4 and 5.

<table>
<thead>
<tr>
<th>Question number</th>
<th>Alternative answers (percentages)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
</tr>
</tbody>
</table>

A difference between the number of company representatives stating that their organisation is using process management, and the number of companies actually using process management the way it was defined in this study, could be expected. Therefore, conclusions regarding how widespread the use of process management is in small Swedish enterprises could not be drawn at this stage of the study.

However, the main purpose of the mail survey was to establish relations with managers in small enterprises that claim to use process management within their companies. About 200 of these persons answered the survey, a group which was considered to be large enough for further research.

Survey two – telephone interviews

A total of 62 companies participating in the mail survey were also studied using telephone interviews. This was a stratified random sample; all companies selected for the second survey had answered that they had some kind of process management system within their company.
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A guide with general definitions and open questions was sent to the companies before the interviews started. The aims of the telephone survey were to:
- Verify the answers received in the mail survey.
- Study the effects of process management within small companies.

The participating organisations were almost equally distributed between manufacturing companies and service companies. A majority of the companies had some kind of quality management system implemented within their organisation. On average the companies had 52 employees and had been using process management for about four years.

Of the companies that had stated in the mail survey that they were using process management almost one third were categorised during the telephone interviews as traditional functional organisations. None of the participating companies were entirely horizontally managed. Instead they used different kinds of hybrid organisations. Process owners and process improvement teams were managing and improving across functional units. Functional managers were used to provide specialised skills in areas such as marketing, product development and corporate finance.

About 20 percent of the companies in the survey said that the main motive to start using process management had been a pressure from external organisations such as customer companies and in some case parent companies. At a majority of the companies the general response from the personnel when implementing process management had been positive or very positive. About half of the companies reported that the commitment shown by the personnel had become higher due to the use of process management. Main problem areas included bureaucratic documentation procedures and difficulties when trying to involve older personnel and middle managers. Only a few companies reported lack of resources as a main problem when implementing process management.

Results of the study show significant correlations between some of the measured indicators. Generally the large companies had established some kind of ownership to their core processes. This was not the case in many of the small firms. Also the system of process improvement was generally more developed and had a higher level of co-ordination in the large companies than in the small ones. Examples of process improvement in the large companies include core process improvement teams commissioned by the process owners and meeting at regular intervals, assessing the performance of each process.

At the companies that had a system for regular assessment of process performance there was also a tendency of higher commitment among the personnel. At the companies where the use of process management had been initiated within the organisation the response from the employees had been very positive. When the initiative had come from external customers or if process management had been implemented due to the demands of the new ISO 9000 standard the response from the employees had been a bit less positive. If the initiative to start using process management had come from within the organisation the chances were higher that a clear ownership of the processes had been established. The tendency to follow up and use results from measurements in the processes were also higher if the initiative to start using process management had come from within the organisation.
Case studies

To evaluate the effects of implementing process management in small enterprises case studies have been performed at two of the companies participating in the telephone survey. The cases have been selected to represent different types of industries and also different types of implementation strategies.

The first organisation has 35 employees and is a subcontractor in the boat industry. Eight years ago a new CEO took over the leadership of the company. For a few years the company had been experiencing a difficult situation with heavy expenses and a decrease in sales. The primary focus was on immediate improvement activities and short term problem solving. After about two years the new CEO began transforming the company from a traditional functional organisation with a hierarchical chain of command into a horizontal process management organisation. A flatter team-oriented structure replaced the former top-down hierarchy. The levels of authority and number of functional lines were minimised. This required a radical shift in thinking among the personnel. Those who earlier had been used to work according to priorities and quotas set by the managers now had to think much more by themselves. Work design, product inspection, cost reduction and process improvement became the responsibilities of job teams. Two functional managers provided specialised skills in the areas of finance and human resources. The performance of the company increased considerably. Under the strong leadership of the new CEO the company had reached a process oriented and customer focused organisation.

The second organisation is working in the service industry and has about 150 employees. Two years ago business was very good. To improve the internal efficiency and customer focus the senior management team decided to change the organisation from functional orientation to process management. A person with long experience of implementing process management in other companies was employed as quality manager. In two months he had reworked the organisational chart into a process hierarchy with core processes, subprocesses, operational, supporting and management processes. But the commitment shown by the top management was decreasing. The general business climate was deteriorating and the company was losing sales. For about half a year the implementation was halted due to vacillation by the senior management. After six months it was decided that the change towards process management should continue. The insecurity among the personnel resulted in considerable damage to the mandate for change. Through some promising results achieved by the parts of the organisation that was using process management the opinion for organisational change improved. Today the process map has found widespread use in the company and one of the core processes is horizontally managed.

Conclusion

At a majority of the studied companies the general response from the personnel when implementing process management was positive or very positive. Main problem areas included bureaucratic documentation procedures and difficulties when trying to involve older personnel and middle managers. At the companies where the use of process management had been initiated from within the organisation the likelihood of a successful implementation was
Quality Improvement

significantly improved.

In the mail survey about 28 percent of the studied companies stated that they were using process management within their organisation. Many of those companies were later categorised as traditional functional organisations. None of the participating companies were entirely horizontally managed. Instead they used different kinds of hybrid organisations.

In general the companies with many employees had assigned owners to their major processes. This was not the case in most of the small firms. Also the system of process improvement was generally more developed and had a higher level of co-ordination in the large companies than in the small ones.

References


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Case studies of Process Management in Small and Medium Sized Enterprises

Case Studies of Process Management in Small and Medium Sized Enterprises

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**ABSTRACT**

This paper presents the results of case studies of process management in seven Swedish small and medium sized enterprises (SME). These studies are part of a larger research project aiming at describing experiences of introducing process management in SMEs. Our findings were that, in general, the studied companies had not changed directly from a functional orientated organisation to a process orientated organisation. Instead they were still in, or had recently passed through, an intermediate state characterised by a team and project based organisation where focus was shifted towards a cost reduction emphasis. The transitions described by the case companies have been summarised schematically in a model with three stages: starting with functions, continuing via teams and projects, and ending with processes.

**1.0 Introduction**

Small and medium sized enterprises\(^1\) (SME) account for a large proportion of the total business in most countries. Their importance as a major engine for innovation and creation of new jobs is often emphasized, see for example Storey (1994).

Quality related programmes developed with the large company in mind are increasingly being employed also in many small and medium sized enterprises. Process management is one of many methodologies within total quality management (TQM) that has found widespread use in recent years, see for example, DeToro & McCabe (1997) and Lee & Dale (1998). However, in a study of quality award winners, Hansson (2001) found process orientation to be problematic for small organisations. In several aspects, for example in terms of specialisation, formalisation and resources, small and medium sized organisations are not like the large ones (Storey, 1994; Ghobadian & Gallewar, 1996). Much of the contemporary quality-related systems, methodologies and tools are therefore not necessarily the most suitable for small and medium sized organisations.

The new ISO 9000:2000 series of quality management system standards (CEN, 2000) strongly promotes the adoption of a process approach within the certified company (Garvare, 2000; Tsin et al., 2002). In the standard, the process approach is defined as

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\(^1\) In this paper small and medium sized enterprises are defined as privately owned companies with between 10 and 200 employees.
the application of a system of processes within an organisation, together with the identification and interactions of these processes, and their management”. Organisations must recognise and establish processes together with their sequence and relations, monitor and analyse process performance, and manage and control the processes in compliance with the requirements. It could be argued that the pressure on small and medium sized enterprises to adopt a process approach will probably increase due to the update of ISO 9000. Pritchard & Armistead (1999) state that lack of understanding of process management is the biggest difficulty for organisations in the initial stages of adopting a process approach. To aid the prevention of potential negative consequences, as well as to enhance the utilisation of potential benefits, experiences of introducing process management in small and medium sized enterprises have been investigated.

1.1 Process management

Modern quality management is based on the idea that to remain competitive an organisation has to ceaselessly upgrade the way it fulfils the true needs of its customers (Dale, 1999). It is not enough to focus on the finished products that customers receive. How these products are produced, i.e. the processes, also needs to be addressed. Strong competition and forever increasing customer demands lead to short product life cycles and rapidly changing product concepts. Combined with escalating complexity of products and processes this emphasises the importance of controlling and systematically managing the processes of an organisation.

Traditionally organisations have been managed vertically and hierarchically with a division of power between functional units. This could lead to ineffective addressing of many cross-functional issues and thereby sub-optimisation of the organisation. By using horizontal process management the organisation is viewed as a network of processes linked across the organisation. According to DeToro & McCabe (1997) policy and direction is still set from the top, but the right to examine and change methodologies and procedures is delegated to cross-functional work teams.

1.2 Empirical Studies

In Garvare (2001) a study of process management in Swedish small and medium sized enterprises is presented. Experiences have been examined through 1,500 mailed questionnaires, telephone interviews with 62 senior managers, and case studies at two of the participating companies. A presentation of the case studies, carried out during 2001, are included in this paper as Company F and G. Results of the investigation by Garvare (2001) revealed that at a majority of the studied organisations the general response from the personnel when implementing process management had been positive or very positive. Main problem areas included documentation procedures and involvement of middle managers. When the use of process management had been initiated from within the organisation rather than due to pressure caused by external actors, the implementation had more often been successful.

