Sari Stenfors

STRATEGY TOOLS AND STRATEGY TOYS: MANAGEMENT TOOLS IN STRATEGY WORK

HELSINKI SCHOOL OF ECONOMICS

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Abstract

This dissertation elaborates on the challenges and opportunities of strategy-tool use in strategy work. Strategy tools, such as Porter's Five Forces, SWOT Analysis, Scenario Analysis, Executive Information Systems, and the Balanced Scorecard, are developed to support organizations with the complex demands of competitive markets and the quest for maintaining and creating strategic advantage. Strategy tools are often based on academic research and they are introduced into practice through business schools, consultants, popular business articles and strategy literature. There are currently hundreds of different strategy tools available in the market and executives in organizations use on average five different strategy tools - yet there have been very few studies on how strategy tools are used and how their use supports strategic success.

The six studies of strategy-tool use, which make up this book, expand the traditional perspective on the notion of 'use' to include social, cultural, and political factors that shape the use of strategy tools in social environments. Furthermore, the Strategy-as-practice approach is utilized as an umbrella to bring together the different disciplines which are studying strategy tools. The study highlights that there is a shortage of strategy toys, i.e. strategy tools used to facilitate creative strategy work. Only three percent of the tasks for which strategy tools are used concern strategic innovation and development. On the other hand, a balance of strategy work activities that creatively explore new opportunities and activities that efficiently exploit known resources is intrinsic to long-term organizational survival and success.

The dissertation suggests that the best way to facilitate strategic success with strategy tools is not to look for individual tools that provide correct answers to specific needs and institutional pressures, but to compile a balanced set of tools that caters to company's aspirations. The study also draws attention to the power exerted by strategy tools, since they have both conscious and unconscious effects. The choice of which strategy tools to use is not insignificant, since each tool's underlying assumptions and beliefs have a major impact on the strategy work carried out using it.

Keywords: *strategy-as-practice, use of management tools, strategizing, decision support systems*

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This doctoral dissertation could not have been written alone. Confronters and challengers as well as supporters and collaborators were essential in the process of constructing the Synthesis section and the six essays that this book contains. My research work has steadily evolved as it has been negotiated in different research communities, research groups, conferences, seminars, presentations, and classes that I have taken and given. I am deeply grateful to both the academic scholars and the strategy workers that have left their mark in my research. Even so, errors in this dissertation are my responsibility – any inaccuracies are entirely my own.

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The six essays in this book are based on extensive data gathered between 1998 and 2006. Over 300 strategy practitioners and more than 200 students took part in this research. The work of collecting the data has depended on the support and kindness of many people, to all of whom I am exceedingly grateful.

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Sari Stenfors

Table of Contents

PART I

PART II

Essay One
Stenfors S. & Tanner L.: **High-level decision support in companies: Where is the support for creativity and innovation?**
In *Creativity and Innovation in Decision Making and Decision Support*, Vol 1, eds. Adam F., Brezillon P., Carlsson S. & Humphreys P. Ludic, London. Ch. 12, 215-235, 2006.

Essay Two
Stenfors S.: **Strategy tools: A set of 'golf clubs'.**
Manuscript submitted to Long Range Planning.
Earlier version of the paper peer reviewed and presented at 2006 Strategic Management Society Annual International Conference.

Essay Three
Moisander J. & Stenfors S.: **Exploring the edges of theory-practice gap: Developers and users of strategy tools.**
Manuscript submitted to Organization.
Earlier version of the paper peer reviewed and presented at 2005 Strategic Management Society Annual International Conference.

Essay Four
Korhonen P., Stenfors S. & Syrjänen M.: **Multiple objective approach as an alternative to radial projection in DEA.**
In *Journal of Productivity Analysis*, 20/3, 305-321, 2003.

Essay Five
Korhonen P., Mano H., Stenfors S. & Wallenius J.: **Inherent Biases in Decision Support Systems: The Influence of Optimistic and Pessimistic DSS on Choice, Affect, and Attitudes.**
In *Journal of Behavioral Decision Making (forthcoming).*
www.interscience.wiley.com/journal/bdm

Essay Six
Stenfors S. & Tanner L.: **Evaluating strategy tools through activity lens.**
In *Helsinki School of Economics Working Papers, W-419.*
Paper presented at 22nd European Group of Organization Studies Colloquium.

PART I

Preface

"Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution." Albert Einstein 'What Life Means to Einstein' in the Saturday Evening Post, 26th of October, 1929.

The main argument of this dissertation is reflected in Einstein's words. In organizations, the strategic-level challenge is to explore what is new and unknown while simultaneously exploiting what is known. In strategy work this means being creative but striving for efficiency. This doctoral thesis maintains that organizations need to facilitate both types of strategy work.

This study concerns the use of tools that facilitate strategy work. It looks at the mundane yet important tasks that make up strategy work and how tools are used to facilitate them. Having carried out these tasks myself for more than 15 years in my business career, the overall perspective presented in this study came naturally. As an academic perspective on strategy, however, it is a fairly new viewpoint. Strategy-as-practice has been a recognized academic field for a little over 5 years. Today, it has an active community of more than 2000 members (see http://www.strategy-as-practice.org/) who contribute to an array of prevalent academic theories while pursuing their practical relevance. This is also the ambitious goal of this dissertation.

Consisting of an assortment of six essays, this doctoral thesis is multidisciplinary. In the essays, the common denominator is strategy-tool use, but the different theoretical and methodological perspectives and research designs reveal different aspects of the phenomena. Furthermore, the essays were written for publication in journals in different academic fields and discuss issues that are of current interest in each of them. Operations Research and Management Science, Decision Support Systems, Cognitive-Behavioral Psychology, Organizational Research and Strategic Management all have their own research traditions, and all have much to offer when attempting to understand strategy-tool use.

From readers of this dissertation, I request patience. As well as representing an array of research traditions, the six essays use somewhat different terminology that caters to the traditions of the specific academic field in question. Also, repetition is unavoidable as the same themes and ideas are developed and considered from different perspectives. To avoid further repetition, the Synthesis section aims not to summarize, but to present the main argument of the dissertation by unfolding key elements in strategy-tool use and strategy work. To accommodate more casual readers, a short summary of the main points of each essay is provided immediately after the Synthesis section.

Key notions

Strategy. Socially accomplished activities (Jarzabkowski, 2005) that are consequential for outcomes of considerable importance to the organization. Examples are activities that contribute to a firm's survival and competitive advantage. The outcomes do not have to be part of the intended or explicit strategy.

Strategy work. The praxis of strategy. Planning, meeting, presenting, analyzing, communicating and so on. Includes not only planned but also emergent strategy work.

Strategy tool. Generic name for any method, model, technique, tool, technology, framework, methodology or approach used to facilitate strategy work. Strategy tools can be conceptual, such as those employed in strategy design, they can be process tools such as project management techniques, and they can be physical tools such as computers and documents. Strategy tools can be based on methods or theories emanating from any discipline or school of thought. Examples include Balanced Scorecard applications, SWOT analysis, Porter's Five Forces, Real Options, Enterprise Resource Planning, Management Information Systems, Analytic Hierarchy Process and Data Envelopment Analysis.

Strategy-tool use. The consumption of strategy tools (Whittington, 2003). This includes not only the physical behavior when using a strategy tool – pushing buttons, listing strengths, viewing numbers – but also what the user 'does' by performing the physical actions and what each user 'makes' of the know-how offered by the tools. Consumption can take forms other than those which are expected, thus altering the product. The user(s), tool(s) and context(s) determine the ways in which strategy tools are used.

Strategy practitioner. A strategy worker who skillfully adapts strategy practices such as strategy tools to the context. In cases of strategy-tool use, strategy practitioners are also called users. This primary focus in this study is on company executives, but for example middle managers and consultants can also be strategy practitioners.

Strategy toy. A strategy tool that contributes to the development of the company by fostering exploration, creativity, new viewpoints and the unlearning of old views. Gains from strategy toys may far exceed those achieved using strategy tools which focus on efficiency, but returns from strategy toys are less certain, may take longer to emerge and the distribution of their returns, in general terms, is not as clear. The use of strategy toys is 'serious play' that permits discovery, innovation, flexibility, experimentation, risk taking, variation and search. Brainstorming is a popular strategy toy. Even so, strategy tools developed with the intention of enhancing creativity are not always necessarily used as strategy toys (e.g. Durand and Van Huss, 1992) and strategy tools that have been developed to improve efficiency can sometimes be used as strategy toys (e.g. Simons, 1991). It is the exploratory use that differentiates strategy toys from other strategy tools. While strategy practitioners have a key role in the use of strategy toys, the context and the tool must provide the right environment for 'serious play'.

Synthesis:

Strategy work, strategy tools and strategy toys

SIGNIFICANCE: THE NEED FOR TOOLS IN STRATEGY WORK

The goal of this dissertation is to establish how strategy tools can better facilitate strategy work. This section introduces the primary focus and provides background on the central research constructs.

There are no rules or regulations that specify strategy work. For businesses, articles of incorporation are the rules that govern the management of a corporation, but they do not describe how strategy-related activities should be conducted. For example, Finland's new Companies Act, which came into force at the beginning of September 2006, states in very broad terms that the duty of company directors is to "act carefully to further the interests of the company". The bylaws that govern a corporation's internal management cover topics such as how the directors are elected, how meetings of directors and shareholders are conducted, and what officers the organization will have. While bylaws vary from organization to organization, it is not customary to describe strategy work.

The main duties of strategy work fall upon the shoulders of company executives, but what exactly do they do that could be made easier by the use of strategy tools? In the medical and legal professions, the skills and activities of practitioners are strictly regulated and straightforward to describe, but activities engaged in by business professionals are context dependent and their skills are not standardized.

The literature relating to executives' activities illustrates both the variety and the rapid pace of work undertaken by executives. Henry Mintzberg's (1973) seminal study describes ten roles for executives based on different activities: monitor,

spokesman, disseminator, figurehead, liaison, leader, entrepreneur, disturbance handler, resource allocator, and negotiator. Mintzberg (1973) adds that more than half of the individual activities engaged in by executives last less than nine minutes and only 10% exceed one hour. Kotter (1982) confirms that in general, executives' workdays consist of short, disjointed segments of activities. Furthermore, many studies highlight the fact that usually every day of work at upper management levels is full of social activities (e.g. Weick, 1995) and that both communication and collaboration are of high importance (e.g. Kanter, 1989). Differing forms of networking, project meetings, phone calls, mail and conversations fill up each executive's daily schedule. In overall terms, the activities engaged in by executives are socially embedded and influenced by specific circumstances and different configurations of cultural, historical and social powers (e.g. Dargie, 2000; Pfeffer, 1981).

In toto, activities engaged in by executives form the basis for organizational strategy. Not all of these activities result in outcomes that are of considerable importance, but in general, executives aim to add value to an organization by influencing and realizing both internal and external processes. These processes are often uncertain, complicated, interconnected, ambiguous, conflicting, and constrained (Mason and Mitroff, 1981). Furthermore, they usually involve risk, responsibility and serious impacts. All in all, strategy work is hard and difficult (e.g. Whittington, 2003) – and hard work deserves appropriate tools. Like strategy work, strategy tools are socially embedded in an organization. For this reason, more precise identification of the need for strategy tools requires that the viewpoint is expanded from executive level to organizational level.

At organizational level, strategic activities focus on success by creating and sustaining a company's competitive advantage. A review of articles published in the Financial Times (FT) between January 2004 and July 2006 reveals a diverse but illuminating list of modern organizational activities that have contributed to outcomes of considerable importance. FT reports that organizations have generated competitive advantage by: identifying major trends, enhancing

foresight and insight, concentrating on timing, pursuing opportunities and entrepreneurship, developing networks, creating social capital, collecting intangible assets, executing mergers and acquisitions, abandoning outdated views and practices, reviewing mission and purpose, creating new visions, providing learning opportunities, cultivating innovation, restructuring and cutting costs, financing promising initiatives, measuring performance, initiating expansion, listening to customers and other stakeholders, creating a marketing mind-set, recognizing suitable technologies, facilitating leadership development and transition, increasing diversity, forming strategic partnerships, contributing to the community, mastering complex knowledge, fostering commitments, achieving resource fluidity, realigning and reorganizing resources, developing new business models, and unifying management. On the whole, these organizational activities are conflicting and contextual, and although they provide an understanding of what type of activities may require support, they cannot be used as a general recipe for activities that lead to strategic success.

On the other hand, they do reveal that activities which creatively explore new potential and activities that efficiently exploit known resources both contribute to strategic success. James March (1991) points out that an appropriate balance between these two different types of activities is intrinsic for long-term organizational survival and success. Organizations that mostly engage in activities which creatively explore new potential may suffer from too many undeveloped new ideas and too little unique competence, while organizations that engage primarily in activities that efficiently exploit known resources may find themselves in suboptimal stable equilibria.

Maintaining a suitable balance between activities that creatively explore new potential and activities that improve efficiency is a major concern in strategy work. Michael Porter (1996) also addresses this issue: "*Competitive advantage and sustainability cannot be achieved through operational effectiveness alone… [They are] possible only through performing different activities from rivals or performing similar activities in different ways.*" The processes that are customary in organizations have a natural tendency to select and support, often implicitly,

activities that improve efficiency. These activities have more predictable outcomes that can be harvested in a timely manner and logically described using existing discourses. Also, Argyris and Schön (1996) report that organizations have tendencies towards what they call "single-loop" learning, rather than exploring the unknown, which they call "double-loop" learning. Furthermore, Amabile (1998) and Hamel and Prahalad (1995) point our that companies habitually employ management structures that preclude creativity and innovation. Choosing to perform activities which are explorative in nature takes special effort (Wright, 2001). This quandary presents a major opportunity and challenge for facilitating strategy work through the use of strategy tools.

RESEARCH QUESTION: STRATEGY-TOOL USE

Michael Porter (1996) paints a dark picture of the usefulness of management tools in strategy work:

"The quest for productivity, quality, and speed has spawned a remarkable number of management tools and techniques: total quality management, benchmarking, time-base competition, outsourcing, partnering, reengineering, change management. Although the resulting operational improvements have often been dramatic, many companies have been frustrated by their inability to translate those gains into sustainable profitability. And bit by bit, almost imperceptibly, management tools have taken the place of strategy. As managers push to improve on all fronts, they move farther away from viable competitive positions."

He argues that strategy tools facilitate activities that efficiently exploit known resources and in doing so endanger long term organizational survival.

It is my contention that although Michael Porter highlights a serious problem with strategy tools, these same strategy tools can also offer a solution to that problem – strategy toys.

Strategy toys are strategy tools which facilitate explorative strategy work. The use of strategy toys is 'serious play' that facilitates discovery, innovation,

flexibility, experimentation, risk taking, variety and search. By using strategy toys routinely in strategy work, organizations may help to break away from the natural tendency to focus on the efficiency of known resources. Thus, strategy toys may help in achieving and maintaining the desired balance between exploration and exploitation. It is however important to note that strategy tools which have been developed to enhance creativity are not necessarily used as strategy toys (e.g. Durand and Van Huss, 1992), while strategy tools which have been developed for improving efficiency can sometimes be used as strategy toys. For example Simons (1991) describes that in strategically uncertain situations, tools, which are normally used for strategy implementation, are used interactively for organizational learning and creation of new strategies. It is the exploratory manner in which strategy toys are used that differentiates them from other strategy tools, not their prescribed use.

The concept of a strategy toy is an output of my research and strategy-tool use is the key construct in the notion of a strategy toy. In a parallel fashion, strategy-tool use is the main construct in my dissertation. In the quest to establish how strategy tools could better facilitate strategy work, I set three general research questions that deal with strategy-tool use: What is strategy-tool use and how does it affect organizations? How can strategy tools and particularly strategy toys be evaluated? How could strategy tools better facilitate strategy work and yet foster scholarly rigor? Existing literature on strategy-tool use provides only partial answers to these questions.

Strategy-tool use in the literature

Literature on strategy-tool use is scant and scattered. In general, research into strategy tools does not form a well-defined and integrated section of literature, and the views of different schools of thought concerning strategy-tool use differ significantly. The primary perspectives on strategy-tool use are presented below.

The general approach to Strategic Management often presents strategy tools as the practical outputs of academic research. Many theories of strategic

management - such as Real Options, the Value Chain and Porter's Five Forces - are offered as strategy tools that provide practitioners with the possibility of implementing theories in practice. Strategy tools are introduced into practice via business schools, consultants, popular business articles and management literature (e.g. Sahlin-Andersson and Engwall, 2002). This approach is closely tied to the business of consulting since many strategy tools are also developed by consultants. Usage studies concentrate on surveys of the tools being used (e.g. Rigby and Bilodeau, 2005), reports on the usefulness of tools (e.g. Dorgan, Dowdy, and Rippin, 2006; e.g. Matheson and Matheson, 2001) and accounts concerning specific strategy tools. These reports show that strategy tools are a large, heterogeneous group of products and a component in modern strategy work that can be helpful in some situations. On the other hand, these reports often overlook other-than-expected ways of using strategy tools and only seldom relate critical views and failures.

In Management and Organization literature, the main theory concerning strategy tools, management fads and fashions (e.g. Abrahamson, 1996; Benders and van Veen, 2001) discusses the adoption of strategy tools. The literature on management fads and fashions explains the dissemination of strategy tools through neo-institutional theory and isomorphic diffusion (e.g. DiMaggio and Powell, 1991). Isomorphic diffusion explains how organizations adopt structures, practices and meanings in their quest for legitimacy. From this macro-level view, strategy tools are seen as normative and regulative structures that provide stability and meaning (Scott, 1995) while also forming and standardizing practice. However, the use of strategy tools is not seen as being intrinsic to the adoption of those tools (e.g. Abrahamson, 1996; Kieser, 1997) since organizations are reported not choosing tools rationally. On the other hand, some literature in this category does depict strategy practitioners as less-naïve agents (e.g. Benders and van Veen, 2001; Clark, 2004), implicitly giving strategy-tool use increased meaning. For example, Benders and van Veen (2001) describe how the use of a particular tool can bestow power and a favorable image on an organization and its users. On the whole, literature concerning

management fads and fashions explains macro-level practices but does not explicitly address micro-level strategy-tool use.

Disciplines that develop decision-support models have been studying tool use for more than 50 years. Both Operations Research, which also provides strategic-level models (e.g. Bell, Anderson, and Kaiser, 2003), and Decision Support Systems, which specializes in support for ill-structured decisions (e.g. Shim, Warkenting, Courtney, Power, Sharda, and Carlsson, 2002), offer several accounts of strategy-tool use. Modeling disciplines provide accounts of the adoption of specific tools, surveys of which strategy tools are being used (e.g. Clark and Scott, 1999), studies of what strategy tools to use and when (e.g. Dyson, 2000) and discussions concerning the evaluation of strategy tools (e.g. Eden, 1995). In general, modeling disciplines adopt a normative tool developers' view of strategy-tool use that assumes prescriptive use of strategy-tools and many of their strategy-tools use concerns relate to situations in which strategy practitioners fail to use tools or misuse them (e.g. Brännback, 1994; Kasanen, Wallenius, Wallenius, and Zionts, 2000; Workman, 2005). However, there are a few studies that also present the views of users. For example, Morecroft (1992) relates that executives view support models as maps that capture knowledge, as frameworks that filter and organize knowledge, or as micro-worlds for use in experimentation, cooperation and learning. Furthermore, decision-support disciplines offer an extensive body of literature on users' cognitive-behavioral qualities (e.g. Benbasat and Dexter, 1982) which, for example, highlights the importance of users' different psychological styles, human-tool compatibility, and different levels of profundity in tool use.

The study of Strategy-as-practice focuses on research into patterns of activities in strategy work. Practice-oriented literature on strategy-tool use describes detailed aspects of strategy work - how strategists think, talk, reflect, act, interact, emote, embellish and politicize when they are using strategy tools. Although this field is new, some important constructs on strategy-tool use already exist. Whittington (2003) defines strategy-tool use as the consumption of strategy tools, while Jarzabkowski and Wilson (2006) describe not only the expected use of strategy

tools, but also the innovative adaptation of tools they refer to as *bricolage*, an artisan-like inventiveness (De Certeau, 1984). Adopting the practice viewpoint implicitly celebrates strategy practitioners and explicitly illustrates the significance of mundane strategy work. Strategy-as-practice is part of a broader practice turn in contemporary social theory and the management sciences over the past 20 years (Jarzabkowski, 2005). In practice studies, practice is seen as both philosophy and sociology, an intrinsic social phenomenon (Reckwitz, 2002; Schatzki, 1996). The practice perspective draws on work by Pierre Bourdieu and Anthony Giddens and uses for example Ethnomethodology (Garfinkel, 1967) and Actor network theory (Callon, 1991; Latour, 1992) for theoretical base. Furthermore, studies on practice in the use of information technology (e.g. Orlikowski, 2000) lead the way in studying strategy-tool use from the Strategy-as-practice viewpoint.

POSITIONING: RESEARCH APPROACH AND METHODOLOGY

Strategy-as-practice perspective

This dissertation takes a Strategy-as-practice approach. There are four main reasons why adopting this view allows me to address my research questions in an effective manner.