To further evaluate the results of implementing process management in small and medium sized enterprises, additional case studies have been performed at five of the companies participating in the telephone interviews of the study presented in Garvare (2001). These five case studies (Company A to E below) were carried out during 2002.
2.0 Company A

Company A was founded in 1975 and has about 45 employees. It produces and markets electrical equipment for industrial use. Main operations are in the Nordic countries and the Baltic States. The company is certified according to ISO 9001:2000 and is working to become certified according to ISO 14001 within a year.

In 1995 the company began its transition to process orientation. Two years later it became a member of a large international business group consisting of several companies, both large and small. While still an independent business unit, control over some functions has been transferred to other companies. Research and development is today mainly carried out in Germany, while production and marketing are located in Sweden.

2.1 Start and motives

About seven years before the case study was performed the production manager of Company A attended a lecture and learned about how a large Swedish company worked with process orientated systems in logistics, business and quality management. During this time the production department of Company A was mainly producing for in-company stock shelves. People at the sales department did not feel comfortable when having to sell products that were not already in stock. Despite this strategy delivery time continued to be high. There were quality problems and many products stayed unsold on the shelves, causing high costs to the company. The unsold goods were also tying up material needed for the production of new products that the customers where asking for, and the company had severe difficulties in trying to keep up with changes in customer demands. To stay competitive and remain in business the company was forced to cut lead times and lower costs by making more effective use of its premises.

2.2 Pilot project

After beginning to learn about this new process orientated way of working the production manager became very interested in the subject, attended courses and read literature. He presented the idea of a horizontal organisation for the management group, consisting of the functional managers and the CEO. A small-scale pilot project was initiated, involving a cross-functional team of about five people representing many of the departments of the company. The entire order process of a standard product, produced on regular basis, was selected as focal point for the project. This process was identified and mapped by the team, from customer order and construction, via production, to testing, packing and delivery. The team was then assigned the responsibility for managing and improving all the steps in the process. To avoid a potential large stock of unsold goods, production was strictly based on customer order. External suppliers closely related to the company were involved in evaluating the results of the pilot project. According to the production manager the approach tested in the pilot project was “a completely new way of working”.

The economy manager of Company A actively supported the pilot project, mainly because he saw advantages in not having a large stock tying up capital. The sales manager, and most of the people in the sales department, did not trust that the new system would be able to deliver products on time. Therefore they argued for having the goods on the shelves when the clients asked for it. Heavy resistance also came from the mechanics,
fitters and production personnel. They were used to their old roles, and felt uncomfortable with having to do tasks that were perceived as less qualified, such as packaging or administration. According to the production manager the way employees looked at the status of different jobs was a crucial problem at this stage of the implementation. “A fitter is a fitter and should not be packing products” was a usual reaction from the personnel. Many employees had the opinion that it was a waste of capacity if highly qualified people also did simpler tasks. Some felt threatened in their positions, mainly in the production department but also within administration and management, as some people might not be needed after a restructuring of the organisation.

2.3 Results

After the transition to team-based process management and customer ordered production delivery precision of the pilot process went up from 60 percent to 95 percent within the first year. In spite of the great potential shown by this result, people at the sales department were not convinced that the new approach would be beneficial to the company. They chose to focus on the 5 percent that were still not delivered on time, and continued to counteract all changes.

The outcome and repercussions of the pilot project resulted in a slow company-wide transition into an organisation where cross-functional process teams lead by coordinators are responsible for the operational management of all key business processes. The teams make and deliver all the products, both regular production of standard items and specialised production for certain customers. The teams are also responsible for measurements of product quality and delivery precision within their process. According to the production manager “this way of working makes our understanding of customer needs better.”

During the time of the study process management had been the established way of working within the company for more than two years, but there was still some resistance within the sales department, and a few employees had also chosen to leave the company as a result of the restructuring.

Product testing was one of the functions that had initially been incorporated within the process teams. Since the skill and knowledge of the product testing engineers was specialised it proved ineffective to have these persons work as parts of the process teams. After a few months it was therefore decided that a test function, serving all the other teams, should be re-established.

Working with ISO 9000:2000 was perceived by the managers as helpful in reorganising the company. The new standard required a structured processes approach. “Before the transition, the people working here had their jobs. Today we have separate roles, and different people with different knowledge to solve the assignments”, said the production manager. “Today the employees are looking beyond their original professions and are more actively trying to help each other out. It’s not perfect yet, but the territorial thinking between the departments is reducing”, the production manager said.
3.0 Company B

Company B was founded in the early 1990s and has about 60 employees. It is a manufacturer of mechanical components mainly for the vehicle industry. The company is certified according to ISO 9001:1994, ISO 14001 and QS 9000.

Company B is noticeably production orientated. It has a functional hierarchy with a horizontal division of power between units such as finance, manufacturing, distribution, marketing and sales. About one year before the case study was performed Company B became part of a small regional business network. Within this network a program for introducing a process based way of working among the member companies was initiated. This program has been divided into three steps: measurement, in-house improvement, and teamwork & interaction. During the first step costs of poor quality and the general potential of improvement within the company is measured. In the second step pre-emptive maintenance and improvements based on the previously identified problems are carried out. This step is also intended to bring about a process view among the personnel with a clear notion of the internal value chain, its customers and suppliers. The third step includes improving the interaction and cooperation between the companies involved in the network. Autonomic teams systematically work to control and improve the processes, within the organisation but also within the entire network. The initiative to start this network and the three step program came from a relatively large company in the region which is a customer of Company B. During the time of the case study, Company B was at the first step of the program, and both managers and employees expressed high expectations on the network. Even though Company B is only at the beginning of implementing process management, advantages due to a higher commitment for quality among the personnel have been noticed by the managers.

4.0 Company C

Company C is a privately owned school. It was founded in the 1990s and has about 25 employees. The company has no certified quality management system.

During the time of the study the organisation had a strong customer orientation and highly motivated personnel, determinedly striving to improve methodologies and procedures. The planning horizon was long, cost pressures low and results were measured regularly. However, what had during the previously made telephone interviews appeared to be a process orientated organisation emerged during the case study to be a vision in the mind of a few managers rather than an established way of working within the organisation. No attempt had been made to identify or map existing processes, and there was no written documentation about the horizontal organisation. All the things that were said to be “within the heads of all employees” regarding processes and division of responsibilities, turned out after a deeper enquiry to be very unclear and vague. Company C was therefore classified as a functional orientated organisation with a narrow focus on production.

5.0 Company D

Company D is a family owned sub-manufacturer of process equipment for industrial customers on the international market. The company, founded by an entrepreneur in the beginning of the 1970s, now has about 120 employees. Research and development
account for about 10 to 15 percent of total turnover. The company is certified according to ISO 9001:1994, and is working to become certified according to ISO 14001.

5.1 Start

Three years before the case study was performed a relative to the founder was appointed CEO of the company. At this time the organisation was built on traditional functional departments and a hierarchical chain of command. According to the CEO there was a wide gap perceived between the departments of product development and sales. People at the product development department had a high technical knowledge, but knew little about what the customers wanted. The sales people were in close contact with the customers, but lacked technical knowledge. There were also difficulties in dividing responsibilities between the different departments.

5.2 Reorganisation

The solution proposed by the new CEO to solve the gap dilemma was the implementation of several new cross-functional segments superimposed on the old functional departments. Each segment consists of a specialist responsible for monitoring all products within the segment during their life cycle, from R&D to post-launch evaluation subsequent to market introduction. The company sometimes develops products that are specially made for specific customers. In these cases the segment specialist involved also continues as contact person towards the particular customer. In the new organisation department managers are responsible for all production resources, and also for the personnel and economy of their department. For each project, resources in terms of money are assigned to the head of the segment, who orders services from the different departments. The department managers then make priorities between the orders from the segments.

During the implementation of the segments, there was also a general geographical reorganisation within the company office. All employees were moved in order to “fit the flow”, i.e. to be placed in accordance with their position in the different processes. This was, according to all interviewed at Company D, a very beneficial part of the reorganisation.

5.3 Results

The general advantage of the new organisation was described by the CEO as “a lasting responsibility”. Not only was someone watching over development projects during their whole sequence, but the segment specialists were also responsible for the entire processes within their segments. In the old days there was always a risk that things “fell between the chairs”, i.e. that nobody considered themselves to be responsible for handling difficulties and solving problems that were not clearly within the sphere of a single department.

According to many of the respondents at Company D the new organisation has also resulted in a higher customer satisfaction. No specific disadvantage had been experienced due to the new organisation, apart from the few occasions when projects had been launched without a segment specialist assigned to them. In those cases things had rap-
idly became chaotic, where after someone had promptly been assigned as responsible for the project.

According to representatives of the personnel, there had been some initial insecurity among the employees when the reorganisation was launched. A few of the employees had also left the company due to the changes that had been introduced. Looking back the CEO said he should have put more emphasis on explaining his vision of segments, and the purpose of the reorganisation, already from the start.

6.0 Company E

Company E was founded in 1957 and has about 30 employees. It is a trading company providing industrial customers with a variety of standardised and specially made products and components from manufacturers world-wide. Value is added by offering total solutions, specialist know-how, efficient logistical and IT systems, and a detailed quality assurance system. The company is certified according to ISO 9002:1994 and QS 9000, and was during the time of the study working to become certified according to ISO 14001. Since 1990 the organisation has been part of a trade group consisting of about 50 companies in the Nordic countries, the Baltic States, Germany, and Russia, focusing on import and sales of industrial product components in these countries.

Despite the extra value added, by specialist know-how and by other complements offered by the company, most of the trading products have a very small earning per item. Cost pressure has always been high within the industry, and according to the CEO “the profit lays in working with your internal processes. Concentrating on the processes gives the company opportunities to rationalize, and also provides the employees with a clear view of where they are situated within the whole”.

6.1 Start and motives

The change towards process management started several years ago when the buying department of Company E was to be integrated with the in-house sales department. Some of the functional managers in the company had begun to question the way the organisation was operating, and commenced looking at the flow of work and products through the different departments. They felt there were gaps in the communication within the company, especially between the buying department and the selling department which did not correspond well to each other. Lead times had to be cut and the stock levels had to be lowered. One suggestion that came up was to begin by merging buying and sales into one larger team. A short external management course on organisational change gave the CEO ideas on how to apply and implement the integration. The flow of work in the sales and buying departments had to be identified and mapped before the integration could be performed. Persons involved had to be informed and trained in their new and extended role as being both buyer and seller. When it was finally launched, the project of merging the two departments was already acknowledged by most employees, and also partly implemented on the managerial level of the organisation.
6.2 Results

Initial results of the restructuring were promising, with shorter lead times, more efficient distribution, and forecasting of customer demand. The new organisation was therefore barely given time to settle before the project continued to also include mapping and analysis of other parts of the company. Now difficulties started to emerge. Many of the employees said that they did not see the point in making further changes to the organisation. The management group had already been handling and working out ideas about the continued streamlining, while many of the employees felt uninformed, unsafe and threatened by the proposed additional reforms. Two employees chose to leave the company due to the restructuring, and the rate of change was slowed down.

At the time of the case study a number of new processes had already been mapped, but there had been no further integration of departments within the company. Process owners had been appointed among the functional managers to coordinate and drive the process development. These process owners had also been delegated responsibilities from the CEO for the personnel working within their process. During monthly meetings every department informed the others about the progress of their improvement projects.

In the forefront of the reorganising activities was the warehouse department, pushing its internal procedures and routines towards a structure of horizontal processes. The partly process orientated organisation has also given people at the warehouse a much higher status and better means of influencing their work situation.

The company has begun outsourcing its administration and computer support systems, reforming the organisation to only include core processes vital to fulfilling the mission of the company. According to the CEO, “process management is about understanding what we are doing and how we can do it better.”

Today measurements are used, more widely than before, as a tool for improvement. Organisational goals are set as a result of strategic planning by the management group. The group, consisting of the functional managers, collects the problems, chooses measures to control and decides who will be responsible for the follow-up. Eventually all functions will have to take part in setting their own goals.

Many of the respondents at Company E said the reorganisation has given them a broader, more holistic picture of the company, thereby increasing their motivation to take part in many daily routines. Every employee at the company now has a personal education plan. According to the CEO:

“A majority of the personnel now better understands what others want from them, both externally and internally. It used to be ‘quality by accident’, and then we started defining who the customers and stakeholders are. It is important that all the employees know who is doing what. If the sales people are producing many customer-orders but the warehouse is not able to provide the goods, there is a problem. There is a need for understanding between the departments about working towards the same goal.”
7.0 Company F

Company F was founded in the 1950s and has 35 employees. It is a subcontractor in the boat industry and is certified according to ISO 9001:1994.

Eight years before the case study a new CEO took over the leadership of the company. For a few years the business situation had been difficult with heavy expenses and a decrease in sales. The primary focus was on immediate improvement activities, short term problem solving and cost reduction. After about two years the new CEO began transforming the company, from a traditional functional organisation with several departments and a hierarchical chain of command, into a new process based organisation. A flatter team-oriented structure replaced the former top-down hierarchy. One level of authority was eliminated and the functional differentiation was minimised. During this organisational change a few of the middle-managers left the company.

The new organisation required a radical shift in thinking among the personnel. Those who had been used to work according to priorities and quotas set by the managers now had to think much more by themselves. Work design, product inspection, cost reduction and process improvement became the responsibilities of job teams. Two remaining functional managers provided specialised skills in the areas of finance and human resources. The performance of the company increased considerably in terms of reduced lead times, less rework and higher flexibility. Under the strong leadership of the new CEO the company had moved towards a process oriented organisation.

8.0 Company G

Company G was founded in the 1980s and has about 150 employees. It is working in the service industry and has no certified management system.

Two years before the case study was carried out business had been very good. The company had been growing rapidly in terms of sales and employees. To improve internal efficiency and customer focus the senior management team decided to change the organisation from functional orientation to process management. A person with long experience of implementing process management in other companies was employed as quality manager. In two months he had reworked the organisational chart into a process hierarchy with core processes, sub-processes, operational, supporting and management processes. But the commitment shown by top management was decreasing. The general business climate was deteriorating and the company was losing sales. For about half a year the implementation was halted due to vacillation by the senior management. After six months it was decided that the change towards process management should continue. The insecurity among the personnel resulted in considerable damage to the mandate for change. Through some promising results achieved by the parts of the organisation that was using process management the opinion for organisational change improved. At the time of the case study the reworked process based organisational chart had found widespread use in the company, and one of the key business processes was horizontally managed by an appointed process owner.
9.0 Cross case analysis

Our findings were that, in general, the studied companies had not changed directly from a functional orientated organisation to a process orientated organisation. Instead they were still in, or had recently passed through, an intermediate state characterised by a team and project based organisation where focus were shifted towards a cost reduction emphasis. Transitions described by the case companies presented in this paper have been summarised schematically in a model with three different stages: starting with functions, continuing via teams and projects, and ending with processes, see Figure 1.

In all seven cases, the studied companies had originally been production orientated, using a functional approach mainly focusing on stability and control of products and activities. Cost pressure had generally been low with a stable environment and long planning horizons. In the investigated manufacturing companies, produced goods were often delivered to stock, and improvement efforts were primarily concentrated on enhancing product quality. With the exception of the manufacturing process, process responsibility was generally not defined at this stage.

Due to various contextual changes, such as the entrance of a new top manager, or challenging competition leading to a decline in relative performance, five of the seven studied companies had been forced into the second stage of the model. Focus shifted towards improving internal efficiency and resource effectiveness regarding supplies and inventory levels, and a main part of the organisations became cost orientated. In manufacturing companies inventory levels of both incoming and outgoing goods were lowered, and the planning horizon had to be shortened. Pressure was put on external suppliers to shorten their delivery times. In many of the companies the change was initiated by a manager or owner having discovered new ideas regarding organisational structure or improvement based on a process view. Even when intentions were to directly develop a horizontal and process based organisation, the companies often transited into an approach of teams and projects, focusing on improving distribution and resource utilisation, and on minimising delivery times. Typically, a few administrational processes were briefly mapped at this stage, but process responsibilities were informal and at a low hierarchical level, and process performance was not measured. A majority of the employees had not obtained a clear process view on their organisation. During this stage one or a few key individuals became familiar with viewing the organisation in terms of horizontal processes.
Four of the seven companies had, at the time of the case studies, progressed into the third stage of the model. In these companies the process view had been gradually acknowledged by a majority of the employees, and the organisations had slowly become more process orientated. Central organisational activities were mapped and defined in terms of processes and sub-processes. Process owners were appointed at high levels within the organisations. In one of these companies, process managers with responsibilities for day-to-day operations had been formally appointed. Cost pressures were still high, sometimes even higher than before, but the focus had shifted towards improving flexibility and process performance, and towards forecasting customer demands. A new horizontal structure was superimposed on the organisation, with frequent interactions between individuals at all positions of the company. Process performance was being continually measured in processes with designated ownership. No external driver was identified between stage two and three, and the change was seen as endogenously driven. However, despite any transition towards process management the official organisational charts of all studied companies still reflected the old functional organisation, with no clear identification of customers, suppliers, process owners or process managers.

10.0 Conclusions and discussion

Process management is one of many methodologies related to total quality management that is increasingly being employed in small and medium sized enterprises. The recent update of ISO 9000 appears to be one important explanation to the prevalent and rising interest in process management.

A result that emerges from the case studies is that when changing from functional to process orientation the studied enterprises pass through an intermediate state where the process view is gradually spread and acknowledged within the entire organisation. A clear process view and understanding of the general methodology among a majority of the employees appears to be vital for fully implementing process management. In many of the studied enterprises, process owners are appointed among the functional managers. Instead of completely rewriting the organisational chart the new process organisation is superimposed on the old functional organisation.