Firstly, the Strategy-as-practice view unites studies from different disciplines on strategy tools by taking activity, i.e. strategy-tool use, as the unit of analysis. Thus, Strategy-as-practice view serves as an umbrella approach through the focus of strategy-tool use. The traditional literature on strategy tools and strategy-tool use does not offer an opportunity for combining different disciplinary approaches. The practice approach links successfully different theoretical positions and philosophical views (Miettinen, 2006) and constructs an overall understanding of strategy-tool use. Furthermore, it allows the six essays in my dissertation to use an array of research strategies and accommodate the research questions in a suitable way.

Secondly, the Strategy-as-practice view takes a multilevel approach to theoretical problems in sociology. For the goal of this study to be relevant – facilitating strategy work better – the chosen theoretical viewpoint has to permit some level of individual choice. The practice view respects individual choice but does not abandon mainstream strategy-tool approach, fashions and fads. In actual fact, it very conveniently allows additions to be made to it (e.g. Miettinen and Virkkunen, 2005). From the Strategy-as-practice viewpoint, it is the context that makes strategy tools and other structures relevant to both an activity (Jarzabkowski, 2005) and individual choice. Furthermore, the practice perspective allows strategy-tool use to be viewed as a flow of social activity that incorporates rationality and irrationality, content and process, intent and emergence, thinking and acting as reciprocal, intertwined and often inseparable components.

Thirdly, Strategy-as-practice takes a serious approach to practical strategy-tool use (Whittington, Jarzabkowski, Mayer, Mounoud, Nahapiet, and Rouleau, 2003), and is interested in both facilitating strategy work and being theoretically relevant. Treating strategy practitioners as experts in their field offers an opportunity to conduct research on the gap between theory and practice in Strategic Management. Furthermore, by focusing on activities, the practice view highlights strategy-tool use and its human aspects. While strategy can be emergent and strategy-tool users may work at all levels of an organization, the practice view is able to study involvement by upper management and challenges in the shaping of strategy via strategy-tool use.

Fourthly, strategy work studied in this doctoral thesis took place in Finland, which has been reported as being the most competitive country in the world (World Economic Forum, 2005). Thus, work practices in the studied organizations are contemporary and knowledge intensive. The Strategy-as-practice view is an 'after modern' research perspective that yields dynamic and complex explanations reflecting real activities rather than generating static, parsimonious and generalized forms of theory (Langley, 1999; Weick, 1979).

Reports indicate that this type of research approach is a better fit to the increasingly-fragmented, pluralistic and contested methods of strategy work in knowledge-based, post-industrial society (e.g. Lowendahl and Revang, 2004).

Main construct: Strategy-tool use

The main research construct in this study, strategy-tool use, embodies the Strategy-as-practice approach. I view strategy-tool use as consisting of a range of somewhat mundane strategy work activities (see also Jarzabkowski, 2005). The center of attention is not the tool itself, but the way in which it is used. Furthermore, neither the actors nor any associated activities can be considered separately from the situation in which the tool is used, since the situation provides an interpretive context for the action (Brown and Duguid, 1991; Lave and Wenger, 1991).

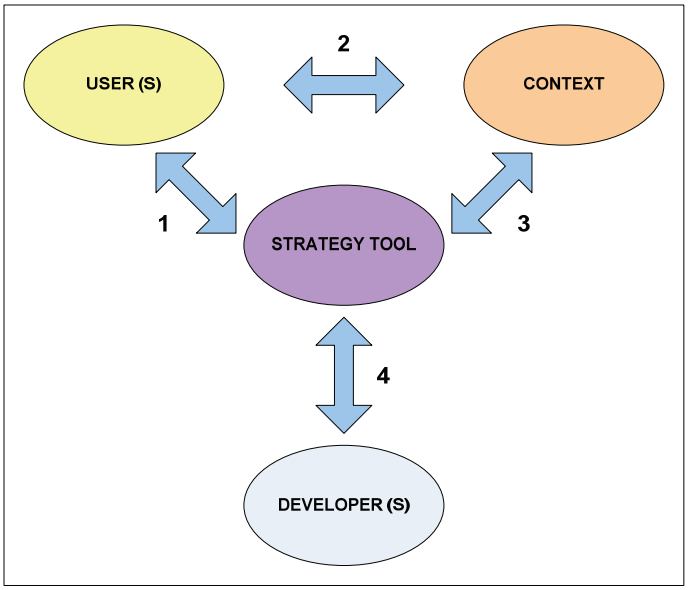

Figure 1: Main elements of strategy-tool use.

I define strategy-tool use as the consumption of strategy tools (Whittington, 2003), where the relationships between user, strategy tool and context form the conditions for use. Strategy-tool use may alter the product by taking forms other

than those which are planned by the developers of the tool. Strategy-tool use determines whether a certain tool facilitates activities that creatively explore new opportunities or activities that efficiently exploit known resources. In general, strategy-tool use determines how the tool will facilitate strategy work. Thus, in studying how strategy tools could better facilitate strategy work, I have focused on strategy-tool use.

My general research questions concentrate on the relationships between the main elements of strategy-tool use: users, the strategy tool, the context and developers (Figure 1 and Table 1).

Observable strategy-tool use occurs between the user and the tool (Figure 1, interaction 1). A deeper level of strategy-tool use in which different strategy work activities play the main role is established by the relationship between the user and the context (Figure 1, interaction 2). Furthermore, tools are often adopted within organizations because of the institutional pressures that emerge from the specific context in which a company is situated (Abrahamson, 1996). Thus, the relationship between the tool and the context (Figure 1, interaction 3) is central to an understanding of the set of tools that exist in an organization. Also, the developers of strategy tools affect strategy work by building into the tools particular interpretive schemes, particular facilities and particular resources for accomplishing strategy work, as well as incorporating specific organizational and managerial forms that define the organizationally-sanctioned way of executing that work (Nardi and O'Day, 1999; Suchman, 1994). Researching the relationship between the tool and the developer (Figure 1, interaction 4) provides a better understanding of the expected use of the tool and the possibilities for tool development.

Methodology and data

The six essays in this dissertation were designed to fill voids in current research into strategy-tool use and are targeted at answering my research questions. All six essays approach strategy-tool use from diverse settings (Table 1). The aim

behind using this array of methods in my dissertation is to capture a holistic picture of strategy-tool use, with the aspiration that adopting different perspectives is likely to reveal some elements that do not fit a previous understanding, and that divergent results promote deeper, more complex and less evident explanations (Jick, 1979; Patton, 1990). One goal has been to choose methods that complement each other and thus increase the validity of the findings (Bryman, 1992; Denzin, 1978; Eisenhardt, 1989). Not only methodological triangulation, but also investigator, theory and data triangulation has been addressed in these studies (Denzin, 1978).

Essay no.	Interaction studied (Figure 1)	General research question	Research strategy	Data collection methods	Analysis methods	Research philosophy
One	1, 3	What strategy tools are used and for what purposes?	Survey	Questionnaire, interviews	Classifications and statistical analyses	Positivist
Two	1, 2, 3	When should the different tools be used?	Grounded theory	Questionnaire, interviews, ethnography	Coding	Interpretivist
Three	1, 2, 3, 4	How could strategy tools better facilitate strategy work and yet foster scholarly rigor? How do users' and developers' epistemological views of strategy-tool use differ?	Case study	Focus group, interviews, participant observation	Discourse analysis	Cultural approach (e.g. Moisander and Valtonen, 2006)
Four	1	How could strategy tools better facilitate strategy work and yet foster scholarly rigor? Does strategy tool's assumptions of user behavior compare to the users' actual behavior?	Laboratory experiment	Computer recording of tool-use behavior	Statistical methods	Positivist
Five	1	Does the use of strategy tools affect users' plans, emotions or attitudes?	Laboratory experiment	Questionnaires and tool-use data	Statistical methods	Positivist
Six	1, 2, 3	How to evaluate strategy tools and particularly strategy toys?	Grounded theory	Questionnaire, interviews, ethnography	Coding	Interpretivist

Table 1: Methodological overview of the essays.

Data for my essays was collected in Finland. The research approaches called for an array of data. I targeted Finland's 500 largest companies (Talouselämä, 2002) and also some smaller companies, students at the Helsinki School of Economics, and academic strategy-tool developers. Owing to the competitive and private nature of strategy activities, the identities of all subjects have been concealed. Descriptions of the specific populations that have permitted me to address my research questions are detailed in each essay.

Contribution, limitations and future research

The results and contributions of my research are described in detail in the essays, and selected central outcomes are described in the next section. Some general comments on the contributions of this study are made here.

The key difference between my research and other available research is that this research is genuinely multidisciplinary. It brings together different disciplines that study strategy-tool use and constructs the notion of strategy-tool use in a way that benefits all of them. The notion of strategy-tool use employed in this study expands the traditional 'engineering' perspective on strategy-tool use to include social, cultural, and political factors that shape the use of strategy tools in a social environment. The six essays both draw from and contribute to the different fields interested in strategy-tool use: Decision Support Systems, Strategic Management, Management and Organization Studies, Operations Research and Management Science, and Cognitive-Behavioral Psychology.

A particular contribution is made in interpreting the exploration/exploitation model (March, 1991) to serve modern strategy practices in which strategy-tool use forms an intrinsic component. Although it is a vital model for all businesses, it has not received the attention it deserves in practical strategy work. The understanding that strategy-tool use is a complex social phenomenon is of major importance in the practical quest to facilitate strategy work which balances activities that creatively explore new opportunities and activities that efficiently exploit known resources.

This study concentrates on an examination of strategy-tool use in business organizations – non-profit and governmental organizations are not studied. The scope of the study and the units used in analysis are natural limitations on a practice view. Contextual limitations on generalizations are clear, but strategy tools are common in all modern organizations, and strategy-tool use across organizations is also comparable to some extent. Limitations that apply to specific research methods are specified in the essays.

More research is required to show the different ways in which strategy work routines and strategy tools and processes are configured to provide sustainable and competitive advantages (Johnson, Melin, and Whittington, 2003). Future studies should address issues related to achieving a better balance between exploration and exploitation in strategy work through the use of strategy toys, and examine in detail issues associated with establishing a suitable ratio for different types of tool use in different contexts.

OUTLOOK: STRATEGY TOYS AND A BALANCED SET OF TOOLS

In this section, I combine elements from the six essays and strategy-tool use literature to discuss strategy tools - and particularly strategy toys - as ways of supporting strategic success.

Where are strategy toys?

To facilitate strategy work with strategy tools in a way that contributes to strategic success, there needs to be an appropriate balance between facilitating activities that creatively explore new opportunities and activities that efficiently exploit known resources. Even so, creative activities do not receive much support in companies today. Essay One in this book shows that in the main, company executives use strategy tools for improving efficiency. Only three percent of the tasks that the tools are used for concern strategic innovation and development. Furthermore, only eight percent of the advantages associated with the tools deal with activating knowledge, experimenting and creating ideas.

Looking at the list of tools used in the companies at strategy-level (Essay One) also reveals that these tools mainly target efficiency. In modern businesses, achieving leanness by doing 'more of the same with less' is the main thrust behind use of the majority of the strategy tools.

The challenge lies in integrating strategy tools that facilitate doing 'new things' into strategy work routines. Strategy tools that have been developed to support creativity, such as Brainstorming, do not have a major part in supporting strategy work. Techniques such as Scenario Planning and Simulation may help in testing and critically examining ideas (e.g. Dyson, 2000), but their use is often sporadic. The strategy tools that are used as part of the daily strategy work routines have typically not been developed to facilitate activities that creatively explore new potential. The mechanisms that would deliberately and routinely help to supplement exploitation are scarce (March, 2006).

The complexity of strategy-tool use poses a further challenge. While an array of tools that could be integrated into everyday strategy work routines to facilitate creativity does exist (e.g. Michalko, 1998; e.g. Roos, Victor, and Statler, 2004; Sutton, 2002), creative tools do not necessarily help in facilitating creative activities. Bricolage, the innovative adaptation of strategy tools by which strategy practitioners produce their own intentful activities from strategy tools, may convert a creative strategy tool to facilitate activities that promote efficiency. Bricolage is contextual and reflexive and emerges from the practical necessities in business culture that dominantly support the exploitation of existing resources. Essay Two in this book highlights the fact that the executives' needs underlying strategy-tool use are: managing effectively, dealing with time, leading change and making sense, and attending to historical, cultural, social and political powers. In the main, these needs concentrate on efficiency issues. In some specific contexts, however, it is possible that bricolage may also turn efficiency tools into strategy toys. For example, Simons (1991) reports that strategic uncertainty may result in this type of use. The context of strategy-tool use warrants attention.

The power of strategy tools

Strategy tools do make a difference. Despite different ways of use and different contexts, the choice of which strategy tools are used is not an insignificant one. Each tool, its assumptions and its underlying concepts and beliefs have an impact. Strategy tools affect strategy work activities (Essay Six) in positive, neutral and negative ways. Furthermore, strategy tools may have outcomes that are not acknowledged and outcomes that may even be erroneous.

Strategy tools are based on theories that may or may not be in accordance with the actual ways that users behave (Essay Four). Furthermore, strategy tools involve moral orders which impose behaviors and foster practices (Latour, 1988). When strategy practitioners delegate strategy work to strategy tools by the act of using them, those tools begin to impose particular behaviors on everyone who encounters them. The development of strategy tools cannot therefore be simply viewed as the creation of discreet, intrinsically-meaningful methods, objects, technologies or devices (Suchman, Blomberg, Orr, and Trigg, 1999). Instead, the development, introduction, and use of strategy tools are all part of the cultural production of strategy work practices (Essay Three).

Essay Five demonstrates in a more specific manner that strategy tools have both conscious and sub-conscious influences. The strategy tool employed in the Cognitive-Behavioral Psychology laboratory experiment affected users' choices, emotions and attitudes. The influence of emotions in strategy work is important. Studies of decision-making in neurological patients who can no longer process emotional information normally suggest that people make judgments not only by evaluating consequences and their probability of occurring, but also - and even on occasions primarily - at a gut-feel or emotional level (Bechara, 2004). The experiment in Essay Five shows that creative strategy work could be facilitated in subconscious ways. In the experiment, a positively-biased strategy-tool had a positive influence on users' emotions and positive effects have been shown to improve creative problem solving, facilitate the recall of both neutral

and positive material, and help in creating new strategies in decision-making tasks (Isen, 2004; Isen and Labroo, 2003). Happiness allows unusual associations and improves creativity.

Toolbox contents

Many executives embrace intuition as an effective approach to exploration. Intuition at executive level is perceived as deeply-held knowledge that provides quick answers in complex situations. A recent article on intuition by Miller and Ireland (2005) points out that intuition is a potentially-creative but troublesome strategy tool. In general terms, the decision-making and management literature agrees that intuition should be combined with examination, experimenting and hard thinking to reduce risk (e.g. Zaleznik, 1997). On the whole, creative strategy work does not have to be foolish, since it is possible to assemble a toolbox that has both strategy tools which facilitate activities enhancing hard thinking and strategy toys that enhance creativity.

Individual choices of which strategy tools to employ are, however, often guided by institutional pressures (Abrahamson, 1996), and decisions about strategy-tool use are based on power discourses, underpinned by specific political and technical rationales, and affected by economic, political, historical and cultural aspects. The set of strategy tools actually employed in an organization is not then a product of careful planning but the result of answering diverse needs and pressures at multiple levels. Essay Two suggests that the best way of facilitating strategic success with strategy tools is not to look for individual tools that correctly answer specific needs and pressures, but to compile a balanced set of tools which caters to the aspirations a company has.

The set of tools that is appropriate for an organization is dependent on that organization's individual needs. For some companies, achieving viability in an environment that experiences dramatic and frequent change requires tools that offer a substantial degree of exploration. Firms competing in fast-cycle markets where sustaining competitive advantage is extremely difficult are typical

examples of such companies. In other firms, for example companies, which have strong market positions and operate in markets which are fairly stable, a lower degree of exploration and a smaller number of strategy toys is probably sufficient.

Overall, sustaining competitive advantage is an organizational capability that allows the adoption of new courses of action while providing stability in everyday activities. In modern strategy work, strategy creation and strategy implementation cannot be separated - experimenting and execution happen at one and the same time, and both change and stability are worked on simultaneously. Strategy tools are an intrinsic part of the modern strategy work and a well-balanced set of strategy tools has the capability to support strategic success. The only requirement is that the tools employed must be harnessed carefully to facilitate stability of change.

Summary:

Highlights of the Essays

Essay One

High-level decision support in companies: Where is the support for creativity and innovation?

Authors: Stenfors S. & Tanner L.

Methodology and data: Survey of strategy-tool use among 274 executives in Finland.

General research question: What strategy tools are used and for what purposes?

Summary: This study investigates the role of strategic-level tools in businesses. Executives working in Finland's 500 largest companies were asked about the tools they use to facilitate major decisions. The responses received indicated that executives actively use a variety of tools, with an average of five different tools per company. The paper presents a list of the tools and also the tasks the tools are used for. Only three percent of the tasks concern strategic innovation and development, and only eight percent of the advantages associated with the tools deal with activating knowledge, experimenting and creating ideas. Strategic-level tools are primarily used for improving efficiency.

Main contributions: This paper makes a contribution to the field of Decision Support Systems (DSS) by describing a void in strategic-level support. The field of DSS provides computer-based decision models for ill-structured decisions and shows potential in being able to provide strategy tools that facilitate innovation and creativity. This study identifies an opportunity for DSS and describes from different points of views the kind of support that strategy workers need. Furthermore, the paper adds to the empirical evidence on James March's (1991) exploration/exploitation theory which claims that activities aiming for efficiency in organizations often outnumber creative activities. This is a major concern for modern companies to whom innovation and creativity are key ingredients in creating and sustaining strategic advantage.

Essay Two

Strategy tools: A set of 'golf clubs'

Author: Stenfors S.

Methodology and data: Grounded theory study of strategy-tool use in practice; questionnaire, interviews, ethnography

General research question: When should the different tools be used?

Summary: Like golf clubs, strategy tools also have specific advantages and features that work best in knowledgeable hands and favourable contexts. This empirical study of more than 250 company executives finds that the context places limitations on both which strategy tools can be used and how they are employed. Furthermore, executives have individual ways of using strategy tools. The study points out that in choosing strategy tools for an organization, the task is not to find a single best and the most correct strategy tool. Rather, the task is to compile a balanced set of tools. The different strategy tools used in an organization form a set of tools which caters to different contextual needs and demands and supports different forms of strategy work. Guidelines for assembling a set of tools are given.

Main contributions: Most articles describing strategy tools assume prescriptive use of the tools and do not take into account different types of use and contextual issues. This paper looks at the challenge of choosing a strategy tool from the point of view of practical tool use. More specifically, it describes what executives do with strategy tools and studies the relatioship between the user, strategy tool and the context. Executives use tools for managing efficiently, leading change, making sense, creating ideas and playing power-games. They 'translate' tools into practice in innovative and adaptive ways that often change the tools' theoretical origins. Furthermore, strategy-tool use is socially embedded and dependent on contextual issues. In sum, this paper introduces a new model of strategy-tool use that looks at tool use as consumption (see also Whittington, 2003). It contributes to the study of Strategic Management also by describing how tools and strategizing activities can be configured to provide competitive advantage.

Essay Three

Exploring the edges of theory-practice gap: Developers and users of strategy tools

Authors: Moisander J. & Stenfors S.

Methodology and data: Case study; discourse analysis of a focus group, interviews, and participant observation.

General research question: How could strategy tools better facilitate strategy work and yet foster scholarly rigor? How do users' and developers' epistemological views of strategy-tool use differ?

Summary: Strategy tools are products of theories and they are used in practice. Thus, strategy tools connect theory and practice. This is the first one of two papers on this theme. This first study looks at strategy tools as technologies of organizational knowledge production and compares users' and developers' epistemological views of a benchmarking tool (Data Envelopment Analysis model). The findings of the study point out that differences in epistemic culture may result in management scholars producing knowledge and strategy tools that lack practical pertinence for corporate actors, particularly in the context of contemporary post-bureaucratic knowledge organizations. The paper suggests that there is a need for strategy tools that promote dialogue and trust and function as learning tools. Also, the study describes implications for strategy tool development that concern both users and developers of strategy tools and suggest closer collaboration.

Main contributions: The neo-institutional view taken by most management tool studies has been criticized of portraying managers as naïve and unrefined followers of fashions (Benders and van Veen, 2001). The practice point of view in this study treats practitioners as experts in their field and provides the opportunity to research the theory-practice gap. The study concludes that a more social model of knowledge and strategy work is needed for tools to better facilitate strategy work and yet to foster scholarly rigor. Overall, this study contributes to better understanding of the theory- practice gap in Strategic Management.

Essay Four

Multiple Objective Approach as an Alternative to Radial Projection in DEA

Authors: Korhonen P., Stenfors S. & Syrjänen M.

Methodology and data: Cognitive-Behavioral Psychology Laboratory Experiment, tool users' actual values and target values.