Horizontal communication between departments seems to be problematic in a majority of the studied enterprises, and the most common way to solve this problem appears to be the merging of departments. During the case studies, a gap between the official emphasis placed on process management, and the actual level of process orientation visible within many of the studied organisations, was observed.

This paper has highlighted a number of issues when introducing process management in small and medium sized enterprises, which may contribute towards a better understanding of the factors influencing the outcome of different implementation programmes.
References


Sustainable Development – Extending the Scope of Business Excellence Models

This article has received
the Literati Club 2002
Highly Commended Award

SUSTAINABLE DEVELOPMENT: EXTENDING THE SCOPE OF BUSINESS EXCELLENCE MODELS

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Abstract This paper presents an example of how to integrate the values of sustainable development in a business excellence model. It discusses definitions and measures of sustainable development, integrating values of total quality management with global human and environmental stakeholder interests. Requirements, core values, main criteria and different concepts of measures for sustainable development are examined, discussed and defined. Existing methods and strategies for quality and business excellence are compared with definitions of sustainable development. Indicators for sustainable development in an organisational and business context are discussed and a rough framework is presented.

Keywords Sustainable development, Business excellence, TQM, Measurement

Introduction
The question of sustainable development seen from the perspective of limits to global growth has been an issue for some 30 years (Meadows et al., 1972). The original issue has developed from having a main focus on limits of economic activity to the realisation that a balance must be found between business excellence and ecological sustainability (Hediger, 1999; Edgeman and Henseler, 2001; Edgeman, 2000). Effective and efficient organisations are needed to finance environmental protection and social improvement. On the other hand, over the years quality issues have evolved from being focused on product performance to comprehensively addressing business excellence. Customer focus has evolved into the broader concepts of interested parties, human stakeholders, environmental stakeholders and societal sustainability. Today's business excellence models, such as the Malcolm Baldrige National Quality Award (MBNQA) and the European Quality Award, are not to any large extent reflecting this shift of focus. In this paper an extended version of the MBNQA model, including many aspects of sustainable development, is presented.

Describing sustainable development
"Sustainable development is development that meets the needs of the present generation, without compromising the ability of future generations to meet their own needs" (WCED, 1987). Sustainable development requires both widespread economic prosperity and shared environmental concern. Our total economic activities must add enough value to guarantee everybody a decent life without damaging the ecological system in such a way that the survival of future generations is endangered. Many economists speak of weak and strong sustainability as a major distinction between technocentric and ecocentric positions, representing two main directions that quite often, at least in the short term, are in conflict with each other. The categories of sustainability can be further divided into very weak, weak, strong and very strong (Hediger, 1999). A third dimension, representing societal focus with elements such as equitably distributed level of wellbeing and equal opportunities, supplements the weak and strong parts of sustainability. Several authors describe this triple bottom line or division of focus on economic prosperity, social equity and environmental protection; see, for example, Elkington (1998), Topfer (2000) and Walker (2000).

Very weak sustainability requires that general production capacity of the economy should be maintained intact so that per capita consumption is constant over time (Hediger, 1999). It is also classified as resource exploitative and implying an increase in GNP/capita (Edgeman, 2000). Weak sustainability can...
be described as the philosophy that all types of capital are equivalent and that there is a perfect or near perfect substitutability between natural capital and man-made capital. It requires the summed value of aggregated economic activity and environmental quality to be maintained over time. Intrigenerational and intergenerational equity are emphasised. Ecological and biogeochemical processes that are irrecoverable if lost (critical natural capital) must be safeguarded (Compton et al., 1998). **Strong sustainability** requires that development or regeneration of renewable natural resources matches or exceeds depletion of non-renewable natural resources (Edgeman, 2000). **Very strong sustainability** requires that the quantity of natural capital should increase or at least be maintained constant. Reduction of resources consumption is needed (Edgeman, 2000). The goal is a stationary state limiting human scale activities to zero population growth and zero economic growth – safe minimum sustainability standards (Hediger, 1999).

**Definition of sustainable development and efforts needed**
Sustainable development is defined as the process to reach a steady state where both humanity and nature thrive. The objective is to achieve satisfied basic needs for all humans in balance with a healthy natural environment. To succeed with this, a global management process for sustainable development is needed. The management process should lead social and economic transformations that optimise production as well as distribution of the outcome, without jeopardising the potential for similar benefits in the future. The management process should also ensure a stabilisation of the global population level. Management processes are needed on the personal, organisational and societal levels. Why should an organisation pursue sustainability? Shriberg (2000) summarises three reasons to begin the journey toward sustainability:

1. Morality and intergenerational equity: to live only on what is available without borrowing from future generations of people or biota is morally desirable.
2. Survival: the stresses we are currently placing on ecosystems are too large for the continued wellbeing of any organism. Therefore, in the long run, sustainable development is a prerequisite to survival and prosperity on this planet.
3. Organisational benefits and risks: by embracing sustainability, an organisation positions itself as a “first-mover”. By not embracing sustainability, organisations face consequences in terms of increased economic and social liability.

**Values for sustainable development**

**Requirements of sustainable development**
Sustainable development as a function of organisational excellence results in a rather complex equation. This paper only presents some ideas for the ongoing debate. The intention is to translate the requirements of critical global processes to areas of organisational concern. The two principal stakeholders are defined as humanity and nature. The report *Limits to Growth* lists five critical elements which are industrialisation, food production, population, pollution and consumption of non-renewable natural resources (Meadows et al., 1972). The target level for the wellbeing of nature is a subject for ongoing debate and is not dealt with here. However, even if the level of limits for the five elements can be debated it is reasonable to say that all elements have limits that, for organisations, means to minimise pollution, the consumption of non-renewable natural resources and the destruction of arable land. Assuming a stable natural environment human well-being depends on food and industrial production and their distribution. Population growth puts pressure on industrial and food production. There is a risk with the approaching limits that global per capita GNP and per capita food production will decrease as a consequence of a growing population (Traine, 1997). On the other hand there is evidence that population growth decreases when per capita GNP increases (Martin, 2000). Population growth also directly threatens nature by converting natural areas into agricultural use. Furthermore, population growth leads to increased pollution (WCED, 1987). Poverty is not primarily a problem of global production but a problem of unequal distribution (Ackerman et al., 2000). This indicates unequal distribution as one of the primary causes threatening global sustainability. Measuring poverty is not complicated but measuring its causes is. Causes for pollution are relatively easy to measure objectively but causes for poverty are subject to political debate, which complicates the issue. There is a need to have measurement tools equivalent to those on the
ecological side such as life cycle analysis (LCA). Tools like economic LCA and systems for poverty aspects and impacts might exist but they do not seem to be in common use. Lack of relevant and accepted measures constitutes a problem for societal equity in the triple bottom line. Therefore, it is important to operationalise the drivers of poverty. Global organisational excellence requires business excellence but with limitations imposed by nature (pollution and non-renewable resources) and social issues (unequal distribution). There seems to be ample potential for improvement in the global management process. Organisational measures should support global sustainable development. For a start, organisational values should reflect all aspects of sustainable development.

**Measuring sustainable development**

Many different concepts can be applied as measurements and indicators of sustainable development. We propose, based on an idea by Compton *et al.* (1998), four categories of indicators divided as:

1. driving force;
2. state;
3. reactive response;
4. active response.

The main processes to focus on are management for sustainable development, industrial production and food production. Each process exists on the local, regional, and global level and is affected by personal, organisational and societal processes. The indicators should cover the areas of the triple bottom line. An example of industrial production in the ecology area is generation of waste (driving force) resulting in contaminated land (state) with the response to treat waste (reactive response) and reduce the waste generation (reactive response). An example regarding the management process related to the previous example is public and international pressure for limits (driving force) resulting in legislation and control (state) with one response being fines for rule breakers (reactive) and another incentives for waste reduction (active). Building the matrix for economy and ecology should be feasible whereas the great challenge lies in integrating the social equity component, especially when looking at the processes on a global scale.

**Proposed core values**

Business excellence needs to be based on deployed core values (Edgeman, 1998). The proposed values for a management process of sustainable development should be considered as an example. Five core values have been chosen. All organisational values should reflect the effects on local, regional and global level as well as the implications on personal and societal sustainable performance:

1. **Sustainable stakeholder balance.** Long-term balance between the interests of all stakeholders forms a basis for sustainable development.
2. **Learning excellence.** Continuous individual, organisational and societal learning is needed to reach sustainable development. Good learning creates a climate of improvement and innovation. Increased flexibility is needed for adaptation to rapid change. Learning the values guiding sustainable development is an integral part of learning excellence. Good ability for learning helps the work with customisation, simplification and developing products consuming fewer resources.
3. **Process performance excellence.** The process view forms the foundation of the systemic view. Using process management enables co-ordinated learning and improvement in different parts of the system. The mother of all processes is the global process that transforms stakeholder interests to satisfied stakeholders. The satisfaction of the stakeholder “nature” will have to be interpreted by humans. Process performance excellence is defined as managing the processes effectively and efficiently with a result that maximises the integrated stakeholder value in the long perspective while maintaining a balance between the interests of all stakeholders.

4. **Stakeholderocracy.** Sustainable development is based on integrity and respect for all stakeholders. Participation by everybody based on democratic values must be encouraged since, in this model, everyone has the right to an opinion without fear of retribution in its expression. Respect and formal authority are earned through competence, maturity, responsible stewardship, humility, and faithfulness.
to core values for sustainability and servanthood. Formal authority is temporary and subject to the scrutiny of stakeholders. The responsibilities and privileges of leadership are to some extent shared by all.

(5) **Transparency.** Open and equal information is vital for long-term balance between interests of all stakeholders. Corruption is a major development obstacle. It counteracts market forces and stakeholder interests and generally reduces performance. Open information of compliance with performance standards for management and employees leads to fair and transparent competition.

**Modification of business excellence models**

Excellence for sustainable development can be built on the triangle "person-organisation-society" (Edgeman, 2000). One way of doing this is to redefine stakeholder priorities. Excellence is required on all levels, which means that organisational excellence should promote personal and societal excellence and simultaneously retain customer focus. It is the individual in his roles as voter, activist in a citizen group, customer, manager and employee that creates the drive for change. Current models of business excellence, based on the values of total quality management, are not focusing on the concept of the *Triple Bottom Line* but have their drivers and enablers in the traditional context of the market economy. To a small extent the existing components, of public responsibility and citizenship as well as focus on the human resources, promote personal and societal excellence, social equity and environmental protection. Nothing is mentioned about restraining growth. On the contrary, quite often focus is on organisational growth contributing to an increased GNP. However, there has been a development where more focus is put on human resources and society.

Improvement strategies such as Six Sigma and quality assurance based on ISO 9000 aim at customer satisfaction and an improved bottom line by reducing the costs of poor quality. This represents very weak sustainability. ISO 14000 requires a continuous improvement in environmental performance, not only adherence to defined limits, and it could be said that ISO 14000 contributes to strong sustainability. There is an increasing requirement to integrate social, ethical and ecological aspects both into traditional cost accounting and into the decision-making processes of all companies (Compton et al., 1998).

Based on the belief that sustainable development requires personal, organisational and societal excellence the MBNQA model can be modified in such a way that business excellence more clearly supports global sustainable development based on personal and societal sustainable excellence and the concept of the triple bottom line.

Using the five proposed core values, 12 criteria have been chosen and tentatively introduced in a modified model based on the MBNQA (Figure 1 and Table I). The new model represents a shift of focus from results to enablers.

**Conclusions**

It is the human that drives change in different roles as consumer, employee, manager and citizen. Sustainable values have to be implemented on personal, organisational and societal levels. This can be achieved through effective and efficient management processes balancing economic prosperity, social equity and environmental concern. Most of today's business excellence models are primarily focusing on the paying customer and a single bottom line of economic improvement.
Table I — Extending MBNQA with a proposed model integrating sustainable development

<table>
<thead>
<tr>
<th>New criteria</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Leadership for sustainable development</td>
<td>Setting the mission, vision and values corresponding to sustainable development. The five guiding values are: sustainable stakeholder balance; learning excellence; process excellence; stakeholder democracy and transparency</td>
</tr>
<tr>
<td>1.2 Support for societal excellence</td>
<td></td>
</tr>
<tr>
<td>1.3 Support for personnel excellence</td>
<td></td>
</tr>
<tr>
<td>2 Development and deployment of strategy</td>
<td>Strategies are set to comply with economic prosperity, social equity and environmental protection. Systemic thinking is essential</td>
</tr>
<tr>
<td>3.1 Knowledge of the value adding process</td>
<td>Special focus on the paying customer</td>
</tr>
<tr>
<td>3.2 Knowledge of the process of managing natural capital</td>
<td>Special focus on the (critical) natural capital</td>
</tr>
<tr>
<td>3.3 Assessing priorities of stakeholder needs</td>
<td>Looking at all the stakeholders: economic prosperity, social equity and environmental protection</td>
</tr>
<tr>
<td>4. Process control and information system</td>
<td>Measurement processes track both stakeholder needs and stakeholder satisfaction</td>
</tr>
<tr>
<td>5. Developing the human resources</td>
<td>Personnel are selected, trained and continuously learning in order to attain personal excellence</td>
</tr>
<tr>
<td>6. Supporting societal excellence</td>
<td>Strong co-operation with society</td>
</tr>
<tr>
<td>7. Process management excellence</td>
<td>Process excellence both in design and results</td>
</tr>
<tr>
<td>8.1 Results from customer satisfaction</td>
<td>Measurement of quality</td>
</tr>
<tr>
<td>8.2 Economic results</td>
<td>Results of organisational excellence</td>
</tr>
<tr>
<td>8.3 Personal results</td>
<td>Results of personnel excellence</td>
</tr>
<tr>
<td>8.4 Social results</td>
<td>Results of societal excellence</td>
</tr>
<tr>
<td>8.5 Results from managing resources</td>
<td>Impact on the environment</td>
</tr>
</tbody>
</table>

prosperity. In this paper we have discussed the sustainable organisation, making some suggestions about how the requirements of critical global processes could be translated to areas of organisational concern and how organisations could be measured using adapted business excellence models. 

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Measuring Sustainable Development using Process Models

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Measuring Sustainable Development using Process Models

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ABSTRACT

This conceptual paper presents a process model combining TQM-values and indicators of Sustainable Development (SD). The intention is to find synergies in applying a process view on different systems for SD-measurements. A global process is introduced and global sustainability is related to critical elements of production, resources and population growth. Indicators of organisational performance are classified into drivers, input, enablers, output and outcome. SD is described with the three dimensions of Economy, Environment and Ethics, representing a modified version of the Triple bottom line. Existing measurement systems for SD are categorised according to the proposed organisational process model and positioned within the 3E dimensions. The use of indicators for SD in different organisations, including small and medium-sized enterprises, is discussed.

Introduction

The original issue of Sustainable Development (SD) has widened from a main focus on limits of economic activity to the realisation that a balance must be found between economic prosperity, environmental protection and social equity, see for example Pearce & Warford (1993), Elkington (1999) and Rao (2000). Reporting performance on all three previously mentioned areas is often called the triple bottom line, (Elkington, 1999; Topfer, 2000).

Based on a comprehensive examination of literature, Hellsten (1997) shows that fundamental core values of Total Quality Management (TQM) are customers focus, management commitment, everybody’s participation, focus on processes, continuous improvement and fact-based decisions. The idea of this paper is to combine these values with measurement of SD.

Issues of SD are essential to all types of organisations (Edgeman & Hensler, 2001). The importance of the subject suggests that measurements of SD should to a larger extent be included in management systems such as ISO 9000 and Business Excellence models such as the European Quality Award and the Malcolm Baldrige National Quality Award (Garvare & Isaksson, 2001). Quality management systems are increasingly being integrated with business management systems that also include health, safety and environmental issues (Wilkinson & Dale, 1999; Karapetrovic, 2002). This emphasises the necessity of finding agreed indicators for all dimensions of SD.

A great number of measurements systems, quantifying either some or all of the areas of the triple bottom line, both for organisational and national performance, exist today, see section 3.1 below. The large number of proposed indicators could be a problem, especially for small organisations. Another difficulty could be that proposed indictors are not clearly related to an organisational process view. The process view, being a core value of TQM, and also emphasised in the...
new version of ISO 9000 (CEN, 2000; Tsim et al., 2002), should be included in models measuring SD-performance.

Forsberg (1998) summarises critique against how traditional measurement systems have been used. Some of the concerns described are that: functional specialisation is encouraged, focus is limited on monetary measures, and short-term efficiencies and cost reduction are supported at the expense of long-term considerations, for example quality, morale, innovation and effectiveness.

In this paper the focus is on creating a process-based model that structures existing indicators of SD. The proposed organisational process model is based on a global process model.

**Model Structure**

**Global process model**

For true sustainable development the organisational performance needs to be related to global performance. We propose to use the five critical elements that present limits to global growth as reported by Meadows et al., (1972). These elements are pollution, industrial production, food production, population growth and use of non-renewable resources.

The main stakeholders for the global process are identified as Humanity and Nature and the assumed interest of these stakeholders is a good life and a healthy nature. This means that processes related to the critical elements could be considered as support for the operative processes that produce the value added for the main stakeholders. Industrial production and food production are combined into a process called producing goods and services (see Fig. 1). The problems of pollution and use of non-renewable resources are transformed to support processes called limiting pollution and limiting use of non-renewable resources. Global management processes should define these limits. Population growth is converted to a support process called maintaining a sustainable population. Obviously the size of the sustainable population depends on many factors, such as political, societal and technological levels of the world. One supplementary process, compared to the five critical elements, has been added to the support processes - measuring and monitoring performance. This is the process that feeds “World Management” with required information. Probably many more support processes could be added but we think measurement is principally very important. Management processes on the global level are currently run by organisations such as the UN, EU, G8 and The World Bank as well as by the super power US.