General research question: How could strategy tools better facilitate strategy work and yet foster scholarly rigor? Does strategy tool's assumptions of user behavior compare to the users' actual behavior?

Summary: This study investigates an intrinsic assumption made by a benchmarking tool. The benchmarking tool, Data Envelopment Analysis (DEA) model, uses radial projection as a standard technique to establish targets for decision making units (DMUs, i.e. the organizations, departments, or people being compared). The output of a DEA model is an efficiency score for each DMU and radial projection is used to calculate the scores. Basically, radial projection does no more than proportionally improve a DMU's current variable values until the efficient frontier is reached, establishing a target for the DMU on that point. This paper describes an experiment where the DMUs (199 students at Helsinki School of Economics) were free to choose their own target values on the efficient frontier and compares those target values to the values established by radial projection. The results show that the use of radial projection for target setting is too restrictive. For example, radial projection does not take into account a DMU's preferences and the change in time scope between the current point and the target point.

Main contributions: This study contributes to the development of DEA models in the field of Operations Research/Management Science. It reveals a gap between the theory used in DEA for picking targets and the practice of setting goals. Instead of using radial projection, the study suggests using an interactive, multiple-objective linear programming model that takes into account user's aspirations by 'communicating' with the user. In general, this study supports the results of Essay Three by showing the importance of dialogue, and of dialogue with the tool. Moreover, it draws attention to the significance of knowing the limits and assumptions that lie behind a strategy tool.

Essay Five

Inherent Biases in Decision Support Systems: The Influence of Optimistic and Pessimistic DSS on Choice, Affect, and Attitudes

Authors: Korhonen P., Mano H., Stenfors S. & Wallenius J.

Methodology and data: Cognitive-Behavioral Psychology Laboratory Experiment; questionnaires and tool use data.

General research question: Does the use of strategy tools affect users' plans, emotions or attitudes?

Summary: This study investigates the influence of a strategy tool. An experiment was set up to study plans by users' (225 students at Helsinki School of Economics) before, during and after tool use, emotions during tool use, and attitudes towards the tool used. The tool was an interactive computer-based time-allocation model that helped the users' to plan their future use of time with the aim of achieving their long term goals. Some of the users were given a deliberately-biased tool that provided values that were either too high or too low. The results of the experiment showed that the strategy tool had a significant impact on users' plans. Moreover, the too high values given by some of the tools improved users' emotional states and, to some degree, had a positive influence on their attitudes towards the tool.

Main contributions: The study demonstrates that strategy tools do matter. The implications of the conscious and sub-conscious influences of the tool on users' choices, emotions and attitudes are of importance for both the users and the developers of strategy tools. This paper makes a contribution to the field of Cognitive-Behavioral Psychology, adding to the work of many DSS scholars.

Essay Six

Evaluating Strategy Tools through Activity Lens

Authors: Stenfors S. & Tanner L.

Methodology and data: Grounded theory; questionnaire, interviews, ethnography.

General research question: How to evaluate strategy tools and particularly strategy toys?

Summary: While hundreds of different strategy tools are promoted by business schools, consultants, scholars and popular business literature, the usefulness of strategy tools is unclear. This study reviews evaluation literature and suggests conceptualizing usefulness as a form of activity. Accordingly, the study constructs an evaluation framework by examining individual-, interpersonal-, organizational- and societal-level strategy-tool use. The evaluation framework takes into account the positive and negative consequences that tool use has on strategizing activities. Furthermore, it focuses evaluation on usability, significance and connections of strategy tools. Such a view allows for evaluating, explaining and expecting different experiences and consequences of strategy-tool use in organizations.

Main contributions: The study makes two main contributions. Firstly, mainstream strategy tool theories in management and organization literature overlook the importance of strategy-tool evaluation. This activity-based study respects individual choice and brings out the importance of evaluation at the same time as it builds on the main theories. Secondly, returns from strategy tools that facilitate efficiency and tools that facilitate creativity vary not only with respect to their expected values, but also to their variability, their timing, and their distribution within and beyond the organization (March, 1991). The practical contribution of this study is an evaluation framework that in spite of the differing returns, allows for the evaluation of strategy toys and strategy tools in general.

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PART II

Essay One

Stenfors S. & Tanner L.

High-level decision support in companies: Where is the support for creativity and innovation?

Chapter 12

High-level decision support in companies: Where is the support for creativity and innovation?

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Abstract

Decision support tools that are used to support major decisions in companies have become increasingly popular. This study investigates the role of decision support tools in high-level corporate decision-making. Executives working in Finland's 500 largest companies were asked about the decision support tools they use when making major decisions. The responses received indicated that executives actively use a variety of tools, with an average of five different tools per company. The main finding of the study is that executives mainly use support tools for the purposes of improving efficiency not for the purposes of enhancing creativity. Furthermore, innovation and creativity are key ingredients in creating and sustaining strategic advantage, yet not many tools, used for major decisions are specifically designed to support creativity and innovation. Tools which support creativity and innovation are needed.

Keywords

Decision support, corporate decision-making, creativity, innovation, use of management tools.

1. Introduction

Decision support tools offered to facilitate major organizational decisions are diverse (e.g. Bain & Company 2005) and range from simple frameworks like SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis to intricate organizational OLAP (Online Analytical Processing) systems. Scholarly fields that currently offer support tools are numerous as recent developments in the information technology have opened up the decision support tool market for new possibilities. In addition to the study of decision support systems (DSS) itself, tools that claim to support major decision-making in companies can be found at least in the following fields: management, marketing, accounting, finance, logistics, systems science, systems thinking, industrial engineering, information systems, operations research/ management science, knowledge management and artificial intelligence. Some of these disciplines could be classified as being within the field of DSS, or as having common roots, but some do not even feature interdisciplinary communication. Overall, the supply of high-level decision support tools is abundant.

The purpose of high-level decision support tools is to offer significant gains and benefits for the organization using the tools (e.g. Barthélemy, Bisdorff and Coppin 2002; Brännback 1996; Eom, Lee, Kim and Somarajan 1998). For example, Business Intelligence gathers information into readily utilizable forms, Value-Focused Thinking (Keeney 1992) guides decision-making towards proactive instead of reactive thinking, Problem Structuring Methods (Mingers and Rosenhead 2004) reduce complexities, EIS (Executive Information System) can act as a communication medium and many tools make decisions generally more transparent. Indeed, Jelassi, Williams and Fidler (1987) describe the entire discipline of DSS through the advantages it aspires to gain its users: "DSS is a computer-based system which has the objective of enhancing the overall effectiveness of decision-makers, especially in their unstructured and semi-structured tasks."

Despite the projected benefits, there are ambiguous reports on high-level decision support tool use in practice. According to some studies decision support tools are not used by executives (e.g. Carlsson and Walden 2000; Kasanen, Wallenius, Wallenius and Zionts 2000; Nutt

2002), and the articles that do report tool use for major decisions (e.g. Clark and Scott 1999; Eom et al. 1998) have studied decision support tool experts working in organizations, not the executives making the actual decisions.

The goal of this study is to find out what types of tools are used in high-level corporate decision-making and what role the decision support tools play in those decisions. We have asked executives working in Finland's 500 largest companies to define the tools that they or their organizations use for support when making major decisions. Morecroft (1992) reports that the use of support tools at executive level can be unconventional as the tools are used for strategic thinking, group discussions and learning in management teams. Asking executives themselves to list tools that they perceive relevant to major decision-making leaves the definition of *use* open to include conceptual and other unconventional uses. To understand the uses of the tools better, we have additionally asked the executives how these tools support organizational decision-making processes.

2. Effective Decision Support

Major decisions in modern companies are framed by complex challenges. The executives of today's companies are under continuous pressure to find new sources of growth in increasingly demanding and competitive business environments. Organizations have a constant need to improve their competitive advantage and respond faster to changing markets by reducing costs, improving quality, becoming customer-driven, increasing productivity, and innovating.

Creativity is the essential first step in innovation processes (West and Farr 1990), without creativity innovations do not take place. Creativity is often defined as the development of ideas about products, practices, services or procedures that are novel and potentially useful for the organization (Amabile 1996; Zhou and Shalley 2003; Shalley, Zhou and Oldham 2004). Only when these ideas are successfully implemented in the organization do they become innovations (Amabile 1996; Mumford and Gustafson 1988). In the modern competitive organizations, creativity is essential not only in bringing about product

and process innovations, but also in generating business concept innovations.

Major decisions in organizations are about business effectiveness that involves both creativity and efficiency, i.e. "doing the right things" and not only "doing things right" (Drucker 1963). Creativity is needed to find opportunities that provide businesses with significant results, and efficiency of operations is needed to secure competitiveness. Lately, the importance of creativity has been much discussed, as creativity has been found to be the key factor in the success of countries, firms, communities and individuals (e.g. Florida and Tinagli 2004). Nevertheless, executives are reported to be more drawn into improving efficiency than increasing creativity (e.g. Ford and Gioia 1995; Levy 2005; March 1991; Roffe 1999).

How can organizations increase creativity? According to King and Anderson (2001) there are four broad strategies that can be followed: First, the organization can introduce procedures that encourage the generation of new ideas. Perhaps the best known of these techniques is Brainstorming developed by Alex Osborn 1953. Second, the organization may train people in the skills required for successful creative performance. This training can be a course in the domain that the organization would like to innovate in. Many studies have noted that creativity requires domain expertise (e.g. Gardiner 1993) that needs to be acquired before creative acts can take place. Third, the organization can recruit creative individuals or reallocate people to positions that are appropriate to their level of creativity. Creativity can be measured in a variety of ways, for example according to creative ability, personality type, creative process skills and characteristics of creative outputs. Companies can measure creativity of their personnel and organize accordingly.

The fourth alternative for increasing creativity is to take measures within the organization to improve the likelihood of cultivating creative acts. A strong body of literature attests that creativity can be enhanced by providing: effective knowledge and information flows (e.g. Andrews 1965 and 1967; Brown and Eisenhardt 1995; Pelz 1956 and 1967; Simonton 1984), nurturing organizational culture (e.g. Amabile, Schatzel, Moneta and Kramer 2004; Deci and Ryan 1985; Shalley and Gilson 2004; Torrance 1965; Zhou and George 2003), supportive social

networks (Bennis and Biederman 1977; Madjar, Oldham and Pratt 2002; Mockros and Csikszentmihalyi 1999; Oldham 2002; Perry-Smith and Shalley 2003), flexible and adequate resources (e.g. Amabile and Gryskiewicz 1987; Moriarty and Vandenbergh 1984), challenging and complex tasks (e.g. Amabile and Gryskiewicz 1989; Hatcher, Ross and Collins 1989; Hackman and Oldham 1980; Tierney and Farmer 2002, 2004), and good person-environment fits (e.g. Kristof 1996; Schneider 1987). Despite the extensive literature on enhancing creativity, organizations are struggling with implementing these actions in practice.

Supplying reliable and systematic support for creativity is a field that started with techniques to encourage generation of new ideas in the 1950s. The field of Computer Science has followed later in their quest to support creativity, and literature on computerized creativity support has only become mainstream research in the 1990s. Lubart (2005), in the field of Human-Computer Studies, suggests classifying creativity support tools according to the functions they facilitate: *1. Management of creative work 2. Communication between individuals collaborating on creative projects 3. Creativity enhancement techniques 4. Accomplishing creative acts through integrated human-computer cooperation during idea production*. Most of the creativity support tools (for a list of tools see for example Mycoted 2006) can be categorized in these four classes.

A comparison of King and Anderson's four strategies to increase creativity to Lubart's categories of existing creativity support tools, points out that there are probably still many areas of creativity support that have not been explored. Our study aims to point out some of these areas by studying how creativity is currently supported in companies. Overall, our objective is to find out if decision support tools indeed are effective, i.e. support both creativity and efficiency of major decisions.

3. Research Design

Our study is based on an executive-level survey conducted among the 500 largest companies in Finland (Talouselämä 2003). Finnish executives were selected for specific reasons. Finland has been reported as being the most competitive country in the world (World Economic

Forum 2005). Therefore, it can be presumed that not only leading-edge technological possibilities and knowledge of decision support tools but also the ambition for creativity and innovations, exist in Finland's largest corporations. Furthermore, the relatively transparent nature of the corporate world in Finland allowed us easy access to people working at executive level.

The research design was cross-sectional and data was collected using questionnaires and unstructured interviews according to survey methods described, for example, in Babbie (1990). The data consists mostly of open-ended written descriptions provided by the respondents, i.e. executives involved in making major decisions in the 500 companies reporting the largest annual turnover in Finland (Talouselämä 2003). Executives in the public sector and in not-for-profit companies were not included in the study.

Our study had two main objectives: 1. To find out which kinds of tools are used to support major decisions in companies and 2. To examine which tasks these tools support.

In our study, following Clark and Scott's (1999) definition, the term 'tool' is used as a generic name for any method, model, technique, tool, framework, methodology or approach used to provide decision support. Tool therefore refers to a decision aid used in a methodological manner for specific purposes in decision-making or planning activities. A tool can be either quantitative or qualitative and can be manual or computerized. It can be based on DSS methods or methods from another discipline. A tool can also be based on one or several methods.

The survey was carried out in the period of March to September, 2003. A short questionnaire with five questions was mailed to executives involved in major decision in Finland's 500 largest companies. A Web version of the questionnaire was also made available. In total, data was collected from 274 executives: from 182 filled and submitted questionnaires and from 92 unstructured interviews with executives who responded either by sending us an e-mail or phoning in their response to any of the issues raised in the questionnaire. The unstructured interviews took place for three main reasons: 1. The respondent found answering the questionnaire restricting as their organization's decision-making activity was spread over several

divisions; 2. Tools were used only in part or tailored to specific situations; 3. There was an ongoing organizational change in the company, such as merger, reorganization, or restructuring of the strategy process. The high number of unstructured interviews reflects the challenges involved in conducting a strategic-level survey and studying views held by executives concerning tool use.

Of the 182 respondents who returned the questionnaire, 16 were chief executive officers, 17 were executive vice presidents, 92 were executive officers, 52 were managers, 2 were specialists and 3 did not provide information concerning the function they performed. Thus, approximately 70 percent of the respondents held executive positions. The managers in our study frequently served as close assistants to the executives or were important members in strategic management teams. The initially contacted executives often mentioned that responses for our questionnaire were discussed in top managerial teams. Overall, the executives' viewpoint is conveyed in the responses.

To obtain a general view of tools from executives' viewpoint, survey answers were depicted and interpretive classifications were carried out. The classifications employed emerged and evolved from the data through an iterative analysis process carried out by our research group. Statistical analyses were used to support analysis and conclusions. Dependencies and frequencies are reported in this paper. Qualitative analysis of the unstructured telephone and e-mail responses was carried out to obtain in-depth understanding and provide additional evidence.

4. High-Level Decision Support

4. 1. Tools for Major Decisions

To establish which tools the respondents acknowledged using, they were asked to make a list of the tools that supported major decision-making and planning activities in their company. In our pre-testing phase, both the preliminary open interviews and the initial questionnaire tests showed that executives were unable to name tools unless examples were given. To clarify the concept of a tool in our survey, we provided an array of examples of systematic decision-support tools: Balanced

Scorecard, Spreadsheet Applications, Brainstorming, SWOT Analysis, Transport Optimization Models, Six Sigma, Product Line Simulation Programs, Scenario Planning, Risk Analysis, Life Cycle Analysis, Data Mining, and House of Quality. The first four of these (Balanced Scorecard, Spreadsheet Applications, Brainstorming, SWOT Analysis) were the tools mentioned most often in our in-depth pre-testing, the eight other tool names were selected for their diversity and added in order to provide wider mental associations.

The 182 questionnaire respondents listed a total of 865 tools from a variety of disciplines. We were able to classify 94 percent of the tools into 18 groups (Table 1). The figure in the Frequency column shows the number of times each tool was mentioned.

Support tool group	**Frequency**
SWOT Analysis	136
Spreadsheet Applications	120
Balanced Scorecard	104
Risk Analysis	66
Analysis of the Financial Statements or Investments	63
Quality Methods	51
Scenario Planning	46
Environment Analysis	40
Brainstorming	37
Statistical Analysis	33
Life Cycle Analysis	25
Optimization	23
Project Management Tools	20
Simulation	20
Value Chain Analysis	10
Human Resource Management Tools	7
Management Information Systems & Business Intelligence	7
Enterprise Resource Planning	7
Number of tools classified (94 %)	**815**

Table 1. Executives' lists of support tools in groups.

SWOT Analysis was mentioned 136 times and it is clearly the most common tool used by executives to support the making of major

decisions. *Spreadsheet Applications* came second, but their function is somewhat different to that of other tools as they are often used in a supplementary role or for data storage and calculations. It is worth noting that the first two groups consist of tools that are quick and easy to use, and which many people in companies have the ability to use. People in executive positions have most probably learned about these tools at the university level since almost every respondent had an academic degree, mainly in the fields of Business Administration (109/182) and Engineering (52/182). On the other hand, many of the tools described are offered by consultants who provide specific services to teach and facilitate the use of their tools.

The possibility that the list of examples we provided constrained responses to the named subset of tools was taken into account, and the compiled list of tools was compared to the list of strategic level tools provided by OR/MS professionals without an example list in Clark and Scott (1999). Although this article does not provide exact frequencies, the two lists appear quite similar. The absence of *Balanced Scorecard* group in the list by Clark and Scott is probably a result of the fact that the Balanced Scorecard is a recent introduction. In general, we could not detect evidence of anchoring to our list of examples.

The list of tools provided by executives appears to contain only a few tools that directly support innovation and creativity. In our classification, only *Brainstorming* is a tool group that is mainly intended to support creativity. In Lubart's (2005) classification of creativity support tools, these tools belong to category *3. Creativity enhancement techniques*. *Scenario Planning* group, and perhaps some other tool groups, may contain tools that provide some support for innovation and creativity, but often the companies experiment with and alter tools which makes it difficult to analyse the exact features of the tools that are used. Also, we were not able to identify tools that belong to other categories in Lubart's classification. The lack of use of newer tools, for instance tools that provide evolving active decision support through integrated human-computer cooperation is significant. In sum, the tools used for major decision-making are fairly simple and somewhat trendy.

4. 2. Support Tools at Company and Industry Level

The frequencies in Table 1 show that companies do use tools to aid major decision-making and planning, and that executives take advantage of that support. The questionnaire responses indicate that a company used an average of five different tools.

The use of support tools was most common in the *Construction* industry, where the average company used seven tools when making major decisions. None of the other industries reported using more than six tools, but the next highest group, that used just about six tools per company, included *Furniture, Information Technology, Energy, Wholesale Trade/Daily Goods, Telecommunications, Business Services*, and *Food and Drink*. These companies varied in size, but all of them used information technology extensively. The industries that did not use or used only few support tools were *Textiles/Clothing* and *Motor Vehicle Sales* industries, the executives in these industries preferred to trust their intuition and did not use much information technology.

	Response category			
	Questionnaire	**Interview**	**Non-respondents**	**All**
No. of companies	172	92	236	500
Percentage	35	18	47	100
Turnover 2001, average (M€)	637	553	431	524

Table 2. Average turnovers and the number of companies in different response categories.

Looking at both questionnaire and unstructured interview data, only 13 percent (33/264) of the companies indicated that they did not use any kind of tools when making major decisions. This group included companies whose company culture either did not support or actually prohibited the use of tools. It is likely that the percentage of companies not using any tools for major decisions is higher, since some companies of this type were probably among the ones who did not respond to our survey. Furthermore, average annual turnover is highest among companies that responded by returning the questionnaire (Table 2).

Small companies did not reply to our questionnaire as often as large companies. Thus, use of tools in larger companies appears to be more extensive than in smaller ones.

4. 3. Context for Tools

Respondents listed 1033 tasks that 865 tools were used for. We categorized the tasks to establish which kind of specific decisions, problems and needs the corresponding tools were used to support.

DECISION CONTEXT	number
Corporate and Business Unit Decisions	
Vision	**119**
Innovation and Development	33
Investment Decisions	86
Environment Analysis	**140**
Internal	59
External	57
Risk Management	24
Strategic Planning	**209**
Strategy Implementation	**67**
Feedback and Control	**109**
Monitoring Strategy	71
Financial Control	38
Subtotal (62 %)	**644**
Functional Decisions	
Planning of Production, Logistics and Purchasing	78
Finance	79
Planning of Sales and Marketing	35
Functional Management	97
Quality and Process Development	35
Research and Development	29
Project Management	27
Human Resource Management	9
Subtotal (38 %)	**389**
Total number of tasks for tools	**1033**

Table 3. Contexts for decision support tool use.

The different tool usage categories identified in our study emerged from the support tool task descriptions written by the executives. The different tasks were classified into two hierarchy levels (adapted from Stahl and Grigsby 1992, 104): *Corporate and Business Unit Decisions,* and *Functional Decisions* (such as Sales and Marketing, Finance, Human Resources etc). Furthermore, *Corporate and Business Unit Decisions* were classified using the elements in Kotler's (1997, 80) strategy process. This allowed us to analyze the reported use of tools in different management contexts.