In order to lead change for sustainable development, management commitment is crucial. Organisations producing goods and services need clear directives for their activities. Global limits and guidelines are transformed to national directives that become drivers for organisations. It is important that organisations have reliable and agreed upon processes for measuring and monitoring performance. Many of the surveyed measurement systems relate to national SD-performance and some to global SD-performance. These systems fall outside of the scope of this article, which primarily focuses on measurement of organisational SD-performance. However, the existence of national systems for measurement forms an external enabler for the national organisations, and in that context some of the national systems for measurement are mentioned.
Management Processes
Leading change towards sustainable development

Operative Processes
Providing a good life for everybody
Maintaining a healthy nature

Support Processes
Producing goods and services
Limiting pollution
Limiting use of non-renewable resources
Maintaining a sustainable population
Measuring and monitoring performance

Solar energy (Input)

Global Resources

Good life and a healthy nature (Output)

Figure 1
The global process model based on the five critical elements and a generic process template, derived from Isaksson (2001).

Organisational process model
The support process of producing goods and services found in the global process model (Fig. 1) is built up of networks of organisations forming linked value chains. The processes of these individual organisations could schematically be described in a model (Fig. 2). This organisational process model illustrates five different types of measurements – drivers, input, enablers, output, and process outcome which is the stakeholder satisfaction.

Figure 2
The organisational process model.
The model combines the division of enablers and results used in most business excellence models with the idea of dividing indicators into driving force, state and response. Process input is directly controlled by the organisation and consists of the services and goods bought. In an organisational context both input and demand could be seen as driving forces creating enough voltage to push or pull the flow through the processes of the organisation. Customer demand, management values, and national legislation are some examples of internal and external drivers for the organisational processes. Examples of internal enablers are the structure of the organisation and its processes, enabling a low resistance for the flow of goods and services from input to output. A society with the support and infrastructure to aid organisations with SD could be a strong external enabler. Stakeholders include customers, suppliers, shareholders, employees, current and future societies and the nature in general. The impact of the output is stakeholder satisfaction, which in the case of Nature could be measured with indicators such as loss of species or degraded biotype. Stakeholder responses to the outcome, including side effects such as social problems or pollution, are management issues, for instance affected by societal demands and requirements of the owners of the organisation – external and internal drivers.

Indicator structure

In general, an indicator is something that provides useful information about a system. Indicators can be used to describe the state of a system, to detect changes in it, and to show cause-and-effect relationships (Miller, 2001). When attempting to measure SD the indicators should be relevant, understandable for the users, limited in number and adaptable to future developments. Necessary data should be readily available, of known quality, adequately documented and updated at regular intervals (Compton et al., 1998). Ideally the indicators should also show links between the different goals of SD (Farrel & Hart, 1998).

Creating a single figure effectively covering all aspects of SD-performance could prove extremely challenging. Using three indicators of economic, environmental and social performance should make the task easier, even if adding up each area is a challenge in itself. Each category could have measurements that relate to different steps in the studied processes, from drivers to outcomes. According to Robert (2000) there are two general levels of concepts and tools for measuring transition towards SD. Firstly, metrics can be used to test the relevance, quality and quantity of activities to ensure they are aligned with SD. Examples are rate of recycling and purity of recycled fractions. Secondly, metrics can be performed on specific impacts in nature. Examples are indices on the global warming potential of gases and relative impact on the ozone layer from various chemicals. Due to the complexity of the system metrics of the first kind are generally more relevant from a strategic point of view. In a simplified manner the two levels could be seen as measuring process output versus measuring the impacts of the output or the outcome. In our process model we have defined the outcome as equivalent to stakeholder satisfaction. This needs to be interpreted both for Nature and Humanity using relevant indicators.

Within the World Bank and the UN-council ECOSOC, a division in driving force, state and response indicators is used for measuring SD, (Rao, 2000). Examples given for driving force include both process inputs such as raw materials and demand for drinking water and process outputs such as discharges and emissions. In the proposed organisational process model we separate process inputs in the form of goods or services from drivers that stand for demand related to the goods and services produced as well as the side effects caused. Drivers are both demand for the products and requests for restrictions regarding undesired outputs such as social problems and pollutants. The state indicators given in the ECOSOC-paper correspond largely with what we have named outcome or stakeholder satisfaction. Response indicators are the measures taken to handle problems caused by the output. The response could be further divided
in two parts, active and reactive response, (Garvare & Isaksson 2001). As an example, a reactive response for a process producing waste is to improve the re-use of the waste produced. An active response would be to reduce the quantity of waste produced.

**Proposed dimensions of measurement**

The concept of the Triple bottom line is often used to organise different types of organisational performance measures and includes the financial, environmental and social performance (Elkington, 1999; Töpfer, 2000). Instead of the terms Social Equity or Social Responsibility, Ethics has been chosen to describe the social part of organisational performance. Ethical behaviour includes issues such as corruption, payment of taxes, wages and employee safety. The authors believe that the term Ethics more clearly describes what is required than the commonly used Social Responsibility. This results in a proposal to use the triple E:s of Economy, Environment and Ethics (3E) as main dimensions for measuring organisational performance with regard to sustainable development (see Fig. 3).

![Figure 3](image)

**Figure 3**
Proposed dimensions for measuring organisational performance with regard to sustainable development.

A valuable contribution to this area is the BEST model for sustainability (Edgeman, 2000; Edgeman & Hensler, 2002). "B" stands for bio/physical sustainability, "E" for economic sustainability, "S" for social sustainability and "T" for technological sustainability. This model expresses the same main dimensions as the proposed 3E, with the addition of the technological sustainability. Based on a process view, technology could arguably be seen as an enabler more than an output. With sound technical solutions the process output for the chosen three dimensions will be improved. The advantage and contribution of the 3E-model should be its closer alignment to the management of processes.

Combining the 3E and the five types of measurements in the process model results in a matrix that can be used to classify existing measurements (see Table 1).

**Systems for 3E indicators**

The literature survey for SD-measurements has not been exhaustive but serves more as an example to test the proposed measurement model. The systems for 3E indicators that have been found can be divided into two main groups; national and organisational indicators. The national indicators enter into the organisational process model mainly as drivers. A good national SD-performance acts as a driver through stakeholder demand, competition, culture and legislation but also as an enabler in providing infrastructure and support. In the organisational process model, enablers are mainly defined as processes that help organisations to work with 3E in a structured way. In both main groups of indicators the majority cover only one of the dimensions, but there are also those that cover two or even all three dimensions.
A country ranking for the major economies is presented in the World Competitiveness Yearbook by IMD. The World Bank supplies national information with the World Development Index and the World Development Report. The Environmental Sustainability Index (ESI) ranks the environmental performance of 122 countries. This is an initiative from the World Economic Forum Annual Meeting 2001.

ESI divides indicators into five phenomena, 22 core indicators, and 67 indicators. The five phenomena are environmental systems, reducing environmental stress, reducing human vulnerability, social and institutional capacity and global stewardship. Even though the objective is to focus on environment, indicators from other areas affecting the environment are used.

In the ESI 2001 report the best correlation between any of the 67 individual indicators and environmental performance is found with the indicator of corruption reduction. The level of corruption is one of the most important ethical indicators. National level of corruption defined by Transparency International as the Corruption Perception Index (CPI) is measured for 91 countries in the 2001 report.

Another national indicator for the ethical level is the Human Development Index (HDI) from the United Nations Development Program (UNDP) that combines life expectancy, educational attainment and income. The Commission of Sustainable Development (CSD), UN Economic and Social Council (ECOSOC), presents a set of indicators covering the themes of Social, Environmental, Economic and Institutional Sustainability.

On the organisational level the Global Reporting Initiative (GRI) covers the 3E-dimensions. GRI includes almost 100 indicators but also proposes that smaller organisations could use a more limited set of measurements. Indicators for organisational economic performance in the context of SD quite often focus on the output, to some extent on the input and very little on stakeholder satisfaction, enablers or drivers. Currently mentioned economic indicators include typical performance measures such as net profit, gross margin and return on average capital employed (ROACE).

Quality related indicators such as lead-time, yield, capacity utilisation and customer satisfaction are not mentioned in the GRI. Quality indicators for services and products represent process results that have a profound effect on the economic performance. There seems to be a lot of synergy to be gained in combining the process view and basic values and methods from TQM with SD. According to the theories of the Balanced Scorecard, internal process efficiency and customer satisfaction drive the economic performance (Kaplan & Norton, 1996). The existing economic improvement potential could probably be measured by using theories of Costs of Poor Quality, see for instance Dale & Plunkett (1995).

The environmental indicators of the GRI include stakeholder satisfaction (impacts to nature) and enablers. However, management systems such as ISO 14000 and EMAS are not specifically mentioned. There are several measures for environmental organisational performance such as the Innovest EcoValue’21 rating and the Ecological footprint. These seem to be geared for larger organisations. Other measures for environmental performance are eco-labels such as the Green Dot, the Blue Angel, the EU Flower, the Swedish “Good Green Buy”, “The Nordic Swan” and “Krav” (SSNC, 2002). Ethical labelling has also started, but is not as developed as the Green labelling.
GRI proposes 37 different indicators for social performance, dealing with areas such as health and safety, wages, training, discrimination, freedom of association and suppliers. The indicators mostly fall within the categories of results and enablers, but suppliers are also monitored. Stakeholder demand is a primary driver of 3E performance. To a certain extent the stakeholder demand can be controlled by the organisation through the use of information. In order to specify ethical performance, indicators for wages and taxes paid, as absolute figures and as ratios, are important. Economic surplus is needed for sustainable development but this surplus is of little value if not distributed fairly. This is a complicated issue since fair distribution is a value that is often viewed rather differently by different groups. Income distribution can be monitored by different indices, such as comparing the income of the wealthiest 20% to the poorest 20%. An important ethical indicator is the level of corruptive behaviour. The SA 8000 standard, published by the Council on Economic priorities Accreditation (CEPAA), covers some of the areas, as does the standard AA1000 of the Institute of Social and Ethical Accountability. Still another area of ethical indicators is gender equality.

An organisational enabler that should be mentioned is the World Business Council for Sustainable Development (WBCSD). This is a coalition of 150 international companies advocating sustainable development. WBCSD provides a guide for companies to report performance and is closely aligned with GRI.

Table 1
Examples of organisational performance indicators classified according to the organisational process model and positioned within the 3E-dimensions.

<table>
<thead>
<tr>
<th>Dimension (3E)</th>
<th>Input</th>
<th>Drivers¹</th>
<th>Enablers¹</th>
<th>Output</th>
<th>Outcome¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy</td>
<td>Cost and CPQ of raw-materials and services, GRI</td>
<td>WCY, WDI, CSD, Legislation, org. policy</td>
<td>WBCSD Business Excellence, Level of ISO 9000 Educational level</td>
<td>Cost of Poor Quality, ROACE, Level of Business Excellence, Effect on level of natural capital, New products</td>
<td>Customer Satisfaction Indexes, Customer loyalty, Repurchase rate</td>
</tr>
<tr>
<td>Environ­ment</td>
<td>ELU GRI Green labels</td>
<td>ESI, CSD Legislation and company policy</td>
<td>WBCSD, Level of ISO 14000 Educational level The Natural Step</td>
<td>Environmental behaviour, Environmental projects, Pollution, Environmental labelling</td>
<td>Environmental impacts, Environmental rating and image</td>
</tr>
<tr>
<td>Ethics</td>
<td>GRI Ethical labels</td>
<td>CPI, CSD, HDI Legislation and org. policy</td>
<td>Level of A-8000, Educational level Fair trade policy</td>
<td>Social behaviour, Average earnings, Employment security, Ethical labelling</td>
<td>Social impacts, Social responsibility, rating and image</td>
</tr>
</tbody>
</table>

¹ Internal drivers include corporate and management norms and values. Common external drivers for all dimensions are stakeholder demands such as customer preferences, legislation, culture and national levels of competitiveness.

² Internal enablers include processes and systems that make work with the 3E-dimensions easier. Examples of external enablers are branch organisations and the general level of education within a region or a country.

³ Process output leads to various outcomes for different stakeholders.

AA 1000 - Institute of Social and Ethical Accountability 1000. www.accountability.org.uk
CPQ – Cost of Poor Quality
EMAS – Eco-Management and Audit Scheme, Standardised approach offered by the European Union
ESI – Environmental Sustainability Index, www.ciesin.columbia.edu/indicators/ESI
HDI – Human Development Index. Combined indicator of life expectancy, educational attainment and income
WCY – World Competitiveness Yearbook of International Management Development (IMD), www.imd.ch/wcy

Table 1 presents a rough framework combining the organisational process model, the proposed 3E dimensions and examples of existing measurements. We have certainly not covered all measurements currently in use, and those appearing here should only be considered as illustrations intended to form a starting point for the discussion. An important observation is that in most measurement systems issues of organisational excellence and quality are almost non-existent. Economic indicators do not seem to take up the Cost of Poor Quality, which should be an important indicator of progress towards SD. A good economic result is not enough, but waste should also be minimised.

**Initiating 3E measurements**

In most improvement projects one of the first objectives is to define the actual performance of the organisation. Commencing work for SD could begin with determining the level of performance for the 3E dimensions.

Today's organisations have rather varying levels of awareness regarding SD. When looking at the situation globally most organisations, both small and large, have only started on the road towards SD. Ideally profits should push companies towards SD. A start could be to quantify the organisational level on a 3E scale, where measuring the output could be a first step. It is important for the organisation to have an appreciation of its level of 3E-performance, and indicators should be chosen within all of the three dimensions. Information should be gathered from main stakeholders and transformed into a list of priorities. In many cases average country and branch performances could work as levels of reference.

Fundamental issues of economic performance are if the organisation is doing what the customers want, and if it is doing it in the right way. The first question requires some kind of a customer survey giving a Customer Satisfaction Index, and the second question could be measured with the Cost of Poor Quality where this is defined as the difference between actual and best possible performance. Additional economic indicators are the use of non-renewable energy and material. Suggested environmental indicators are quantity of main pollutants to air, land and water. Suggested ethical indicators are employee safety and employment security, and the level of taxes and wages paid compared to total company earnings.

**Measurements for small and medium-sized organisations**

All organisations, including the Small and Medium Sized Enterprises (SME), should have an acceptable performance in all 3E dimensions. The definition used here for a SME is a company with less than 200 employees. Taken as a group SMEs often have a significant economical, ecological and social impact but generally a very low awareness of environmental and social issues (Welford, 1994; Gerrans & Hutchinson, 2000). The improvement potential is high, but a serious
problem is that individual SMEs are seldom able to directly measure the effect of their activities on the environment and society, and therefore have little motivation to change. Small enterprises generally display many characteristics, of which we have chosen to highlight two (Vickers, 1990; Ghobadian & Gallear, 1996 and Chittenden et al., 1998):

(i) lack of long term strategic focus and
(ii) lack of in-depth resources.

Measuring performance in all the outlined areas of SD requires levels of capital and expertise that small companies do not normally have. Different types of standards are increasingly being forced along supply chains and the pressure of competing demands often results in SMEs being retroactive to change. Even when managers have a personal commitment to SD they often end up focusing on short term everyday operational issues. Therefore we should be careful when suggesting new innovative approaches and agendas for this sector. Global and national SD measurement policies with respect to SME need to deal with barriers to progress, such as lack of local forums for cooperation and networking where small firms can get guidance and company-specific advice. Given the diversity of small firms detailed developments of measurements are probably needed for each industrial sector. However, many SMEs see a growing demand for eco-friendly products from their customers. SMEs should therefore follow the same strategy as other companies of quantifying the effects and importance of organisational activities measured with relevant indicators within the 3Es.

Conclusions and discussion

In our work we have found a great number of initiatives to measure SD. There seems to be an opportunity for synergy in combining SD indicators to a TQM-based process framework. The customer focus of TQM has been widened to include a broader stakeholder view, also aiding the TQM core value of everybody's participation. The core value of fact based decisions emphasises the importance of actively measuring organisational SD performance. Management commitment is an obvious requirement to succeed with SD. The stronger feedback of stakeholder satisfaction measured as a response to process output should be able to enhance the work with continuous improvements in the organisations using indicators of SD.

With the ongoing integration of quality and environmental performance it seems logical to go a step further and also include ethical performance. Many buyers at all levels want to make a choice that harmonizes with SD. However, today very few, if any, products and services are labelled in credible terms of 3E. Process input has an important effect on the total organisational performance. Goods and services supplied for the organisation come with a 3E history, which should be monitored. Generally accepted measurements for the 3E would help people make a sustainable choice. This would lead to a raised awareness on SD aspects, hopefully starting a chain reaction, which centres attention on the 3E. The main stakeholders on a global level are Humanity and Nature. Today these often have minor influence on organisations, which primarily focus on shareholders and customers. A better balance between the influences of different stakeholders is needed, and this can only be achieved by improvements in the process of managing global SD-performance.

One very interesting issue, which has not been covered in this paper, is the ethical value of products. When resources become scarce it should be important that what is produced goes to satisfy the basic needs first. It might be possible to construct a product value scale based on for example the Maslow pyramid of needs. Changing existing models that are normative for Business Excellence, such as the MBNQA, and developing ethical standards based on initiatives,
such as the SA 8000 and AA1000, are probably prerequisites for a good integration of the 3E into a truly Integrated Management System for SD. Given their economical, environmental and social impact, global sustainability also requires the involvement of SMEs.

The work presented herein is still in an early conceptual stage. The proposed strategy for introducing basic 3E-measurements needs to be elaborated and tested, but should offer a basis for further development.

References


Appendix 1

Mail Questionnaire for the Second Research Project
(In Swedish)
Enkät om processorientering

Att fokusera på arbetsflöden och processorientering blir allt vanligare i många organisationer, och detta lyfts fram i exempelvis den nya versionen av ISO 9000.

I ett forskningsprojekt, som stöds av bl.a. Svenska institutet för kvalitetsutveckling (SIQ), undersöker vi effekter av processorientering i mindre företag. Denna första enkät skall kartlägga i vilken omfattning arbetssättet används. En uppföljande undersökning kommer att studera hur processorientering tillämpas i de företag som använder detta arbetssätt.