Two points are worth noting in Table 3. Firstly, the corporate level executives do not use decision support only for general strategic decisions concerning the company but also quite often for major decisions concerning specific functional tasks. Only 2/3 of the tasks (see Table 3) were at the *Corporate and Business Unit* level and 1/3 at the *Functional* level. Secondly, only three percent (33/1033) of the tasks for the tools could be classified into the strategic innovation and development category. In general, the tools that are currently used in these companies have a very functional role that mainly aims for efficiency.

4. 4. Reasons for Using Tools

We also asked for the reasons why the executives, in general, were interested in using tools. The respondents chose any amount of reasons from ten given alternatives (Table 4), and could also specify reasons themselves. On average, the respondents chose five reasons. From 182 respondents 11 did not pick any reasons for tool use.

In line with our previous findings, the reasons for using tools are wide ranging. Efficiency is also most important here, but interestingly 40 percent of the respondents have marked *Encourage new ideas and creative visions* as a motive for using tools. From Table 1, we note that out of the 182 respondents 20 percent use *Brainstorming*, which was the only tool that we could identify as mainly designed to support creativity and innovation. This indicates that executives are using some other tools

for this purpose, although these tools might not have been designed specifically to support creativity and innovation.

4. 5. Advantages Associated with Tools

Furthermore, we were interested in finding out what advantages had been gained from using the tools. The respondents listed a total of 510 advantages. There was not enough data to make a distinction between the advantages associated with the use of different support tools.

Although, we were not previously able to classify the groups of tools into Lubart's (2005) classes of creativity support, 96 percent of the reported advantages of the tools easily grouped into Lubart's first three categories: 1. *Management of creative work*; 2. *Communication between individuals collaborating on creative projects;* 3. *The use of creativity enhancement techniques*. As noted before, we did not find any tools for human-computer cooperation, nor did we find any advantages that would have fitted into Lubart's fourth category: *Accomplishing creative acts through integrated human-computer cooperation during idea production*.

Reasons for tool use	**Percentage of the respondents that chose the reason**
Clarify company strategy	74
Ease information collection and analysis	70
Aid budgeting and financial planning	70
Assist in implementing strategy throughout the company	54
Help monitor and comprehend the environment	51
Generate dialogue	45
Encourage new ideas and creative visions	40
Strengthen commitment to the organization	39
Facilitate human resource and organization management	24
Support marketing efforts	24
Other role (clarified by the respondent)	13
Number of respondents 182, amount of responses 915	

Table 4. Reasons for using support tools.

We assumed that major decision-making is always a creative process, and grouped advantages that had to do with managing major decisions under Lubart's (2005) first category. This category consisted of nearly 70 percent of the advantages of the tools used, and we divided it further into two categories: *Making processes more efficient* and *Converging and making decisions* (Table 5). Both categories have to do with working efficiently, but in a different manner. Processes can be made efficient at any point in the process, but convergent thinking and making decisions are a specific part of a creative process (e.g. Elam and Mead 1987). These two categories are somewhat equal in size.

Advantages of support tools	Frequency	Percentage
Making processes more efficient	170	35
Converging and making decisions	168	34
Supporting collaboration and communication	112	23
Activating knowledge, experimenting, and creating ideas	38	8
Number of advantages classified (96 %)	**488**	**100**

Table 5. Advantages of tools in modified categories of creativity support.

Efficiency is clearly the strongest advantage of decision support tools used for major decisions. Some of the listed tools (Table 1) produce externalizations that can be shared and used as Boundary Objects (Star 1989), thus *Supporting collaboration and communication* was mentioned as an advantage although the tools listed were not mainly meant to be communication tools. It is notable that supporting creativity directly by *Activating knowledge, experimenting, and creating ideas* is not an advantage associated frequently with support tools. Interestingly, this category made up eight percent of the advantages whereas tool group *Brainstorming* made up only four percent of the tools classified in Table 1. This confirms that tools in other groups than *Brainstorming* are also used for generating new ideas. The executives confided that any tool, overall, could be used to create new views and to provoke fresh thoughts. However, in the executives' view, the tools in general provide more support for improving efficiency than enhancing creativity and they are concerned that tools may cause narrowed and limited thinking.

5. Conclusions and Discussion

The focus of this study is on defining the scope of high-level decision support tools used in companies. In overall terms, the tools that are used in the companies to support major decision-making are much more focused on supporting efficiency than creativity. Although companies use on average five tools, very few of those tools are designed to support creativity and innovation. The processes in companies are geared towards efficiency and rationality, and there are not many support mechanisms to facilitate creative processes. For instance, most of the tools are based on presenting measurements and numbers, yet that may not be the best approach to present creative images that are often not measurable. Also, only few tools allow divergent thinking and incubation which are intrinsic for creativity. All in all, the processes in companies are set to serve efficiency.

Generally, the most commonly used tools for major decision-making are simple and flexible. They can be adapted to different contexts and are fairly easy to learn. Executives use bricolage, artisan-like inventiveness (De Certeau 1984, xviii), to adapt tools to their needs. Often only some parts of tools are used or tools are used in an innovative manner to help tackle tasks on hand. The available tools in a company make up a portfolio of support tools, and executives combine the tools in often unique but reflective ways to support different aspects of their work.

As the business environment becomes increasingly unpredictable, and intangible assets get more important, more helpful tools need to be introduced. Very few firms have been able to sustain an innovation culture over an extended period of time. During adverse times the tendency has been for companies to deliberately focus on opportunities that promise short-term returns. Longer-term, more innovative, and thus more risky, initiatives enjoy scant support at times of low economic growth (Perel 2005). These are times when companies typically introduce new support tools to achieve efficiency. During the 2002 economic turmoil, use of tools increased dramatically as companies resorted to efficiency tactics such as benchmarking and cutting costs (Rigby 2003). More studies are needed to find out how support tools could also enhance creativity during a downturn to help, for example, in finding less risky options for creating stakeholder value. Innovation and

creativity are key ingredients in creating and sustaining strategic advantage.

Creativity is a complex phenomena and it is critical not to oversimplify the ways in which support systems might be used both to reveal and enhance creativity (see also Shneiderman 2002). Creativity support at its best is flexible and unnoticeable yet works as a memory, gives guidance, provides transparent information, motivates, inspires and connects. Lately, the academic community has designed many new support tools that are better geared towards effective and balanced high-level decision-making. For example, problem structuring, new perspective, anticipation, communication, group work, flexibility, and facilitation issues have been tackled by new techniques. Furthermore, active decision support systems (e.g. Carlsson and Walden, 2000) can bring all these features together to guide the user in evolving decision-making processes. Also, the possibilities of support systems have broadened significantly with technical innovations. Virtual reality (VR) technology, intelligent software agents (ISA), soft computing, collaborative support systems and use of tools through mobile and wireless technology open up different dimensions to support tool possibilities. Yet, in our study, despite the advances in support systems, the executives do not mention the new academic applications. The tools that executives use are well established and introduced mainly by consultants, business school courses and popular management literature.

Why do executives not use more effective decision support? The market of high-level decision support tools seems confusing, time-consuming and risky to executives. Despite the amount of research and literature on decision support, the market remains disintegrated and ambiguous. Competition between the disciplines makes unified efforts to improve solutions rare and there is very little research that compares the tools from different disciplines in a sensible way. It would be important to clarify the functions of different support tools and provide accurate information about selecting, implementing and integrating tools that are appropriate to executives' needs.

Overall, in the current competitive and flexible network organizations the support tools are important part of everyday work environment. The executives had positive experiences and an outward-looking attitude towards the tools. They wanted to know more about the

possibilities the tools could offer them. Also, they stressed the importance of simple, transparent, clear, and understandable tools that could be trusted and would support communication. They look for flexible tools suitable for their specific requirements. Unfortunately, the current array of the tools they are using does not meet their needs - better support tools for creativity and innovation are needed.

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Essay Two

Stenfors S.

Strategy tools:
A set of ‘golf clubs’

Strategy Tools: A Set of 'Golf Clubs'

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Abstract

This article introduces a new conceptual model of strategy-tool use by examining strategy tools, executives' use of strategy tools, and different situations in which strategy tools are either used or not used. Strategy tools (for example SWOT analysis, the Balanced Scorecard, Scenario Analysis) are commonly used in modern organizations all over the world to facilitate strategy work. Strategy consultants, popular management literature, and business school courses promote their use. It is, however, not clear when to use what tools. The inspiration for this study was the revelation that this problem had been solved in the game of golf by focusing on the situated practice of golf-club use, i.e. individual swing-style in differing situations. Like golf clubs, strategy tools also have specific advantages and features that work best in knowledgeable hands and favourable contexts. This study points out that in choosing strategy tools for an organization, the task is not to find a single best and the most correct strategy tool. Rather, the different strategy tools used in an organization form a set of tools, which jointly caters to different contextual needs and demands and supports different ways to act – like a set of golf clubs. The paper presents an empirical study of more than 250 company executives and argues that the context places limitations on both which strategy tools can be used and how they are employed. Furthermore, the study shows that executives have individual ways of using strategy tools. Guidelines for compiling a set of tools are discussed.

Introduction

Strategy tools are used to facilitate strategy work. Scholars from different academic disciplines, consultants and companies all develop them. Hundreds of different strategy tools such as Executive Information Systems, SWOT Analysis, Scenario Analysis and the Balanced Scorecard can be found in organizations all over the world,[1] increasingly in computerized form. The idea behind strategy tools is to transform "best practices" or theoretical know-how into steps that are integral to the tool. Ideally, use of the tool then releases knowledge in a practical and contextual form that supports more-effective strategies and facilitates strategizing. Strategy tools have specific advantages and features that work best in favourable contexts[2] and in knowledgeable users hands – like golf clubs.

Collecting a set of golf clubs that matches individual needs is a task that every golfer approaches with dedication. Even though it might be possible to play different golf shots using only a single club, it is sensible to take advantage of the fact that having a variety of clubs allows the golfer to make shots of different length and accommodate differing characteristics of ball flight while also taking into account individual swing-style and specific environments. A golf club manufacturer describes the logic behind compiling a set of clubs in the following way:

"Golf clubs are the tools we use to strike the golf ball. Club-makers create golf clubs that adhere to the rules of golf and maximize the physics of the golfer's swing while allowing for a range of swing error to provide an accurate, long, yet forgiving shot. The better your swing, the less forgiving club you require. A standard set of golf clubs consists of three woods (the 1-driver, 3, and 5), eight irons (3, 4, 5, 6, 7, 8, 9, and PW), and a putter — twelve clubs. The rules of golf allow you to carry fourteen clubs in your bag, so many golfers add clubs where they need the most weapons at their disposal."[3]

This article proposes that the different strategy tools used in an organization should be viewed as a set of tools. The proposal is based on a micro-level strategy-as-practice approach[4] that focuses on strategy-tool use activities.

Traditionally, organization and management theory takes a neo-institutional view of strategy tools. Tool adoption is depicted as a macro-level phenomenon and strategy-tool use is seen as management fads and fashions that cannot be explained by rational behavior in organizations.[5] This universal theory of strategy tool fads and fashions seems to be of little help for the individual modern organizations dealing with the growing number of strategy tools, and some recent literature have pointed out the importance of treating organizations as active agents.[6] On the other hand, a strong body of strategic management literature, often geared more for readers who are practitioners, consultants or tool developers, describes an

array of strategy tools and suggests that closer attention should be paid to the selection of tools.[7] These two streams of literature take different approaches to the questions of organizational agency, rationality of tool choices, and expertise of the users, which makes it challenging to generate a profound understanding of practical tool adoption.

The inspiration for looking at strategy tools as a set of golf clubs came from my difficulties to identify when the use of specific strategy tools was suitable and possible. Strategy tools are an intrinsic part of business school education and also management consultants, popular management literature, and management scholars promote them[8] - yet it is not clear when to use what tools in practice. The revelation that the game of golf had solved this problem by focusing on the situated practice of golf-club use, where the tool, user and the context meet, alerted me to the possibilities of the strategy-as-practice approach.

The goal of this article is to understand the situated practice of strategy-tool use and how this relates to the strategy tools that are currently available. Furthermore, the article introduces elements for a new conceptual model of strategy-tool use. The strategy-as-practice viewpoint allows strategy-tool use to be viewed as a flow of organizational activity that incorporates rationality and irrationality, content and process, intent and emergence, thinking and acting as reciprocal, intertwined and often inseparable parts. The focus of this article on strategy-tool use bases in a wider 'practice turn' in social theory that celebrates the works of Bourdieu, de Certeau, Foucault and Giddens. The general theme in 'practice turn' is to connect social forces and individual activities. Thus, the strategy-tool use focus respects individual choice, which gives this article an opportunity to look at strategy tools as purposefully compiled sets without abandoning the neo-institutional strategy tool theories. In sum, this article takes steps to bridge strategy tool theory and practice.

My presentation of these ideas begins by pointing out some features in currently available strategy tools. I then define the fundamental notions of my research and the research methodology employed. An empirical study of strategy-tool use by more than 250 executives is then described. Finally, I draw conclusions of the study.

The repertoire of strategy tools

A set of golf clubs has three different types of clubs: woods, irons and putters. The modern golfer may also have hybrid clubs in his bag, but in general, to succeed on the golf course (s)he carries some clubs from each category.

Yves Doz and C.K. Prahalad (1981) categorize strategy-level management tools into three different groups: 'Data management tools', 'Managers' management tools', and 'Conflict resolution tools'.[9] They suggest carefully orchestrated use of the entire range of these tools

over time for successful strategic change and control.[10] In the modern organizations, where strategic advantage in the competitive markets is based on innovative solutions and creative thinking, a fourth category of strategy tools is appropriate –'Creativity and innovation tools'.[11]

Long Range Planning (LRP) has been one of the major journals describing new strategy tools since the late 1960s. I reviewed LRP articles between September 1968 and February 2006 to get an overview of the strategy tools offered in the four different categories. More specifically, I looked for articles describing any methods, models, techniques, tools, technologies, frameworks, methodologies or approaches used to facilitate strategy work. The strategy tools I found were conceptual, such as those employed in strategy design, but also often process tools such as project management techniques, or physical tools such as computers and documents. Overall, strategy tools in LRP were based on methods and theories emanating from an array of disciplines and schools of thought.

Most of the tools presented in LRP are 'Data management tools'. Descriptions of incremental development of financial and market-analysis tools have been appearing regularly in LRP over the last 40 years. Also forecasting and risk analysis models, which in the 1960s were based on Operations Research and Management Science theories, appear recurrently throughout the years. Today, majority of the data management tools are in computerized forms and LRP has been in the forefront of this transition. Already in 1974, LRP published an article on Management Information Systems (MIS). Growing interest in Knowledge Management at the end of the 1990s generated discussion of Customer Relationship Management (CRM) and Executive Information Systems (EIS) applications, but little has been written about the next generation of information technology applications as the focus has changed to the possibilities of softer Knowledge Management tools.

Many prevailing management theories, for example Porter's Five Forces, the Value Chain, and SWOT analysis are often portrayed in LRP articles as 'Managers' management tools'. They help managers to focus and show where more managerial resources are needed. Also a variety of human resource, project management and management development tools have been introduced in LRP since the beginning of the 1990s. Differing from the first category of strategy tools presented, the 'Managers' management tools' result often only in one article per tool. These tools are usually conceptual and only occasionally come in a computerized form. However, it is important to note that there are some tools that have gotten much attention, for example Total Quality Management (TQM) and Balanced Score Card (BSC). TQM resulted in ten articles between 1993 and 2002, and BSC was discussed in 12 articles between 1995 and 2004. The articles on BSC are among the most frequently downloaded topics from LRP's homepage. These popular tools are hybrid tools that fit both the 'Data management tools' and 'Managers' management tools' categories.

LRP has published very little on possible tools for dealing with power structures, control and conflicts. The early LRP articles recommend negotiation models as 'Conflict resolution tools'. Tools that are suitable for team-work and team-building, building alliances and networks, managing co-ordination, creating trust, and allowing diversity appear only in this millennium and are not only 'Conflict resolution tools' but often also 'Managers'management tools'.

'Creativity and innovation tools' have been presented in LRP since the 70s. Scenario Planning was described 52 times in LRP articles between 1971 and 2003. Specific tools to support creativity and innovation started appearing more in the 1990s and the recent years have seen a surge in tools that for example enhance strategic play, detection of opportunities, recognition of weak signals, and use of imagination in strategy work.

To sum up, the prevalent strategy tools are 'Data management tools', but also some 'Manager's management tools' and a few 'Creativity and innovation tools' are available. 'Conflict resolution tools' need development, but hybrid tools are popular and available. A study of strategy-tool usage in 172 large companies in Finland,[12] conducted in 2003, mirrors these observations (see Table 1). Most of the tools are 'Data management tools', and there are no reports on pure 'Conflict resolution tools'.

Strategy tool group	Frequency
SWOT Analysis	136
Spreadsheet Applications	120
Balanced Scorecard	104
Risk Analysis	66
Analysis of the Financial Statements or Investments	63
Quality Methods	51
Scenario Planning	46
Environment Analysis	40
Brainstorming	37
Statistical Analysis	33
Life Cycle Analysis	25
Optimization	23
Project Management Tools	20
Simulation	20
Value Chain Analysis	10
Human Resource Management Tools	7
Management Information Systems & Business Intelligence	7
Enterprise Resource Planning	7
Number of tools classified (94 %)	**815**

Table 1. Usage of strategy tools according to Stenfors et al.[12]

Table 1 also reveals that an average set of strategy tools has five tools in it. The executives in the companies were asked to write down the names of the tools that they used in strategy work and on average they listed five tools. However, there are differences between organizations: companies with larger revenues use more tools; some industries require specific tools; in some industries tools are more integrated into their specific ways of working; economic downturns may increase the number of tools; and some organizational cultures do not support or may even prohibit the use of tools.[11] Strategy-tool sets in organizations appear to be significantly affected by situational conditions.

The situated practice of strategy-tool use

In the game of golf, the professional golfers decide what clubs to put in their golf bag by focusing on the situated practice of golf-club use, i.e. individual swing-style in differing situations. They relate their swing-style to a variety of contextual issues: the different kinds of shots that will be needed (e.g. drives, long approach shots, short approach shots, pitches, chips, sand shots, putts, rescue shots), special features of the golf course (e.g. narrow fairways, limited view), the weather (e.g. wet soil, sunshine, high winds), people on the course (e.g. a new caddie, better players, the number of spectators), tactics (e.g. aggressive, safety shots, making the cut, play-off), other limitations on the choice of clubs (e.g. rules, traditions, sponsors, manufacturers, likes and dislikes) and their skills and habits with each club. The selected set therefore takes into consideration differing relationships between the golfer, each club, and the context.

In order to understand better the underlying issues in compiling a set of strategy tools, I examine the situated practice of strategy tool use and start by formulating the notion of 'strategy-tool use' in a more precise manner. By strategy-tool use I mean the different ways of using methods, models, techniques, and frameworks to facilitate strategy work. This includes not only the physical behavior of using a strategy tool – pushing buttons, listing strengths, viewing numbers, showing slides, leading discussions – but also what the user 'does' by performing these actions and what each user 'makes' of the know-how offered by the tools[13] . This interpretation stems from Richard Whittington's definition of strategy-tool use as the 'consumption of strategy products'[14] and has deep roots in de Certeau's view of everyday practices[13] . The examination of consumption shifts the attention from intended uses to different creative and adaptive ways of using both existing and imagined properties of the tools. While relationships between users and the products they consume are already quite intricate, the nature of consumption is strongly determined by the social structures that prevail in each situation (i.e. the context).[15] Like the rules of the golf game that determine the set of golf clubs, these different social relations and contextual forces determine the terms of use and the possible tool choices.

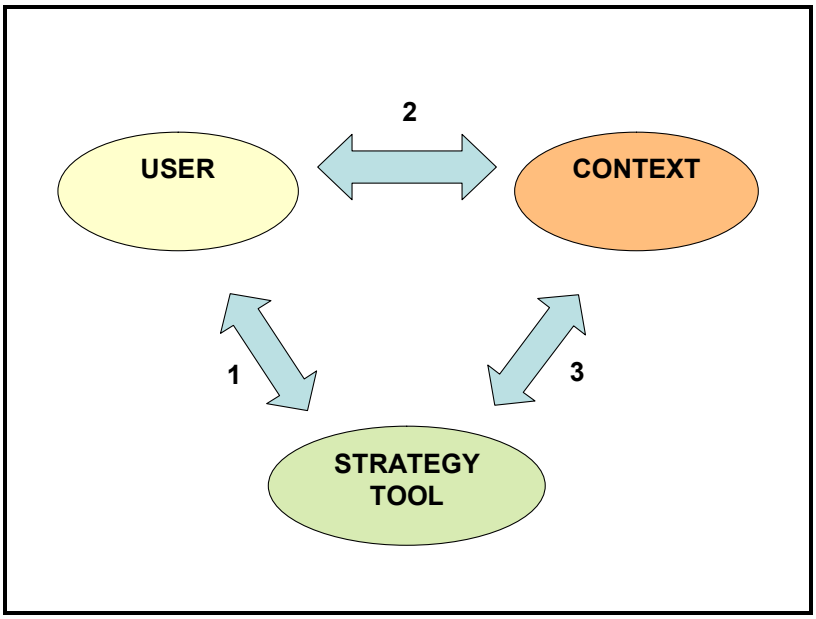

Figure 1. Strategy-tool use in practice

Thus, strategy-tool use occurs within a coexistent and fluid interplay between the user, the tool and the context (see Figure 1). To further complicate the interplay in practice, these relationships often include multiple users, an array of tools and a variety of contexts. I now describe in greater detail the relationships between the three main elements and their role in strategy-tool use.

1. **The Tool↔User relationship**

When examining the practice of strategy-tool use at surface, the observable practices and activities occur between the user and the tool. Most strategy tools have many users but each user of the tool has their own individual ways of using it. Sometimes the consumption of a tool is not physical as the user may imagine the use of the tool or just talk about the use of a tool. Also these incidents are important for strategy work and anybody consuming a tool is a tool user. Altogether, the relationship between tools and users is often problematic. The tool imposes "best practices" and correct behaviors on the user through the activity of being used.[16] On the other hand, users "translate" tools into practice and consume tools in creative and adaptive ways that often distort a tool's theoretical origins.[17]

2. **The User↔Context relationship**

This is a deeper level of strategy-tool use which concentrates on what the user 'does' by performing strategy tool activities and what the user 'makes' of the knowledge emerging from the use. Like the context for golf club use, the context for strategy tool use is set by an array

of issues: regulations, competition, history, organizational setting, resources, power issues, culture, etc. Although the users of strategy tools are not passive, contextual forces establish the terms of action and create an incoherent and often contradictory plurality.[13] Intents, choices, beliefs, needs, views, values, acts, facts, ideologies, motives, purposes, structures, rules and tacit meanings construct, deconstruct and reconstruct the relationship between user and context.[18] Often the roots of the operational logic behind tool use can be identified at this level.

3. **The Context↔Tool relationship**

This relationship is central to an understanding of the set of tools that exist in an organization. Tools are often adopted within organizations because of the institutional forces that emerge from the specific context in which that organization is situated.[5] And while context may prompt an organization to use specific strategy tools, it can also prevent an organization from using alternative tools. Strategy tools can be a method of exercising control and power over both user organizations and individual users. Use of a particular strategy tool can also bestow power and a favorable image on the organization and its users.[6] Furthermore, tools may misrepresent the context in which they are used and yield either advantages or disadvantages compared to situation in which tools are not used.[13] It is also important to note that changes in context may warrant changes in the set of tools used within an organization.

Methodology and data

The general approach taken by this study follows strategy-as-practice school of thought.[4] Strategy-as-practice view treats strategy practitioners as experts in their field and is interested in both facilitating strategy work and being theoretically relevant. The research strategy in the empirical study presented below follows the methodology of grounded theory.[19] I have chosen to follow Charmaz' approach to grounded theory, which takes an interpretivist view to strategy-tool use. I do not assume an objective external reality, but rather paint a picture of an interactive process and its temporal, cultural and structural setting.[20] This particular research strategy was selected to allow a dynamic description of strategy-tool use that captures its complexity as a social process and allows practice-oriented theorization.

The study looks at the different activities around strategy tools that shape and are shaped by the society within which tool use occurs. I concentrate on strategy-tool use by business executives. To gain a better understanding of the activities, I let the executives in the study define the tools used in strategy work, and view strategy-tool use as consisting of a range of somewhat mundane activities. The tool itself is not the center of attention, the way in which it is used is.

I used theoretical sampling and collected data using a variety of methods. The study is based on five different types of data: a survey, unstructured e-mail and phone interviews, themed face-to-face interviews, presentations on strategy tools, and participant observations. Data collection was initiated by sending a short questionnaire to executives involved in strategic management in Finland's 500 largest[21] companies. The survey resulted in 182 questionnaire responses and 92 e-mail or phone interviews with executives, managers or assistants who worked with strategy-level executives. To check the core categories that were identified, interviews were conducted with sixteen executives and five managers from large and medium-size companies in Finland. Four follow-up interviews were also conducted. To extend knowledge of how specific strategy tools are used, seven organizations were invited to give a presentation on their use of strategy tools in a university course. Two of these organizations were consulting companies who reflected on the use of strategy tools by their clients. The researcher also acted as a full participant at executive level for 21 months in one of Finland's 500 largest companies.

The iterative process of data collection, coding and analyzing took place at the same time as concepts emerged to guide decisions about what types of data would next offer opportunities to discover variations and refine the concepts used to analyze strategy-tool use by executives. I have coded the data selectively[22] , formed categories, and generated concepts by making continuous comparisons and going back to earlier data and different data sources when necessary. Even though the data available is rich, the situated context-dependent perspective of the study makes generalizations from the results somewhat suggestive, incomplete, and indeterminate. For more information on data and analysis see Appendix.

The theoretical perspectives adopted in this study have emerged from the data. The notion of strategy-tool use described in the previous section serves the core categories which emerged from the data. These categories are now presented.

Strategy-tool use in context

I report on the situated practice of strategy-tool use from the three relationship perspectives numbered 1, 2 and 3 in Figure 1. The aim is to get a deeper understanding of strategy-tool use in order to identify when to use what tools.

1. Tool↔User activities: Practical ways of using strategy tools

I have categorized different behaviors in using strategy-tools. These activities are embedded in strategy work and only recognizable as strategy-tool use when the tool is physically present in some form or when the name of the tool or some other tool related detail identifies them as such.

Participating hands-on. Hands-on use of strategy tools, i.e. performing the sequences of actions required for the strategy tools to produce results, builds work routines that are recognized and accepted as modern strategy work. Most of the strategy-tool users in this study are executives, who do not usually have duties that require daily hands-on work with strategy tools. For them using tools hands-on takes place during special strategizing episodes.

"A group of key people from our company got together for two days and we simulated different strategic situations with this new tool…I don't think we have implemented any of it… We shared our solutions to different business situations and gained a feeling of camaraderie, which is critical. I now know how and what problems people face, and when we have challenging situations, I feel comfortable giving them a call." (Executive SJCFN02.07)

These hands-on occasions like strategy retreats, strategy planning meetings, and sometimes also initial implementation of an everyday strategy tool such as the BSC and SAP applications, often take place in groups. Different members of the group get to share their approaches and views to an array of issues through using the tools. Thus, many common strategy tools, such as SWOT analysis and Scenario Analysis, have an important social role and are not only used to plan strategy but also to enhance teamwork and prevent conflicts within the group that participates in the sessions (see also a recent article in LRP[23]).

Utilizing outputs. Frequently, executives use the outputs that the tools produce. These outputs are often numbers that result from calculations and data collection within the tool, but they can also be plans, goals, suggestions, statements and descriptions. These outputs are used to create topics, arguments and items of information for discussions, presentations and calculations. Also, executives use strategy-tool outputs to analyze their organization or the market. The outputs that executives focus on are ones that are either of specific current interest or in some way surprising. They transfer the strategy-tool outputs into the company context and make sense of each output in relation to other information they have. One executive describes the process as follows:

" …then we have to relate the results [from the strategy tool] to the operational environment. It is not really ever what the numbers show, they always need to be adapted… and sometimes also recreated and orchestrated to fit the current situation and moment in time." (Executive HEMÄ17.10.1)

Information obtained from reports and news items is often used in a similar way. Furthermore, when used in communication, outputs are often validated by referring to the tool by name or by using the tool vocabulary. Strategy tools legitimize and sometimes even provide authority for an output.

Deriving concepts. Executives sometimes present an idea, notion or concept that has been derived, inferred or inspired by a strategy tool. This type of conceptual use is based on

perception, reasoning, judgment or intuition about the strategy tool or some way of using it. The concepts that executives come up with have to do with key elements in their organization, the relationships between these elements, and explanations for any attention-grabbing issues.

" …one approach we could use is Balanced Scorecard thinking. We need to look for predictive knowledge and anticipatory data from our processes that inform us early enough of trends and changes…Here we could look for instance at the…" (Executive HEVA19.10.2)

Conceptual knowledge holds the potential for creativity and innovation. A tool can bring new perspectives that provide new ideas when they are situated within the company context. Such ideas can have widely differing impacts, but are usually quite practical. The creation and use of concepts appears to be quite liberal in practical situations and motivated by executives' needs, not by quests for theoretical excellence.

Not using a tool or a feature of it. Not all the strategy tools employed in an organization are used by all executives. The data reveals differences in strategy-tool use and also strategy tool sets between executives in the same organization. Personal experience, differing levels of ability, interests and values guide tool use preferences and the depth of knowledge about a tool. At the same time as the tools have a harmonizing effect on strategy work practices in general, the personal choices and differences in tool use give opportunities for diversity.

2. User↔Context activities: Strategy work activities that strategy tools facilitate

In a nutshell, strategy tools homogenize strategy-work routines and build expected behavioral patterns that are recognized as strategy work. The variety in strategy-tool use, however, shows that executives reflexively adapt the tools to generate new modes of acting that answer their situated needs. I now examine these needs more closely by looking at what the users 'do' through their use of the tool. Also these activities I have categorized in four different groups.

Managing efficiently. Explicitly verbalized needs for strategy-tool use follow rational logic, and efficiency is the main reason that executives give for adopting strategy tools. *"Focusing activities", "Optimizing operations", "Making rational decisions", "Maximizing profit", "Perfecting timing", "Rationalizing development", "Systematizing efficiency",* and *"Streamlining routines"* are some of the reasons given for strategy-tool use. The rational logic, dominant in Western business cultures, favors tools and strategy-tool use that can be explained by efficiency. The strategy tools in 'Data management tools' category easily fit this rational framework; however some of the tools in the other strategy tool categories are not so readily justified by the means of efficient management. This perhaps explains why 'Data management tools' dominate the tool usage list (Table 1.) even though, in practice, managing efficiently is only one purpose they are used for.

Leading change. Executives in the study also use strategy tools for *"Supporting communication"* with the organization, *"Building team spirit", "Waking up to new situations", "Finding direction", "Creating new belief systems", "Committing organization"* to specific actions, and *"Engaging stakeholders"*. All these activities have to do with organizational change, and executives' need to lead change. Executives often employ 'Managers' management tools' to lead change, but generally all types of strategy tools, their components, results, aspects or concepts can be used for this purpose. For example, executives may use 'facts' provided by the tools to legitimize the need for change. On some occasions, tools provide a common vocabulary that is used when talking about change and sometimes strategy tools are used as a platform for visioning and experiencing together.

Gaining control and playing power games. The procedures dictated by the tools and the results they generate are also used as a source of authority for steering and shepherding the organization. Any type of a strategy tool can be used to enhance obedience, compliance and cooperation. Although strategy tools are not usually used explicitly for the purposes of control and power, there are many explicit needs for that sort of facilitation. Executives attend to power issues coming from outside the organization, for example market situations, laws, regulations, shareholder expectations, political matters and cultural questions, as well as power issues inside companies such as personal interests, value systems, and organizational settings. Changes in the hierarchy or perceived possible changes in internal or external power structures may prompt organizations to either adopt or retire strategy tools. Also the power delegated to a tool affects its use. Executives may interpret the use of strategy tools or the results they produce in ways that serve their own interests best. This means that executives' own political, cultural, historical, and social connections and interests play an important role in both strategy-tool use and tool choice.

Making sense and creating ideas. The process of making sense and creating ideas is often muddled and executives use strategy tools haphazardly and in parallel within other sense-making and innovation processes. They report using tools for *"Creating new business ideas", "Identifying possibilities", "Finding the vision", "Understanding the market" and "Predicting the future"*. Sometimes they use 'Creativity and innovation tools' for these purposes, but often resort to using 'Data management tools' in innovative ways. For example Business Intelligence tools, ERP and CRM, can be used to find proof that supports a particular idea or to understand specific issues better. In general, the currently used sets of strategy tools do not seem to support executives' needs for making sense and creating ideas in the best possible way, as executives warn that tools may cause *"Limited understanding"*, *"Wrong conclusions"*, *"Tunnel vision"* and *"Inadequate interpretation"*, and make clear that *"Tools are not a substitute for thinking"*.

3. Context↔Tool activities: Structures that determine the set of possible strategy tools

All four categories of User↔Context activities reported above are typical strategy-work activities described also by Mintzberg and Kotter[24] and strategy tools are used to support them. However, these activities do not occur in an isolated way that involves only the tools and the executives – instead, they take place 'on the run' in a social context, where the strategy tool forms a bridge between people who work at different hierarchical levels and who have different expertise. Furthermore, the set of strategy tools used in an organization joins the users of the tools to the world outside the organization. These contextual settings influence and direct both strategy tool use and the strategy tool set used in an organization. Next, I describe four categories of strategy-tool use activities that answer to contextual demands through the tool.

Being up-to-date. Executives in general are interested in keeping their professional skills up to date and working in successful organizations. They converse with their peers, with professional groups and consultants, and they read management literature to obtain information about the latest or most-popular strategy tools. To keep up with the competition, they mimic successful companies' strategy-tool solutions and also create new tool solutions themselves. Having a trendy strategy tool may also improve levels of confidence and radiate a positive image. However, they warn that *"…adopting new tools within a company does not always result in changes in the way that strategy work is carried out in the company"* (Executive SJCFN03.07), as sometimes new tools are a just a superficial way of keeping the organization up to date.

Reacting to market situation. *"External [market] pressure is important. If there is a common threat, the issue emerges [in the organization] and makes [it] ready for the use of tools."* (Executive HRAH87.30)

Any changes or imagined changes in the prevailing market situation may result in changes to the set of tools that an organization uses. Adoption of a new orientation to the marketplace by an organization may change its tool needs. As the primary consideration in the design of strategy tools appears to be achieving higher levels of efficiency, tools are usually adopted when this is an organization's aim. Declining markets can boost the adoption and use of strategy tools. Changes in the market situation, however, may also prevent an organization from using some strategy tools. One of the executives interviewed in this study explained that the market had become so volatile that the forecasting models previously employed were no longer reliable.

Matching resources and objectives. In general terms, the bigger companies that participated in this study are more knowledgeable about strategy tools, use a greater variety of tools and are more organized in their use. The resources available do make a difference to the strategy tool set. Also, a company's prime objectives affect the set of strategy tools

employed and/or the ways in which they are used. A non-profit organization that participated in the study could not use tools that aimed to maximize profit. Insurance companies that participated concentrated on risk analysis and portfolio tools.

Following the system. *"In this industry it is almost impossible to carry on business without these tools."* (Executive SSAM150H1)

Industry practices, traditions, rules, regulations, norms, structures, restrictions, history, culture, power relations and politics can all affect the choice of strategy tools. While all industries are affected by these structures to some degree, some organizations have little choice in connection with the tools they have to use. Organizational structures also affect the choice of strategy tools. Executives participating in the study explained that leadership, ownership, culture, values, history, politics and social settings all have an effect on the set of tools that an organization uses. In one company, the new owner brought in a completely-new set of strategy tools that users described as being much inferior to the previous set. Another organization reported that its owner believes in intuition and argumentation and that the use of strategy tools is not permitted. In contrast, some of the companies that participated in the study value expression of diverse viewpoints and strongly advocate the use of many different strategy tools.

All in all, context appears to determine the possibilities for strategy-tool use. Its primary function seems to be to limit the selection of strategy tools that are used, but it also affects the way or ways in which tools are employed, and can sometimes even dictate the entire set of strategy tools that a company uses. The findings of this study are summarized in Table 2.

Practical ways of using strategy tools	**Strategy work activities that strategy tools facilitate**	**Structures that determine the set of possible strategy tools**
Participating hands-on	Managing efficiently	Being up-to-date
Utilizing outputs	Leading change	Reacting to market situations
Deriving concepts	Gaining control and playing power games	Matching resources and objectives
Not using a tool or a feature of it	Making sense and creating ideas	Following the system

Table 2. Three perspectives on strategy-tool use.

Conclusions and discussion

This study was initiated by the question of when to use what strategy tools. To find an answer, the habitual use of strategy tools by executives in modern organizations was compared to the situated use of golf clubs and examined from that point of view. More specifically, three different perspectives on strategy-tool use were discovered: practical ways of using strategy tools, strategy work activities that strategy tools facilitate, and structures that determine the set of possible strategy tools. The framework presented in this paper allows for structured research on strategy tool use and contributes to the research on strategy tools and to the study of strategy-as-practice. The practical results of the study serve both strategy tool development and strategy work.

The study found that relationships between the user, the tool, and the context bring an incoherent and often contradictory plurality to strategy-tool use which makes the choice of a suitable strategy tool challenging. Also, tool use in organizations is restricted by contextual issues and there may sometimes be only little room for active choice in tools. Overall, in a dynamic social setting with changing markets and different demands on tools, it is quite clear that no single strategy tool is adequate. The task of finding just one most-suitable strategy tool is therefore not appropriate.

Rather, the task is to compile a set of tools that jointly cater to different contextual needs and demands and support diverse forms of strategy work while keeping in mind the different practical ways of using strategy tools (Table 2.). Assembling a set of strategy tools, rather than just concentrating on individual tools, increases freedom of choice and the possibilities for discovering and supporting organization's strategic advantages.

The study introduced four categories of strategy tools that make up a strategy tool set – in a similar way as woods, irons and putters form a golf club set. The four groups of tools, 'Data management tools', 'Managers' management tools', 'Conflict resolution tools', and 'Creativity and innovation tools', correspond well to the four different categories of strategy work activities that strategy tools facilitate ('Managing efficiently', 'Leading change', 'Gaining control and playing power games', and 'Making sense and creating ideas'). However, developers' descriptions of the tools place most of the tools in the 'Data management tools' group. Some tools also offer features of 'Managers' management tools' and 'Creativity and innovation tools', but 'Conflict resolution tools' are not readily found in organizations. There is a significant discrepancy between the array of strategy work that executives are using the tools for and the purposes that the tools are developed for.

In practice, to support their varied strategy work needs, executives often resort to innovative and creative ways of using tools. For example, to gain control and create ideas, executives often skilfully dream up, develop, adapt, adjust, convert, modify, reconstruct, and reshape

strategy tools to meet their needs. These innovative strategy-tool use practices point at a variety of ways to develop tools that are more equally distributed to different strategy tool categories. Von Hippel speaks about the importance of learning from the innovations made by the users.[25] After all, the purpose of strategy tools is to facilitate executive's strategy work, even if the structures that determine the set of possible strategy tools (Table 2) present challenges for tool development.

The most notable learning from executives in this study is the general observation that strategy tool sets used in organizations do not properly facilitate the entire array of strategy work activities although hundreds of different strategy tools are available on the market. This brings up the significance of paying closer attention and more careful consideration to different aspects of strategy work when compiling a set of strategy tools.

Compiling a set of tools

The practical principles for compiling a set of strategy tools that emerged from this study are already used by professional golfers assembling sets of golf clubs.

"Two driver strategy pays off for Phil Mickelson: …In the same way that he used spreadsheets and graphs of his past performances at Augusta to plot his strategy in winning in 2004, he began planning for this one several weeks ago. Mickelson hatched the idea of carrying two drivers while mulling over how to counter the additional length Masters chairman Hootie Johnson tacked onto the course, not to mention bigger bunkers and a forest of pine trees that sprouted up all over the place. So last weekend at the BellSouth Classic, Mickelson put both drivers in his bag and took them for a test-drive -- one to draw the ball left to right, with a maximum distance of about 310 yards; the second to fade it right to left, with a limit of 290. He complied with the 14-club limit by leaving the sand wedge in the car trunk, then finished 28 under par and won by a staggering 13 strokes."[26]

Full range of strategy tools. The set of tools selected should work together by complementing each other, supporting different viewpoints and facilitating work on issues that require special attention. Even if organizations use on average only five strategy tools, the tool sets can be chosen to facilitate different types of strategy work and to serve comprehensive goals. Carefully orchestrated use of the entire range of strategy tools over time support successful strategic change and control.[10]

Contextual limits and opportunities. Strategy tools are based on differing assumptions and work best in particular contexts, with particular ways of use and when seeking particular goals. Understanding the assumptions behind a strategy tool and any restrictions that may apply is an essential part of deciding whether that tool should be adopted. If a strategy tool is already in use, establishing exactly what the restrictions that apply to that tool mean in the

context in which the tool is used may yield vital information. Furthermore, the relationships between the tools are important, as different tools and their different assumptions complement each other.

Experience, creativity, reflexivity, and visualization. Assembling an effective set of strategy tools requires more than knowledge of the selected tools, experience with their use and the contexts in which they can be used. It also requires imagination. Unique combinations of strategy tools and innovative ways of using them require reflexivity and –as it is called in the game of golf - visualization. Similar skills should also be employed when renewing sets of strategy tools and in timing changes appropriately. Changes that affect users and contexts may require changes in tools selected to be part of the set. Furthermore, changes in any tool in the set may require changes in one or more of the others. The most-knowledgeable strategy-tool users are often proactive – they work with tool developers and actively seek out new tools that will meet their needs.