Din medverkan är mycket viktig för att vi skall få fram en tillförlitlig bild av verkligheten. Vi vill understryka att i de resultat som publiceras kommer enskilda företag inte att kunna identifieras.

Enkäten besvaras på nästa sida. Gör det gärna omgående, dock senast den 30 november, och returnera per fax eller post. Tack för Din medverkan!

Med vänliga hälsningar

Bengt Klefsjö
Professor

Rickard Garvare
Tekn. lic.

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Bilagor

- Frågeformulär
Figur 1 Exempel på övergripande processkarta. En process består av ett nätverk av aktiviteter. Den upprepas med viss regelbundenhet, har en början och ett slut samt har kunder (uppdragsgivare) och leverantörer (uppdragstagare). Exempel på vanliga processer i företag är inköp, tillverkning, fakturering, underhåll samt anställning av personal.
Enkät om processorientering – Frågeformulär

De uppgifter som lämnas kommer att behandlas konfidentiellt. För vårt fortsatta arbete behöver vi dock uppgifter om vilka företag vi fått svar från. Begreppen process och processorientering beskrivs längst ned på sidan.

Kryssa för de alternativ som gäller för Ditt företag

Den organisation jag arbetar i:  
- ☐ är helt eller delvis processorienterad.
- ☐ har tidigare prövat processorientering men använder inte längre detta arbetssätt.
- ☐ har inte sysslat med processorientering.

Har något arbete genomförts för att identifiera och kartlägga processer i Ditt företag? ☐ Ja ☐ Nej ☐ Vet ej

Har personal i Ditt företag utbildats i processorientering, processledning eller liknande arbetssätt? ☐ Ja ☐ Nej ☐ Vet ej

Finns någon processägare utsedd i Ditt företag? ☐ Ja ☐ Nej ☐ Vet ej
(person som ansvarar för strategiska och övergripande beslut rörande en process)

Finns någon processledare utsedd i Ditt företag? ☐ Ja ☐ Nej ☐ Vet ej
(person som ansvarar för den dagliga verksamheten och ser till att processen lever upp till de krav som företagsledningen har ställt)

<table>
<thead>
<tr>
<th>Ditt namn</th>
<th>Företagets namn</th>
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<table>
<thead>
<tr>
<th>Din befattning</th>
<th>Postnummer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>


TACK!

En process består av aktiviteter som upprepas med viss regelbundenhet. Den har en början och ett slut samt har kunder (uppdragsgivare) och leverantörer (uppdragstagare). Exempel på processer är inköp, tillverkning, fakturering, underhåll samt anställning av personal.

Processorientering (även processledning, process management) innebär att företagsledningen utser medarbetare som ansvarar för att företagets processer kartläggs, styrs och förbättras.
Interview Guide for the Second Research Project (In Swedish)
Telefonintervju angående processorientering

För en tid sedan deltog Ni i en enkät om processorientering i småföretag. Utifrån de sammanställda svaren har Ert företag valts ut som intressant för en uppföljande undersökning. Uppföljningen kommer att ske i form av en telefonintervju och syftar till att ge en djupare bild av hur processorientering tillämpas i de företag som använder detta arbetssätt. Er medverkan är av avgörande betydelse för att undersökningen skall ge ett tillräckligt resultat.


Resultatet av undersökningen kommer att användas till en analys av hur små företag använder sig av processorientering och vilka effekter detta har. Ni ges ett tillfälle till självutvärdering för egen vinning, samt bidrar till ett forskningsprojekt som kan vara av intresse för alla kvalitetsinriktade småföretag. Samtliga svar kommer att behandlas konfidentiellt och vid publikation kommer resultat från enskilda företag inte att kunna identifieras utan deras medgivande. Vi ser fram emot Er medverkan!

Med vänliga hälsningar

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Bilagor:
1 Intervjuunderlag
2 Ordförklaringar
Intervjuunderlag

1. Inom vilken bransch verkar Ert företag?
2. Är företaget certifierat enligt någon av standarderna i ISO 9000?
3. Hur länge har Ni arbetat med processorientering?
4. Vad motiverade företaget att börja arbeta med processorientering?
5. Fanns det något motstånd mot införandet av processorientering och hur yttrade sig i så fall detta?
6. Vilka är Ert företags huvudprocesser och hur har dessa kartlagts?
7. Vilka andra processer har kartlagts (stödprocesser, ledningsprocesser)?
8. På vilket sätt mäts nyckelfaktorer i processerna, och i vilken omfattning?
9. Hur har processägare, processledare och individägare utsetts? Vilka befattningar hade de tidigare? Vilka befattningar har de idag?
10. Har personalens engagemang påverkats av processfokuseringen?
11. Har processorienteringen ändrat internutbildningen på företaget?
12. Har organisationsstrukturen förändrats till följd av processorientering?
13. Har det framförts synpunkter från personalen på arbetssättet? Vilka?
14. Vilka personer jobbar med processförbättring och hur går detta arbete till?
15. Vilka problem upplever Ni av att arbeta med processorientering?
16. Vilka fördelar upplever Ni av att arbeta med processorientering?
17. Vad skulle Ni ha gjort annorlunda om Ni börjat med processorientering idag?
18. Rekommenderar Ni andra småföretag att börja arbeta med processorientering?
Ordförklaringar
– i den ordning de förekommer i intervjuunderlaget.

En **Process** består av sammanhängande aktiviteter som upprepas med viss regelbundenhet. Den har en början och ett slut samt har kunder (uppdragsgivare) och leverantörer (uppdragstagare). Exempel på processer är inköp, tillverkning, fakturering, underhåll samt anställning av personal.

**Processorientering** (även processledning, process management) innebär att företagsledningen utser medarbetare som ansvarar för att företagets processer kartläggs, styrs och förbättras.

Den process som har till uppgift att uppfylla externa kunders behov och förädla de produkter organisationen erbjuder kallas för **huvudprocess** (även operativ process, nyckelprocess eller kärnprocess). Exempel på huvudprocesser är orderhantering och produktutveckling.

**Stödprocesser** syftar till att tillhandahålla resurser till huvudprocesserna. Exempel på stödprocesser är underhåll, personalrekrytering, bokföring och redovisning.

**Ledningsprocesser** är processer vars syfte är att styra, planera och följa upp organisationens verksamhet. Exempel på ledningsprocesser är planering och revision.

En **nyckelfaktor** är ett klart definierat mått som skall ses som ett styrningsmått för att uppnå organisationens övergripande verksamhetsidé och vision. Nyckelfaktorn skall vara målsätt och kopplad till processer.

**Processägaren** är den som ansvarar för de strategiska och övergripande beslutens rörande en process. Exempelvis kan detta gälla beslut angående infrastruktur, omfattning och dimensionering av processen.

**Processledaren** är den som ansvarar för den dagliga verksamheten i processen samt ser till att den lever upp till företagsledningens krav.

**Individägarens** uppgift är att fördela personalen på bästa möjliga sätt över de olika processerna.
Appendix 3

Case Study Agenda for the Second Research Project
(In Swedish)
Förslag till agenda vid företagsbesök 9-10 april 2001

Kort presentation av projektgruppen och forskningsprojektet

Presentation av företaget och dess verksamhet, affärsidéer, organisationsschema, eventuella processkartor och liknande.

Enskilda samtal genomförs parallellt:

- Diskussion med VD
- Diskussion med en processägare eller motsvarande (ej VD)
- Diskussion med en processledare
- Diskussion med en individägare (fördelar personalresurser)
- Diskussion med en medarbetare som inte är processansvarig eller sitter med i företagets ledningsgrupp.

Frågeställningar som kan vara intressanta att diskutera vid dessa samtal är:

- Vad är Din roll i organisationen?
- Vilka processer arbetar Du med?
- Hur infördes processorientering i företaget?
- Vad var det som förändrades? Vad blev bättre och vad blev sämre?
- Vilken typ av organisation hade ni tidigare? Hur fungerade den?
- Vad bör man tänka på när man inför processorientering?

Samtliga svar kommer att behandlas konfidentiellt. Ovanstående planering skall endast ses som ett förslag till agenda vid besöket.

Med vänlig hälsning

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Sammanfattning
This thesis aims at contributing to increased sustainable competitive performance of small and medium sized enterprises in harmony with nature and society. The overall purpose has been specified in the following three parts: to explore implementation of statistically designed experiments within small and medium sized enterprises, to describe experiences of using process management in small and medium sized enterprises, and to conceptualise integration of business excellence and sustainable development, with a special focus on small and medium enterprises.

During the last few decades the interest and industrial use of systems, tools and methodologies related to quality has grown considerably. Some of these were originally developed with the large company in mind, but today many small organisations also try to implement them. However, management strategies developed for large organisations do not generally translate well into small organisations. Despite the potential benefits and advantages due to size many small enterprises have been slow to implement quality management.

The research presented in this thesis has been divided into three research projects. The scope of the first project was to explore the implementation of statistical techniques for process improvement within small and medium sized enterprises. A longitudinal study of two case companies resulted in a model for implementing design of experiments......(cont.)