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APPENDIX

DESCRIPTION OF DATA					
Data collection method	**Survey**	**Unstructured e-mail and phone interviews**	**Participant observations**	**Presentations on strategy tools**	**Themed face-to-face interviews**
Objective	To create a wide view of contemporary strategy tool use in companies.	To obtain information from companies who did not wish to take part in the survey and companies who wished to provide information in addition to the survey.	To get situated hands-on experiences and real-life observations of contextual strategy-tool use and strategy work.	To obtain users' and consultants' descriptions of strategy tool use.	To check on emerged key concepts and to deepen understanding of specific aspects of strategy tool use and strategy work in companies.
Guiding questions	When to use what tools?	How are strategy tools used? When are tools not used?	What type of activity is strategy tool use and in what situations does it take place?	How do different contexts affect strategy tools used in the organization?	What are the strategy work activities that are facilitated by using strategy tools?
Type of data	Short, open-ended questionnaire (paper & web form).	Open-form e-mail reply or a phoned response.	Ethnographic observation.	Presentation in a university course.	Themed face-to-face interview.
Informants	Questionnaire sent to top-level managers involved in strategic management in the 500 largest companies in Finland [21]. Altogether 182 respondents from 172 companies, out of which approximately 70 percent were executives.	92 executives, managers or assistants working with strategy tools.	Researcher acted as a complete participant for 21 months at executive level in one of Finland's 500 largest companies.	Seven organizations gave a lecture in a university course on the use of specific strategy tools in their organization.	In total 21 informants (16 executives and five managers) working in large and medium-size companies in Finland. Also four follow-up interviews to check on key concepts.
Contents	Respondents own lists of : 1) strategy tools used in supporting the making of major decisions in their companies, 2) different purposes for these strategy tools, and 3) advantages and disadvantages of using the tools.	The data varies from short statements about why strategy tools were not used to lengthy descriptions of strategy routines and processes.	The company employed two strategy tools and was in the process of adopting a new tool. Researcher took part in both strategy work and strategy tool use.	Four presenters represented major Finnish companies who described the use of one specific strategy tool or strategy tools in general. Two organizations were consulting companies that reflected on client's tool use. One presenter was from a military organization.	Interview themes range from general strategy work to specific points concerning the core categories. Some interviewees also showed documents related to their strategizing and strategy tool use (e.g. slides and plans of the strategy process, documents from strategy meetings, and printouts of strategy tool results).
Recording of data	All statements were coded.	All data was transcribed.	Notes were taken of formal and informal meetings at different levels in the company. Other material includes minutes taken at executive and board meetings, and printouts of strategy tool results.	The presentations were videotaped and transcribed in part.	Notes were kept of four interviews and 21 interviews were recorded and either fully or partly transcribed. Notes were taken to describe additional documents.
Emerging concepts	Strategy-tool use is contextual and subject to institutional forces.	Strategy-tool use and non-use is embedded in strategy work.	Different ways of using strategy tools and categories of strategy work activities.	Relation of strategy-tool use to users, tools and contexts.	Final core categories

Essay Three

Moisander J. & Stenfors S.

Exploring the edges of theory-practice gap: Developers and users of strategy tools

EXPLORING THE EDGES OF THEORY-PRACTICE GAP: DEVELOPERS AND USERS OF STRATEGY TOOLS

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ABSTRACT

This paper takes a discursive, strategy-as-practice perspective to the study of strategy tools and the theory-practice gap in strategic management research. Based on a case study, the paper argues that differences in epistemic culture may complicate communication and co-operation between academics and practitioners. These differences may also result in management scholars producing knowledge and strategy tools that lack practical pertinence for corporate actors, particularly in the context of contemporary post-bureaucratic knowledge organizations. The paper suggests that there is a need for strategy tools that promote dialogue and trust and function as learning tools. Furthermore, it concludes that the development of strategy tools that genuinely support practical strategizing calls for a more social model of knowledge and strategy work.

Keywords: management tools; strategic management; epistemic culture; sociology of technology; strategy as practice

INTRODUCTION

> *"We do not collect information to build up bureaucracy. We only collect information that we perceive important. Not every [strategy] tool with a fancy name interests us. We achieve very good results; our growth has been exceptionally fast and profitable, and we don't believe that [the use of] theoretical models would empower us to get even better results. We focus on profitability, not on complicated calculations. Our good fortune is based on the simplicity of our business idea, and most of our achievements depend on our people, who work better with and through personal contacts than by using [strategy] tools.."*
>
> (Executive of a large Nordic corporation, Aug. 2003).

There are currently hundreds of different strategy tools, i.e. management tools that support strategy work, available in the market, increasingly in accessible computerized forms. Strategy tools, such as Balanced Scorecard applications, SWOT analysis, Real Options, Value Chain, Porter's Five Forces and Executive Information Systems, are generally designed to facilitate strategic management and to make practical strategy work in organizations more effective. These tools are often based on academic research and they offer practitioners possibilities to implement management theory in practice. Strategy tools are introduced into practice through business schools, consultants, popular business articles and strategy literature (Abrahamson, 1996; Sahlin-Andersson and Engwall, 2002). According to several studies, however, strategy tools tend to be missvalued, under-utilized and misinterpreted by business practitioners (Kasanen, Wallenius, Wallenius, and Zionts, 2000; Miller and Ireland, 2005; Nutt, 2002; Styhre, 2002).

While much of the existing management and organizations literature takes a neo-institutional view on these topics and discusses the seemingly irrational adoption practices of tools as a macro level diffusion phenomenon (e.g. Abrahamson, 1996; Kieser, 1997), we shift the focus by taking a form of strategy-as-practice perspective (Whittington, 2003). Our focus is inspired by two articles in Organization. Firstly, Timothy Clark's critical article on popularity of management fashion theories where he concludes that "One reason for the preoccupation with management fashion may be an increasing concern and insecurity about the status and value of academic knowledge." (Clark, 2004: 2). Secondly, Damian Hodgson's

(2004) report on bureaucracy caused by a "modernist" project management system in a "post-bureaucratic" organization.

In our paper, the reported problems in producing, promoting and using strategy tools that support practical strategy work in organizations are discussed as a case of theory-practice gap that stems from differences in epistemic cultures of users and developers of a strategy tool. Moreover, we maintain that this gap originates from two different epistemic cultures or rather discourses of corporate epistemology that practitioners of contemporary knowledge organizations and management scholars draw from (Mc Kiernan and Carter, 2004; Seidl, 2006; Whittington, 2004).

Mainstream strategy scholars have tended to draw on a discourse of corporate epistemology that may be described as "modernist" in the sense that it values "scientific detachment over practical engagement, the general over the contextual, and the quantitative over the qualitative" (Mc Kiernan and Carter, 2004: 62). Many critics have argued that such a view to producing and warranting knowledge in organizations may guide management scholars to producing knowledge and strategy tools that lack practical pertinence for corporate actors (Mc Kiernan and Carter, 2004; Whittington, 2004). Also more generally, there have been reports of a "relevance gap" (Aram and Salipante, 2003: 189) and numerous calls for a closer reconciliation of academic theory with managerial reality. Many have argued that the practices of inquiry that are prevalent to mainstream management research do not necessarily provide knowledge that supports everyday strategy work in contemporary organizations (Aram and Salipante, 2003; Gopinath and Hoffman, 1995; Pettigrew, 2001; Powell, 2001a).

The purpose of this paper is to respond to these calls by working towards a better understanding of the cultural-epistemic differences that may sometimes divide corporate practitioners and modernist strategy scholars. Drawing conceptually from sociology of technology (Suchman, 1994), social epistemology (Longino, 2002, 1990) and the discursive approach to organizational culture (Linstead and Grafton-Small, 1992; Riad, 2005), we view strategy tools as discursive artifacts and technologies of organizational knowledge production, which take diverse forms in different epistemic cultures (Knorr Cetina, 1999). We argue that differences in epistemic cultures, clashing conceptions of 'knowledge' and the 'subject of knowledge' in particular, may result in management scholars producing knowledge and strategy tools that lack practical relevance for corporate actors. This may be the case particularly in the context of contemporary flat, networked and team-based learning organizations where knowledge is to be taken not only as a property of the individual mind of an expert or a knowledge worker but also as something that takes the form of accumulated

experience and learning embodied in the organization's culture, systems, processes and practices.

We report findings from an empirical case study, which focuses on a co-operative project between a group of distinctively "modernist" academic strategy tool developers and a group of managers from a contemporary knowledge organization. Based on ethnographic and documentary materials, we illustrate how members of these two cognitive communities invoke two different, and to some extent conflicting, discourses of corporate epistemology in their talk. We examine the forms of intelligibility that these discourses provide for making sense of organizational knowledge production (e.g. about how knowledge is to be constructed and warranted in the organization), and analyze how they work to guide and constrain epistemic practice in the context of flat, networked and team-based project organizations. We do this to elaborate on the cultural-epistemic boundaries that they entail (Suchman, 2005, 1994) and to identify and discuss the challenges and opportunities that these boundaries create for management scholars.

STRATEGY TOOLS AS TECHNOLOGIES OF ORGANIZATIONAL KNOWLEDGE PRODUCTION

In the contemporary knowledge based economy, strategy tools can be viewed and analyzed as technologies of strategy work and organizational knowledge production (Clegg, Carter, and Kornberger, 2004; Graham and Williams, 2005; Whittington, 2004). These technologies involve not only conceptual tools but also material apparatus that range from complex computer programs to simple white boards. Strategy tools thus typically give the organization an opportunity to implement or use a set of theories about strategic management in practice. As such, strategy tools may function as non-human actors actively involved in the making of the organizational realities in which they are used (Knorr Cetina, 1997; Suchman, 2005).

Findings from sociology of technology indicate that although co-operation and co-learning are generally emphasized and valued among the developers and users of new technologies, there are often clear organizational and cultural-epistemic differences that complicate the discussion and dialogue between the two communities (Brown and Duguid, 1994; Suchman and Bishop, 2000). These differences function as cultural and practical boundaries that have to be dealt with and crossed for successful cooperation to occur.

As management technologies, strategy tools are inscribed with particular moral orders and visions of the patterns, purposes and contexts of their use that originate from the

developers' epistemic culture and the often received ways of looking at organizational and managerial practice. Developers of strategy tools build into the tools certain interpretive schemes for the work being carried out, certain facilities and resources to accomplish that work, as well as certain organizational and managerial forms that define the organizationally sanctioned way of executing that work (Nardi and O'Day, 1999; Suchman, 1994). Strategy tools therefore involve moral orders, which impose correct behaviors and foster good practices (Latour, 1988). When corporate actors delegate tasks to technologies those technologies then start to impinge behaviors back on everyone who encounters them.

Therefore, the development of strategy tools cannot be seen simply as a creation of discreet, intrinsically meaningful objects, technologies or devices (e.g., models or systems), or even networks of devices (Suchman, Blomberg, Orr, and Trigg, 1999). Instead, the development, introduction and use of strategy tools can be understood as cultural production of new forms of epistemic and managerial practice. In this paper, we focus only on the epistemic aspects of the cultural production that the development and use of strategy tools entail. We shift the object of inquiry from knowledge about strategy tools to the epistemic cultures that create and give authority to this knowledge.

By *epistemic culture* we refer to a generally shared but constantly negotiated, contested, and changing system of representation (Hall, 1997) that works to construct and give authority to particular ways of knowing in epistemic or cognitive communities (Knorr Cetina, 1999; Longino, 2002, 1990). It offers specific forms of intelligibility for people to make sense of 'knowledge production' and themselves as 'knowers'. It guides and constrains action in organizations by making available particular ways of thinking and talking about knowledge and knowing that are grounded in social practice. It organizes and orients organizational knowledge production particularly through received notions and taken-for-granted practices. These might include, for example, the taken-for-granted cognitive goals and values, received theoretical background assumptions, and collective conventions of normal practice that prevail in the epistemic community (Longino, 2002, 1990) as well as the role expectations or specific forms of identity that are available for 'knowers' or subjects of knowledge in the community. Epistemic cultures exert their influence through complex forms of power and the implicit norms that these sorts of received notions and practices involve (Linstead and Grafton-Small, 1992: 339-40).

In this paper, we thus see epistemic culture as *discourse* or as an open system of representation, which constitutes the conditions of possibility for subjectivity and epistemic agency—the specific conditions for being and acting as a person and knower—in organizations (e.g. Hall, 1997: 1-6; Howarth, 2000: 9). It "make[s] up how we know what we

know" (Knorr Cetina, 1999: 1). From this perspective, a discourse should by no means be understood as a representation of what is known or believed in a community but rather as a precondition for knowledge about organizational knowledge production (Knorr Cetina, 1999: 10).

Hence, the aim here is to identify discourses of corporate epistemology that constitute epistemic cultures and to examine the forms of intelligibility that these discourses provide and offer for making sense of knowledge and epistemic practices in organizations. This theoretical approach to culture enables us to study the ways in which the space of possible and actual action is organized and determined by different epistemic cultures. It also gives us an opportunity to identify problematic issues and conflicting goals, which generate tensions and create cultural boundaries that may complicate collaboration between scholars and practitioners.

RESEARCH DESIGN AND METHODS

Our empirical analysis is based on a case study (Stake, 2003), carried out using discourse analysis (Howarth, 2000) of naturally occurring documentary data as well as cultural talk produced using focus groups (Morgan, 1993), personal interviews (Holstein and Gubrium, 1997), and participant observation (Rosen, 1991).

The case

The case analyzed in this study is a cooperative project between academic developers and corporate users of a strategy tool. The developers are faculty members and graduate students of a business school, who specialize in operations research/management science (OR/MS) models. The users are managers of a division of a large corporation of the utilities sector, who have been using a strategy tool developed by the OR/MS scholars for pricing and in competitor analysis. The developer-scholars aim to engage in further collaboration with the user-managers to produce "decision support for strategic decision-making" in the company. We thus look at these two groups as potential partners and collaborators.

The company is a large corporation which could be described as a flat, networked and team-based learning organization, where a culture of dialogue, collective decision-making, and team work is cultivated. It may be characterized as a *learning organization* where collective knowledge, shared expertise, joint perceptions, and contextual skills are accented. To illustrate, the company defines its corporate strategy and core values in terms of "creativity and innovation" through "continuous learning" and "readiness to change",

emphasizing "co-operative spirit" through "respect for others" as well as "open and active communication". Good results in this discourse are attributed to "joint achievement" by a "successful team". The aim with these policies is to encourage and foster creativity and risk taking in the organization as well as to provide knowledge workers with the challenge needed to have them stretch beyond their perceived limits.

The academic community is a well established OR/MS department specialized in developing tools that support decision making. The science of OR/MS draws from the disciplines of mathematics, economics, and cognitive psychology. The OR/MS community was chosen because it typically holds onto the "modernist" epistemological stance that characterizes much of mainstream strategy literature.

The tool is a Data Envelopment Analysis (DEA) model, a benchmarking model, that is used by the authorities in the utilities sector, and thus by corporations in the industry. DEA is based on original ideas of Charnes, Cooper and Rhodes (1978) and today employs state-of-the-art economic theories of efficiency. Computerized DEA models are nonparametric "black box" models (i.e., knowledge is built in and closed into the model), which compute given data into an efficiency score that reveals how efficient a company is compared to its competitors.

Strategy tools, such as the one analyzed here, are generally offered by an array of disciplines (Bain&Company, 2005). Traditionally, they have been promoted by consultants and management scholars geared towards practical solutions. Recently, improvements in information technology have accelerated the development of strategy tools, making the use of more complex tools possible and increasingly popular in everyday contexts. These developments have also encouraged OR/MS scholars to develop new mathematics or logics - based tools to support strategic management.

The selection of the case and data was based on theoretical considerations (Stake, 2003). The case is not a typical case of collaboration between management scholars and practitioners or between academic developers and corporate users of strategy tools but rather a case that manifests the phenomenon intensely and offers a particularly good opportunity to learn about cultural-epistemic boundaries that may divide the modernist strategy scholars and corporate practitioners of contemporary knowledge organizations (Stake, 2003: 152).

Data

The data for our empirical study consist of four different types of textual data: (1) *personal interviews*, taped and transcribed into texts; (2) *focus group data* videotaped and fully transcribed into texts; (3) *participant observation data*, field notes and journal reflections; and (4) *documentary and archival* data.

Personal interviews and the focus group. In the beginning of the research process, a set of background interviews (five taped and fully transcribed, two recorded in writing) were conducted to contextualize the case. A high level executive of the case company, involved in company development, was interviewed twice to gain an overall understanding of the strategy process, the involvement of the organization in it, and the strategy tools used. Also, six high level managers from other companies in the industry were interviewed to collect information on the general market situation, their use of the strategy tool in question and strategy tools in general, and their strategy processes.

Then, to focus specifically on the epistemic cultures and the associated discursive practices of the developers and users of the strategy tool, personal interviews and a focus group were conducted. Two OR/MS developers and four corporate users of OR/MS models were separately interviewed twice during the case study. First, personal interviews were conducted and tentatively analyzed so as to get a preliminary understanding of the important topics and issues that should be discussed in the planned focus group. Both developers and users were asked to describe their views on how formal methods are and can be used in organizations for strategic planning and everyday managerial work. Second, follow-up interviews were carried out to elaborate on the themes and issues that had come up in the course of analyzing the focus group data as well as the other empirical material. Both the developers and users were particularly asked to comment and reflect on the views, ideas and opinions that they themselves and the other participants of the focus group had expressed about the use of formal methods in business organizations. Excerpts from the focus group data were used to elicit this information.

The focus group was organized to elaborate on the themes brought up in the personal interviews as well as to focus specifically on the interaction between the two groups. The focus group consisted of two developers and three users (one user was absent) who were led to discuss the role of formal methods in management work and in decision-making.

Participant observation data. Participant observation was carried out at two levels. One of the authors collected data as a member (complete participant) of the observed OR/MS community, as well as a board member of the national OR/MS society and as a participant of international OR/MS conferences. The other author collected data as an outsider participant in research seminars and informal get-togethers organized by the department where the OR/MS developers were employed.

Documents. The documentary and archival data analyzed in this study consists of

publicly available communications material, in printed and online forms, on the case company as well as on the global OR/MS community. This material includes the annual report and the website of the case company as well as current newsletters and websites of the International Federation of Operational Research Societies (IFORS), Institute for Operations Research and the Management Sciences (INFORMS) and a National Operation Research Society.

Analysis

The empirical data gathered for the study were analyzed as texts. In line with the basic premises of most forms of discourse studies, our analysis was based on the assumption that social texts, such as the material gathered here, can be studied for the cultural forms they realize and make available. In other words, to learn about epistemic cultures we focused on the discursive practices, interpretive repertoires, modes of argumentation and expressed epistemic virtues through which the corporate users and OR/MS developers organized their talk about strategically valuable knowledge and about the role of strategy tools in producing this knowledge. The analysis was carried out using basic analytical procedures employed in discourse studies, particularly those recommended by Potter and Wetherell (1987). Our aim was to identify the discourses of corporate epistemology that practitioners and scholars call on in their talk by searching for patterns that organize their statements (and what is sayable and thinkable) about knowledge and knowledge production in organizations. We examined the forms of rationality that inform and justify these ways of thinking and talking about knowledge and epistemic practices. Finally, we also analyzed the sorts of subject positions and subjects of knowledge that personify the identified discourses.

The methodology that we have chosen has its limitations (e.g. Reed, 2000).Yet, in our case, it allows a perspective that emphasizes social aspects of epistemology (e.g. Chia, 2000), and brings deeper understanding of the challenges of strategic management. As regards generalization of our results, it seems worthwhile to emphasize that our purpose is to work towards a better understanding of *how* the cultural-epistemic boundaries between practitioners and academic scholars are produced and maintained in text, talk and signifying practices. Our aim is not to say anything about how typical or wide-spread these boundaries are within the scientific community in general. Neither do we intend to make any claims about the personal beliefs of single members of the groups that we studied. Rather, our purpose is to offer some clarification and to raise some critical questions about the cultural conditions of successful collaboration between academic strategy researchers and practitioners, as we have pointed out.

SCHOLAR AND PRACTITIONER ARTICULATIONS OF EPISTEMIC CULTURE

As anticipated, two different discourses of corporate epistemology were invoked in the texts that we analyzed. While the OR/MS scholars tended to reify a discourse that can be described as "modernist" in the sense that it emphasizes the role of individual 'knowers' as detached and objective decision-makers, the corporate managers also called on a discourse that acknowledges the social nature of knowledge. We labeled this discourse "post-bureaucratic" as it seems to be in line with the contemporary post-bureaucratic management philosophies (Heckscher and Donnellon, 1994; Powell, 2001b; Powell, Koput, and Smith-Doerr, 1996). These two discourses may be understood as two different *epistemic cultures*, which offer different strategies and policies for creating and warranting knowledge in the organizations (Knorr-Cetina, 1999: 1-3). Next, we shall illustrate the observed differences in the epistemic cultures in three different areas: subject of knowledge, nature of knowledge and knowledge creation.

Subject of knowledge

In the modernist OR/MS culture the knower, the subject of knowledge, is generally an individual whose epistemic authority is based on rational and logical thinking as well as on a rigorous use of systematic methods. In line with the ontological presumptions characteristic of the operations research discipline (Rosenhead, 1996), the subject position (the collection of qualities, rights and obligations, appropriate ways of being and acting) that the OR developers produce for the knowledge worker, in their talk, is that of the single individual decision-maker who pursues predefined values and interests.

In the OR/MS developers talk, corporate knowledge workers are represented as "decision-makers". The term refers to a fairly independent, self-directed, and ideally rational "top-manager" of a hierarchically organized corporation. As the *Institute for Operations Research and Management Science* (INFORMS) identifies its target group, OR/MS is for "time-starved executives" who want to make "bolder decisions with less risk" (INFORMS, 2004a). The description of what operations research is at the INFORMS web page is illuminating:

> *In a nutshell, operations research (O.R.) is the discipline of applying advanced analytical methods to help make better decisions. By using techniques such as mathematical modeling to analyze complex situations, operations research gives executives the power to make more effective decisions and build more productive systems based on: More complete data; Consideration of all available options; Careful predictions of outcomes and estimates of risk; [and] The latest decision tools and techniques. (INFORMS, 2004b)*

Consequently, the modernist OR/MS discourse of corporate epistemology directs developers to design strategy tools primarily for individual use by people who have considerable power in the organization and who run the firm fairly independently, mainly delegating tasks to their subordinates. Much like mainstream strategic management theory, such thinking tends to ascribe to the managers great powers to define problems, identify sources of competitive advantage, and to redirect their business (Alveson and Willmott, 1996).

In the post-bureaucratic culture, however, the subject of knowledge, is not only an individual decision-maker but significantly also a community of people working and producing knowledge individually and collectively in various teams and work groups organized around various intra and inter-organizational collaborative projects. Talking about their daily work, the managers we interviewed constantly refer to "management teams", "auditing teams", "development teams", and "project teams", in which they carry out their tasks. Overall, the *knower,* in this talk, is discussed in terms of teams and individuals as team-members, as the following extract also indicates.

Interviewer: ...what happens during your workday?

> *Manager: [...] on many days I have meetings until midday; they can last till afternoon... I tend to have meetings every day. It is very rare to have a day entirely for one's own activities. Also, the days pass, pretty much, talking to different people about ongoing projects and then again with the members of my team. So [my daily work] is, of course, of this social [nature]... (Practitioner 1I72T)*

Consequently, the knower, in the post-bureaucratic discourse of corporate epistemology, is not only the individual "executive" who uses strategy tools to make better decisions. The knower is also a multi-tasking team-member who participates in collective processes of knowledge production and decision-making and whose epistemic agency and authority may well be continuously negotiated and renegotiated on a daily basis.

Nature of Knowledge

> Well [the model] can, of course, be used solely to evaluate, i.e. to evaluate what their technical efficiency is just like here, so that no assumptions are made about the preferences of the decision maker, and this now is the basic idea. Then, what we also have been developing is combining multiple criteria decision making, and in a way setting on top of these output measures these preferences [...] so there is this one level that is added. Well, this is then immediately a strategic choice, and some upper level manager can define the importance of goals, that technical efficiency. And then, the next phase is that this [model] can be used when planning how the functions could be improved, if you are inefficient. (Scholar 1I68P)

In the modernist OR/MS culture, knowledge is generally discussed as objective, clear, indisputable, and logical facts, e.g. probabilities, results, best alternatives, input data, parameters—mainly numbers. For modeling purposes knowledge needs to be explicit, at least partly. Intuition, feelings, information about power relations or political implications are not often treated as knowledge. Good knowledge, is also correct and accurate—it mirrors reality and approaches the truth. Moreover, it is often something that can be represented in terms of a logical structure and a set of empirically testable hypotheses (also Déry, Landry, and Banville, 1993).

This type of knowledge can be expressed as a set of propositions detached from the knowing subject (Scharmer, 2001), and it can therefore be moved from one organizational context to another without changes in the validity or content of the knowledge. Knowledge is thus a 'thing' that can be gathered and stored in remote data banks or documented as correct procedures and later used when a need rises. In a OR/MS seminar that we attended as participant observers, many of the scholars talked about strategically important knowledge in terms of "case banks" for documenting "best practices" and "efficient processes".

Moreover, in the modernist OR/MS culture knowledge is also value free, or the values have been made explicit. In the interview talk of the OR/MS scholars, the possibility of a single uncontested representation of the problematic situation under consideration is generally taken for granted. There is always a solution to a problem that is the "best possible" (i.e., closest to the truth with the current level of scientific expertise), as one of our informants put it.

> *As I said in the beginning, I believe that we created the best model that could be built at the moment, and then, of course, there are issues, which still should be improved. And the argument that I would here use is this argument that I have learnt from scientific realism, that there exists what the best scientific explanation understands to be existing. In other words, we believe that we have operated in the best way, not perfect, of course… (Scholar 1I99P)*

In this sort of knowledge culture, then, disputes concerning appropriate courses of action would seem to stem either from erroneous beliefs, lack of accurate information, or failures in logical thinking and calculation. Disagreements can thus be solved by distributing correct information about facts and by getting informed about the priorities or values of an "upper-level manager".

In general, much like the traditional strategic management scholars (Aram and Salipante, 2003) OR/MS developers tend to talk about good—or rather "optimal"—knowledge in terms of general and preferably timeless principles that are valid across a variety of situations. This makes ideal knowledge permanent, complete and unified (or unifiable). It is assumed that the relevant contextual or situational factors can be discovered and abstractly represented or objectified, and then included into the general models.

In the post-bureaucratic culture, however, knowledge is not merely the property of knowledgeable and intelligent individuals. Knowledge is rather a collective achievement of the entire staff of the firm. In the corporate strategy of the case company, for example, employees are commissioned to work together, creatively and innovatively, to achieve business performance in rapidly changing market environments. In such an epistemic culture, the nature of knowledge is social, perspectival, and contextual.

In the interview and focus group data, practitioners repeatedly talk about knowledge in terms of collective processes and objectives, e.g., in terms of "development of internal processes according to the company vision". Accordingly with their corporate vision and values, they represent knowledge as intrinsically linked with the social and learning processes within the organization. Corporate knowledge seems to be conceptualized as accumulated experience and learning embodied not only in the individual members of the organization but also in the organization's culture, systems, and processes (see also Demerest, 1997; Sveiby, 1996). In this sort of epistemic culture, knowledge is essentially *social* in nature.

Such strategic knowledge is also *perspectival*. It is relative to specific interpretive frameworks and perspectives of those who are making the knowledge claims (Miller and Fox, 2001). It usually thus pertains to a point of view or an 'agenda' that is not necessarily neutral

or unbiased, as one of the practitioners pointed out.

Moreover, as project workers and members of different intra and inter-organizational teams and work groups, corporate knowledge workers need to co-operate with numerous different professionals in different organizational environments, continuously adapting to changing relations of power and rules of interaction. Each of these micro-cultural environments may well have different objectives, norms and standards for producing strategically valuable knowledge. Expertise in the post-bureaucratic epistemic culture is hence also highly *contextual.*

In their talk, the practitioners explicitly recognize this and express a need for a multiple different models, which can provide information and offer insights from a number of different angles.

> *In my mind [...] measurements should be set so that there would be various points of views. One measurement would give you one viewpoint and then there would be another indicator that would offer some other viewpoint of the same topic. And then, summing them up one could see what effects these measurements together will have from the first point of view and then from the other, and what their combination is. (Practitioner F74L)*

On the whole, the heavy reliance on 'facts', which characterizes the scholar talk, is missing in corporate managers talk. A fact cannot necessarily be isolated from values and it does not become a fact until it is valued by fellow knowledge workers. In the new post-bureaucratic organizations, where the employees do not always work in formally hierarchical subordinate-superordinate relationships, different people may well have their own interests and perspectives, which lead them to pursue different objectives, and to identify different factors as relevant (Baker, 1992). In such a case, there is usually a potential for conflict (Rosenhead, 1996).

Therefore, the criteria for good knowledge are rather pragmatic in the post-bureaucratic epistemic culture. Rather than searching for "optimal" solutions, practitioners are guided to search for knowledge that works. In their talk, the managers described good knowledge as something that gives "food for thought". They explicitly acknowledged that knowledge is partial, fragmentary, relational and bounded, and thus called for tools for integrating knowledge from multiple perspectives.

Knowledge creation, learning and the role of strategy tools

In the modernist OR/MS culture, corporate knowledge creation is based on

solving problems through a process of rational decision-making with the help of different strategy tools. In the vein of the mainstream strategic management literature, organizations are represented as problem seekers and solvers (Von Krogh, Roos, and Slocum, 1994: 57), and OR/MS models as devices that produce solutions to these problems. There is no talk, however, about the particular ways in which the obtained solutions should be implemented in corporations.

In our data, the scholar-developers do not explicitly talk about learning. Implicitly, however, learning is discussed in terms of gaining "more complete data" through accumulation of new and better quality facts, and also in terms of mastering the "latest decision tools and techniques" for organizing information and solving complex problems (INFORMS, 2004c).

This is understandable because in the OR/MS literature there has been very little discussion on the role of models in individual or organizational learning. It is rather assumed that the information and the analytical power that the tools provide is strategically important as such. Strategic advantage can be created by teaching the individuals in the organization to complete their appointed tasks better, faster and more efficiently by using appropriate mathematical technologies and correct logic. The actual learning processes through which this information is transformed into strategically valuable knowledge are not discussed.

Consequently, in the modernist OR/MS culture, the role of strategy tools in the creation of business knowledge is to help the decision-maker to make better decisions. Much like INFORMS, which uses "Operations Research: The Science of Better" as their slogan, the scholar-developers offer their expertise to correct logical slips and errors in decision-makers' information processing. To illustrate, in the focus group discussion, one of the scholars used his opening lines to demonstrate the usefulness of academic expertise for the corporate world by presenting his prospective customers a hypothetical investment problem. When the practitioners failed to solve the problem, the scholar reflected upon the incorrect answers as follows:

> *This example just, in general, means that it is very hard to make those decisions, even when a problem looks fairly simple… Well, I have used this example to show company executives […] This [incorrect investment option] is tempting, and senior executives just … of course …it cannot be seen that, that it is profitable to invest into those…So, … one could begin [this meeting] by pronouncing that formal methods are needed. And, if we are wondering what kind of collaboration [there exists] between companies and universities… then it could, of course, be said that there already is cooperation with us too. (Scholar F52P)*

In other words, the role of the OR/MS scholars and models is to "help" corporate actors who are incompetent in mathematical-logical reasoning or who fail to apply it in decision-making. Formal methods and decision support systems provide the managers with "correct information" and suggest optimal choices based on a systematic mapping and measurement of the factors, components and attributes that are relevant in the decision-making contexts. By and large, a logical or mathematical model is assumed to do the job.

In the post-bureaucratic epistemic culture, knowledge creation is a collective endeavor, based on continuous processes of organizational and individual learning, open communication and creative interaction between members of the organization. Decisions are made in management teams and work groups, consensus about a chosen course of action thus being reached through discussions and negotiations between different actors. Such "joint management practices", as they were referred to, rely on achieving commitment through negotiation of the values, interests, and objectives involved. Therefore, corporate knowledge creation, in these organizations, would seem to involve various forms of collective problem structuring, collaborative problem solving and interactive learning (e.g. Argyris and Schön, 1996; Senge, 1990).

At the level of the individual knowledge worker, the decision-making problems that the corporate managers and other knowledge workers face tend to be unclear and difficult to formulate. The facts, goals, values and situations on the basis of which decisions are to be made are represented as unstable or altogether unknown beforehand. Decision-making problems thus need to be structured, defined and clarified 'on the run', in the process of making the decisions. Talking about his everyday work, for example, a manager pointed out, in the focus group discussion, that he cannot necessarily take time to define "big decisions". He rather has to make a number of "small decisions", quickly responding to changes in situations as they emerge. And it is often only at hindsight that he realizes that a more systematic decision should have been taken. As he puts it, "it would be good if I always actually *had* a problem".

In these sorts of situations, neither formal decisions nor exact decision-moments can be detected. Decisions and events rather evolve over time dynamically, and managers take small decisions to achieve decided goals instead of taking one big decision. In situations like these, the decision-process often turns into a process of muddling through (e.g. Weick, 1995). One thing leads to another, and earlier events and moves guide and constrain the way in which the practitioner can perceive and structure their current problems.

Moreover, accordingly with the post-bureaucratic management philosophies, the production of strategic knowledge is represented as a dynamic, spiral process of continuous

development and knowledge creation. For example, one of the practitioners described this by noting that "everything is depicted as spiral processes". In the contemporary business environments, knowledge is dynamic and there is no static finish that would reveal the set of truths about the world. Hence, there is no ending to the spiral of knowledge creation.

In this sort of knowledge culture, the role of strategy tools is to foster dialogue, to help to elaborate on new ideas, and to bring about critical views. The DEA model, for example, is represented primarily as a learning-tool, which is used conceptually for both individual and collective processes of knowledge creation. The practitioners do not talk about using the model for its prescriptive purposes, i.e. for calculating efficiency scores for strategic decision-making. It seems, therefore, that to make use of these 'modernist' technologies of knowledge production, practitioners of the contemporary post-bureaucratic knowledge organizations may adapt them and reinterpret their use creatively (see also Graham and Williams, 2005; Jarzabkowski, 2004; Zbaracki, 1998).

DISCUSSION

Our empirical analysis suggests that the conditions of possibility that the modernist and the post-bureaucratic epistemic culture offer for knowledge production, learning and organizational activities in general, differ and even conflict in many important ways. Below we shall discuss a number of issues that we find problematic for bridging the alleged theory-practice gap in the field of strategic management research.

In the post-bureaucratic epistemic culture, knowledge would seem to consist of a body of diverse theories and their articulations onto the world, which changes over time in response to the changing cognitive needs of those who develop and use theories. The corporate knowledge worker works in several simultaneous and parallel projects, teams, and functions, where knowledge is produced in collaboration with other members of the organization. In this environment, much of strategically valuable knowledge is embedded in historically specific social and cultural practices. It emerges from the interplay of opposed or complementing styles and points of view.

In this sort of epistemic culture, knowing is not so much a matter of pooling objective facts and figures. Knowledge is not a static 'thing' or something that can be easily proceduralized or commodified. As Miller and Fox put it, (2001: 675) here can be no "grand storehouse of knowledge" that aggregates into truth for everyone Knowledge is rather contextual and perspectival, always pertaining to a point of view or to an implicit 'agenda' that is not necessarily neutral or unbiased. In this culture, black-box-models, such as the

DEA model studied here, may understandably be viewed as problematic or even suspect because there are no easy ways of scrutinizing the implicit values and assumptions on which the model is based. As one of the managers put it during the focus group discussion, it is important to understand "what is entered in the model" because the models often have implicit "political steering effects".

Furthermore, in post-bureaucratic epistemic cultures, strategically valuable knowledge is also known to be highly dynamic in nature; it is characterized by continuous change and activity. In this sort of learning environments, important decision problems are often hard to pinpoint and define, and processing information, from outside in, to solve existing problems and to adapt to changing environments is not enough. It is necessary to create new knowledge and information from inside out, thus redefining both problems and solutions as well as actively creating the environment in the process (also Von Krogh and Grand, 2000: 14). The goal is to provide surroundings where limits can be stretched, old wisdom challenged, and new views discovered.

Therefore, it may be very difficult to create a data base of best practices or appropriate procedures and methods that would provide conclusive knowledge for all the members of the post-bureaucratic epistemic culture. Best practices emerge in a particular context, and in order to apply them to another context, they must first be disassembled and then re-embedded in a different organization or situation (Newell, Swan, and Kautz, 2001). Brown and Gray (2004) describe this problematic process as planting a seed, germinating it in its new context and then cultivating it slowly by allowing it to take the form that honors its new context.

Consequently, practitioners, the users of management knowledge, cannot be taken as passive recipients of 'more advanced' tools, techniques and concepts (Gibbons, Limoges, Nowotny, Schwatrzman, Scott, and Trow, 1994; Pidd, 2004). They must be viewed as collaborators, who need to understand the limits and possibilities of the 'theory' embedded in these knowledge artifacts. Practitioners need to be actively engaged in configuring and incorporating management tools into the everyday practices through which knowledge is created in organizations.

IMPLICATIONS FOR THE DEVELOPMENT OF STRATEGY TOOLS

Despite the possible epistemic-cultural differences between academics and practitioners, we argue that strategy tools hold the potential for bridging the gap between theory and practice. From the perspective of an academic management scholar, a strategy

tool can be a means of practicing a theory, and for corporate practitioners, a tool can be a means of discovering new possibilities to gain new practically relevant knowledge. But in order to bridge the gap, cultural boundaries between practitioners and theorists must be worked on and a mutual ground for understanding must be established. Next we discuss the implications of our analysis for the development of strategy tools.

Learning tools for dynamic business environments. Whereas the traditional perspective to strategy work is premised upon a somewhat stable and calculable world that can be explained and managed with general laws and principles, managers of the flat networked organizations face a highly dynamic business environment—the turbulent, highly competitive and fast-paced global markets, where the rules of the game are not known in advance but form as the game proceeds (Volle, 2000). In such complex business environments, strategically valuable knowledge is contextual, perspectival, and changing, and thus needs to be continuously re-configured and re-articulated from different sources, as we have explained above. In these processes of knowledge creation, it is often difficult to identify and formulate clearly defined problems for individual rational problem-solving (see also Mason and Mitroff, 1981). Managers and other knowledge workers rather need to be able to analyze several different aspects of a given strategic problem or environment simultaneously, looking at the situation from different perspectives and possibly using multiple methodologies simultaneously for both conceptual and methodological triangulation. The role of strategy tools, in strategy work and in epistemic practice more generally, is not so much to provide optimal solutions to decision-making problems but to serve as learning tools.

In these sorts of complex business and learning environments, model-based strategy tools can be used mainly for identifying possible problem-solving and decision-making situations and sites, and for producing multiple representations of these situations. Models may help to structure a problem or an array of problems, or ensure that management teams and other relevant members of the organization are involved in the dialogue through which decisions are made and strategically valuable knowledge is produced. Sometimes, in these cases, there is no use for the final model at all. The goal, then, is not to develop accurate results, exact presentations, refined abstractions, and strict processes but to design strategy tools that are simple and transparent enough to promote dialogue and trust (see also Styhre, 2002).

Tools for dialogue and trust. While majority of the mainstream strategy tools are designed for individual decision-making in hierarchical organizations, contemporary corporate managers often operate in flat project based organizations where knowledge is

typically created and used in the different teams of the organizational learning community, possibly including the strategic alliance networks of the firm (Powell, 2001b, 1990; Powell et al., 1996). In these sorts of environments, strategy tools are not merely practical and conceptual tools that can be used by individual knowledge workers as neutral instruments for making more systematic and transparent decisions that are in line with a predefined strategy. Our study illustrates how strategy tools can be inscribed with particular visions of the patterns, purposes and contexts of use in organizations. These visions reflect the world view and the cognitive goals and values of the epistemic culture in which the tools are developed. As such, strategy tools can also involve particular moral orders and "preferred readings" of the learning and business environment, which guide practitioners to limit themselves only to the categories and procedures that the tools offer. These visions, conceptualizations and epistemic norms may or may not be compatible with the practical or political context in which the tools are used. As a result, management teams would seem to be much more likely to use models when it is clear to them that their ideas and knowledge are represented in the model and when the models do not overly restrict their thinking (also Morecroft, 1992).

Therefore, to be regarded as effective, models must become an integral part of debate and dialogue in the organization. In an epistemic community where no one can give orders, knowing an optimal solution is of little use, especially if it is only the optimal solution to one party's version of the problem (Rosenhead, 1996). Rather, there is a need to generate many models or a very general flexible model and to articulate and elaborate them from the different subject positions that the different members of the organization and its stakeholders can take (see also Longino, 1993: 116). A single uncontested representation of the problematic situation under consideration that the strategy tools sometimes presuppose is often impossible to achieve.

Multiple tools for multiple contexts of knowledge creation. The strategy tools that are commonly used in contemporary knowledge organizations aim to solve specific management -related problems. Some tools provide diversity by creating points of views, like Balanced Scorecard. Others, Scenario Planning for example, help to balance planning and intuition. There are also tools that provide clarity to processes, like Six Sigma. Even some facilitation and dialogue tools are in use for improving intersubjective communication and collective decision-making in organizations. Yet, the available tools cover only a small subset of the tasks that strategy work typically involves. Hence, there is still need for new practical methods suitable for the more complex strategy level problems that characterize contemporary post-bureaucratic knowledge intensive corporations.

Our study suggests that strategy tools should be considered and evaluated as part of the

larger organizational learning environment in which they are used. The solutions and information that they provide are only one input into the complex processes of discussion, negotiation and collective learning associated with decision-making and everyday business practices. Strategy work in contemporary organization therefore requires multiple methodologies. Instead of only one tool that solves the problem; successful strategy work would seem to require a set of methods. Not only is there a need for tools that are context specific, i.e. tailored for specific business and social learning environments, but, there is also a need for tools that are specifically designed for different aspects of the problem, as well as for different stages of the strategy process.

In the unending spirals of knowledge creation, strategy tools have continuously evolving functions and purposes. The needs for the tools thus evolve and the outcomes from the use of the strategy tools take different forms and functions depending on the state of the spiral of strategic knowledge creation. Therefore, it would seem to be important to define the specific points and situations in which the different strategy tools are most useful in supporting the efforts of the members of the organization in their strategy work.

Furthermore, the balance of efficiency and creativity is necessary in organizational knowledge creation. It is easy to be limited only to the categories and procedures that a strategy tool offers. It may even prove to be efficient at times, as both divergent and convergent thinking have their time and place on the never ending spiral of the creation of strategic knowledge. However, as Brown and Gray (2004) among others have argued, it is often the informal ways through which people solve problems that create potential for strategic advantage. As the executive's quote in the beginning of our article suggests, the people, not the tools and the processes are the real geniuses of the organization. Consequently, strategy tools are useful in the long term only if they provoke new ideas and facilitate communication, both with different external stakeholders and between different interest groups within the organization.

In sum, strategy tools at their best can support individual and collective learning, make processes more efficient, and enable emergent qualities. Most importantly, they can support unlearning, the ability to take and to understand new perspectives. However, development of new techniques, technologies, processes and experiences that genuinely support such unlearning call for a more social model of knowledge and strategy work as well as for genuine appreciation of co-production.

CONCLUSION

In this paper, we contribute to a deeper understanding of the ways in which differences in epistemic culture, clashing conceptions of 'knowledge' and the 'subject of knowledge' in particular, may result in management scholars producing knowledge, techniques and tools that lack practical relevance for corporate actors. The neo-institutional view taken by most management tool studies has been criticized of portraying managers as naïve and unrefined followers of fashions (Benders and van Veen, 2001). The practice point of view in our study treats practitioners as experts in their field (Whittington, 2003) and makes no assumptions about their rationality neither their tool adoption practices. However, our study does assume that the idea behind strategy tools is to help strategy work.

Furthermore, by analyzing the more fine grained texture of the cultural-epistemic practices that are important for bridging theory and practice, we illustrate how particular, historically specific cultural discourses of corporate epistemology constitute particular conditions of possibility for subjectivity and epistemic agency for scholars and practitioners. We elaborate empirically on the differences between "modernist" and "post-bureaucratic" epistemic cultures, in particular, and explore the tensions and boundaries that may complicate scholar-practitioner collaboration in the field.

Overall, we claim to offer new insights into the cultural-epistemic complexity of fostering rigor and relevance in strategic management research. We argue that to improve the practical relevance of academic management research in general and strategy tools in particular, strategy scholars need to identify and problematize the subtle and profound cultural differences in epistemic practice that may not only complicate interaction and communication with business practitioners but also hinder collaborative learning in the development of management tools.

To conclude, we argue that the bridging of possible theory-practice gaps in the field of strategic management research calls for mutual learning and partial translation between academy-based management knowledge and corporate knowledge (Suchman, 1994). Nevertheless, it is important to note that being 'different' is the basis and motive for collaboration, since a need for something that the other party possesses makes the cooperation desirable. There is no need to do away with those clashes and tensions that spark creativity and learning—only the misconceptions that develop distrust and misunderstanding must be cleared out.

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Essay Four

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Multiple objective approach as an alternative to radial projection in DEA

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Multiple Objective Approach as an Alternative to Radial Projection in DEA

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Abstract

Radial projection is a standard technique applied in data envelopment analysis (DEA) to calculate efficiency scores for input and/or output variables. In this paper, we have studied the appropriateness of radial projection for target setting. We have created a situation where the decision making units (DMUs) are free to choose their own target values on the efficient frontier and then compared the results to those of radial projection. In practice, target values are primarily used for future goal attainment; hence, not only preferences but also, and on the whole, change in time frame, affect the choice of target values. Based on that, we conducted an empirical experiment with an aim to study how the DMUs choose their most preferred target values on the efficient frontier. The subjects, who all were students of the Helsinki School of Economics, were given the freedom to explore their personalized efficient frontiers by using a multiple objective linear programming (MOLP) approach. To study various and relevant scenarios, the personalized efficient frontiers for all students were constructed in such a way that the current position of each student in relation to the frontier made him/her inefficient, efficient, or super-efficient. The results show that the use of radial projection for target setting is too restrictive.

JEL Classification: C14, C44, C61, D24

Keywords: behavioral decision making, data envelopment analysis, frontier analysis, multiple objective linear programming, target setting, time management

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1. Introduction

Since Charnes et al. (1978, 1979) developed data envelopment analysis (DEA), it has become a widely used and important method for measuring the efficiency of homogeneous decision making units (DMUs) essentially performing the same task. Based on information about the performance of those units, the purpose of DEA is to empirically characterize the efficient frontier. If a DMU lies on that frontier, it is referred to as an efficient unit, otherwise inefficient. When a unit is inefficient, its efficiency is most often measured relative to the efficient frontier by projecting it radially onto the efficient frontier.

In radial projection the values of controllable (input or output) variables are proportionally improved until the boundary of the efficient frontier is achieved. The input/output values of the reference unit are often considered target values for an inefficient unit.

The underlying assumption in the radial projection technique is that suitable target values for each inefficient unit are found without any additional information merely by proportionally improving controllable variables. Thus, radial projection is a value-free technique in the sense that it does not include the preferences of a decision maker (DM).

Furthermore, radial projection does not allow any flexibility for a DM to choose a reference unit for an inefficient unit. This can undermine the significance of a reference unit in practice. Consequently, the standard use of radial projection has encountered occasional critique and suggestions of other methods. For example, see Thanassoulis and Dyson (1992) and Färe and Grosskopf (2000). However, the actual behavior of a DM searching for a reference unit in practice has rarely been studied. The purpose of our paper is to contribute to that research.

In this paper, we study the situation in which a DM has an ability to control a specific DMU. When the DM has the information about the current position of his/her own DMU, it is interesting to observe what target values (s)he would like to set for the next planning period. We organized an experiment at the Helsinki School of Economics, in which the students were asked to plan their time use between studies, work, leisure, etc. for the next academic year. Their current time allocation was the basis for the plan. In this case, like in target setting in general, the targets are set for future activities, and the time frame thus affects the choice.

Each student was randomly classified inefficient, efficient, or super-efficient,[1] and the corresponding efficient frontier was constructed. The students used a multiple objective linear programming (MOLP) model to find the most preferred time allocation plans for the next year. We recorded their final choice and compared it to the starting (current) position and the radial projection. Our results do not support the use of radial projection when the aim is to find the target values for DMUs.

This paper is organized as follows: In Section 2, we first introduce DEA and the background of radial projection. Secondly, we show how the efficient frontier in DEA can be characterized by means of a multiple objective linear programming model, and how this formulation makes it possible to freely explore the efficient

frontier. In Section 3, we describe our experiment, and in Section 4 we explain our results. We discuss the results and present the conclusions in Section 5.

2. Data Envelopment Analysis and Multiple Objective Linear Programming

2.1. Characterizing an Efficient Frontier in DEA

Assume we have n DMUs, each consuming m inputs and producing p outputs. Let $\mathbf{X} \in \Re_+^{m \times n}$ and $\mathbf{Y} \in \Re_+^{p \times n}$ be the matrices, consisting of nonnegative elements, containing the observed input and output measures for the DMUs. We denote by $\mathbf{x}_j$ (the jth column of $\mathbf{X}$) the vector of inputs consumed by DMU_j, and by x_{ij} the quantity of input i consumed by DMU_j. A corresponding notation is used for outputs. Furthermore, we denote $\mathbf{1} = [1, \ldots, 1]^T$ and refer by $\mathbf{e}_i$ to the ith unit vector in $\Re^n$.

The traditional DEA models, i.e., input- and output-oriented CCR (Charnes et al., 1978, 1979), and BCC models (Banker et al., 1984), are formulated and solved as linear programs. To unify the notations of the models we formulate a general model, which includes CCR and BCC models as special cases. Matrix $\mathbf{A} \in \Re^{k \times n}$ and vector $\mathbf{b} \in \Re^k$ are used to specify the set of feasible λ variables. Matrix $\mathbf{A} \in \Re^{k \times n}$ is assumed to be of full row rank.

A General DEA Envelopment Model	A General DEA Multiplier Model
$\max Z = \sigma + \varepsilon(\mathbf{1}^T s^+ + \mathbf{1}^T s^-)$	$\min W = \nu^T \mathbf{g}^x - \mu^T \mathbf{g}^y + u^T \mathbf{b}$
s.t. (1a)	s.t. (1b)
$\mathbf{Y}\lambda - \sigma \mathbf{w}^y - \mathbf{s}^+ = \mathbf{g}^y$	$-\boldsymbol{\mu}^T \mathbf{Y} + \boldsymbol{\nu}^T \mathbf{X} + u^T \mathbf{A} \geq \mathbf{0}^T$
$\mathbf{Y}\lambda + \sigma \mathbf{w}^x + \mathbf{s}^- = \mathbf{g}^x$	$\boldsymbol{\mu}^T \mathbf{w}^y + \boldsymbol{\nu}^T \mathbf{w}^x = 1$
$\lambda \in \Lambda$	$\boldsymbol{\mu}, \boldsymbol{\nu} \geq \varepsilon \mathbf{1}$
$s^-, s^+ \geq \mathbf{0}$	$u \geq \mathbf{0}$
$\varepsilon > 0$ (“Non-Archimedean”)	$\varepsilon > 0$ (“Non-Archimedean”)
$\Lambda = \{\lambda \mid \lambda \in \Re_+^n$ and $\mathbf{A}\lambda \leq \mathbf{b}\}$	
$(\mathbf{e}_i \in \Lambda, i = 1, 2, \ldots, n)$	

Vector $\mathbf{g}^y$ consists of aspiration levels for outputs and $\mathbf{g}^x$ of aspiration levels for inputs. Vectors $\mathbf{w}^y \geq \mathbf{0}$ and $\mathbf{w}^x \geq 0 (\mathbf{w} = \binom{\mathbf{w}^y}{\mathbf{w}^x} \neq \mathbf{0})$ are the weighting vectors for outputs and inputs, respectively. In Table 1, we demonstrate how the basic DEA models can be presented as special cases of the models (1) (Korhonen, 1997). We consider envelopment models. The unit under consideration is referred to by superscript “0”.

Table 1. Specifications of model (1a) for different DEA (envelopment) models.

No.	Model Type	$\mathbf{w}^x$	$\mathbf{g}^x$	$\mathbf{w}^y$	$\mathbf{g}^y$	Λ
1	*Output-oriented CCR model* (Charnes et al., 1978)	$\mathbf{0}$	$\mathbf{x}^0$	$\mathbf{y}^0$	$\mathbf{0}$	$\Re_+^n$
2	*Input-oriented CCR model* (Charnes et al., 1978)[a]	$\mathbf{x}^0$	$\mathbf{0}$	$\mathbf{0}$	$\mathbf{y}^0$	$\Re_+^n$
3	*Combined CCR model* (Joro et al., 1998)	$\mathbf{x}^0$	$\mathbf{x}^0$	$\mathbf{y}^0$	$\mathbf{y}^0$	$\Re_+^n$
4	*Output-oriented BCC model* (Banker et al., 1984)	$\mathbf{0}$	$\mathbf{x}^0$	$\mathbf{y}^0$	$\mathbf{0}$	$\{\boldsymbol{\lambda}\|\boldsymbol{\lambda}\in\Re_+^n$ and $\mathbf{1}^T\boldsymbol{\lambda}=1\}$
5	*Input-oriented BCC model* (Banker et al., 1984)[2]	$\mathbf{x}^0$	$\mathbf{0}$	$\mathbf{0}$	$\mathbf{y}^0$	$\{\boldsymbol{\lambda}\|\boldsymbol{\lambda}\in\Re_+^n$ and $\mathbf{1}^T\boldsymbol{\lambda}=1\}$
6	*Combined BCC model* (Joro et al., 1998)	$\mathbf{x}^0$	$\mathbf{x}^0$	$\mathbf{y}^0$	$\mathbf{y}^0$	$\{\boldsymbol{\lambda}\|\boldsymbol{\lambda}\in\Re_+^n$ and $\mathbf{1}^T\boldsymbol{\lambda}=1\}$
7	*General combined model*	–	$\mathbf{x}^0$	–	$\mathbf{y}^0$	–

Note: [a]The input oriented models are usually solved in DEA as a minimization problem by writing $\mathbf{w}^x = -\mathbf{x}^0$ and modifying the objective function accordingly.

Referring to the value of the objective function, we can define that unit DMU_0 with $\binom{y^0}{x^0}$ is efficient iff

$$Z^* = W^* = \begin{cases} 1, & \text{for Models 1 and 4,} \\ 0, & \text{for Models 3, 6 and 7,} \\ -1, & \text{for Models 2 and 5,} \end{cases}$$

otherwise it is inefficient (see, for example, Charnes et al., 1994). Note that for an efficient unit all slack variables s^-, s^+ equal zero.

2.2. *Radial Projection*

The idea of radial projection dates back to Debreu (1951) and Farrell (1957). Farrell's goal was to measure the technical (in)efficiency of a firm, which he based on the use of radial projection. He separated the technical efficiency from the concept of price (allocative) efficiency, where efficiency is measured relative to a given set of prices. The advantage of the technical efficiency is that no information on values or prices is needed. Together these two determine the overall efficiency of a firm and the value of overall efficiency is the technical efficiency multiplied by the allocative efficiency.

On the other hand, Debreu (1951) shows that the radial projection also implicitly defines prices for the inputs and outputs. The prices that correspond to a radially projected point are thus such that using those, the unit is allocatively efficient. If the true prices are unknown, the technical efficiency is a conservative approximation of the overall efficiency and the radial projection sets an efficient target based on the implicit prices.

The traditional DEA models, introduced by Charnes et al. (1978) and Banker et al. (1984), use the Debreu–Farrell efficiency measure (see Table 1, Models 1, 2, 4 and 5). Thus, the efficiency of an inefficient DMU is determined either by increasing outputs proportionally subject to given input levels or by decreasing inputs

proportionally subject to given output levels. Variables are proportionally improved until the boundary of the production possibility set is achieved.

It is worth noticing that the radial Debreu–Farrell measure of efficiency does not necessarily lead to an efficient target in DEA. For example, Färe and Lovell (1978) criticize the radial projection because of this, and suggest the use of so-called Russell measure to assess technical efficiency. Also, this is why so-called two stage procedures are commonly used. These guarantee that the reference point belongs to the efficient subset of the isoquant. This corresponds to the Koopman's (1951) definition of efficiency. In addition to Russell measure, a number of other non-radial efficiency measures have been suggested. For discussion see, for example, De Borger et al. (1998).

Despite its weaknesses, radial projection has a number of desirable features that are emphasized, e.g., by Kopp (1981). The efficiency measure based on radial projection has a clear economic interpretation regardless of the prices. For example in the input oriented case, the efficiency score defines the proportion of total cost that is associated with the elimination of technical inefficiency. Also, the above mentioned division of overall efficiency into allocative and technical part is based on the assumption of radial projection.

A common feature in the above-mentioned methods is that they are "value free", i.e., they do not explicitly include preference information. Based on this, Thanassoulis and Dyson (1992) criticized the use of radial projection in target setting. Our aim is to compare a "value free" projection to a multiple objective approach, where the preference information is explicitly taken into consideration. We use radial projection as a representative for the value free approaches. Our aim is not to compare the efficiency measures, but to analyze the target values that they implicitly set. Thus we assess, if the radial projection corresponds to the preferences of the DM.

2.3. Exploring the Efficient Frontier

We may define the efficient frontiers of the models (1a and 1b) in the following way. Let us first define the sets $T = \{\binom{\mathbf{y}}{\mathbf{x}} | \, \mathbf{y} \leq \mathbf{Y}\boldsymbol{\lambda}, \mathbf{x} \geq \mathbf{X}\boldsymbol{\lambda}, \boldsymbol{\lambda} \in \Lambda, \mathbf{y} \geq \mathbf{0}, \mathbf{x} \geq \mathbf{0}\}$ and $\Lambda = \{\boldsymbol{\lambda} | \boldsymbol{\lambda} \in \Re^n_+ \text{ and } \mathbf{A}\boldsymbol{\lambda} \leq \mathbf{b}\}$ corresponding to the above notation. In the DEA literature, set T is called production possibility set. We assume that $\mathbf{e}_i \in \Lambda, i = 1, \ldots, n$, where $\mathbf{e}_i$ is the ith unit vector in $\Re^n$.

The definition of efficiency and the corresponding definition for weak efficiency, can be given in the following equivalent form:

Definition 1. A point $\binom{\mathbf{y}^*}{\mathbf{x}^*} \in T$ is efficient (non-dominated) iff (if and only if) there does not exist another $\binom{\mathbf{y}}{\mathbf{x}} \in T$ such that $\mathbf{y} \geq \mathbf{y}^*, \mathbf{x} \leq \mathbf{x}^*$, and $\binom{\mathbf{y}}{\mathbf{x}} \neq \binom{\mathbf{y}^*}{\mathbf{x}^*}$.

Definition 2. A point $\binom{\mathbf{y}^*}{\mathbf{x}^*} \in T$ is weakly efficient (weakly non-dominated) iff there does not exist another $\binom{\mathbf{y}}{\mathbf{x}} \in T$ such that $\mathbf{y} > \mathbf{y}^*$ and $\mathbf{x} < \mathbf{x}^*$.

The efficient frontier is defined as a subset of points of set T satisfying the efficiency condition above. All the efficient DMUs lie on the efficient frontier.

When we want to characterize the frontier, we notice that actually the model (1a) is a reference point model proposed by Wierzbicki (1980) for searching an efficient frontier in multiple objective linear programming (for more details, see Joro et al., 1998). The search on the efficient frontier can be made by using an arbitrary weighting vector $\mathbf{w} = \binom{\mathbf{w}^y}{\mathbf{w}^x} > \mathbf{0}$ and by varying the values of a reference point $\binom{\mathbf{g}^y}{\mathbf{g}^x}$. For each given reference point $\binom{\mathbf{g}^y}{\mathbf{g}^x}$, the models (1a and 1b) find a point on the efficient frontier. The reference point approach is a basic technique in MOLP to project any single point (feasible or infeasible) onto the efficient frontier.

Korhonen and Laakso (1986) developed a reference direction approach, in which a direction vector is projected onto the efficient frontier instead of projecting a single point. Actually, this extension is simple: we only have to parameterize the right hand values of the envelopment model (2a), and the coefficient of the objective function on the multiplier model (2b). This leads to the following models.

A Parameterized General DEA Envelopment Model	A Parameterized General DEA Multiplier Model
$\max Z = \sigma + \varepsilon(\mathbf{1}^T s^+ + \mathbf{1}^T s^-)$	$\min W = v^T(\mathbf{g}^x + t\mathbf{r}^x) - \boldsymbol{\mu}^T(\mathbf{g}^y + t\mathbf{r}^y) + u^T\mathbf{b}$
s.t. (2a)	s.t. (2b)
$\mathbf{Y}\boldsymbol{\lambda} - \sigma\mathbf{w}^y - s^+ = \mathbf{g}^y + t\mathbf{r}^y$	$-\boldsymbol{\mu}^T\mathbf{Y} + v^T\mathbf{X} + u^T\mathbf{A} \geq \mathbf{0}^T$
$\mathbf{X}\boldsymbol{\lambda} + \sigma\mathbf{w}^x + s^- = \mathbf{g}^x + t\mathbf{r}^x$	$\boldsymbol{\mu}^T\mathbf{w}^y + v^T\mathbf{w}^x = 1$
$\boldsymbol{\lambda} \in \Lambda$	$\boldsymbol{\mu}, v \geq \varepsilon\mathbf{1}$
$s^-, s^+ \geq 0$	$u \geq 0$
$\varepsilon > 0$ (“Non-Archimedean”)	$\varepsilon > 0$ (“Non-Archimedean”)
$\Lambda = \{\boldsymbol{\lambda} \mid \boldsymbol{\lambda} \in \Re^n_+ \text{ and } \mathbf{A}\boldsymbol{\lambda} \leq \mathbf{b}\}$	$t : 0 \to \infty$
$t : 0 \to \infty$	

By varying the reference direction vector $\binom{\mathbf{r}^y}{\mathbf{r}^x} \neq \mathbf{0}$ and parameter t, we may characterize the whole efficient frontier.

Pareto Race is an approach and an interface developed by Korhonen and Wallenius (1988) as a dynamic version from the reference direction approach. This interface is embedded in the VIG software (Korhonen, 1987). Pareto Race is a dynamic and visual, free search type interactive procedure for multiple objective linear programming. It enables a DM to move on the efficient frontier by controlling the speed and the direction of motion on the frontier. In Pareto Race the objective function values are represented both in numeric form and as bar graphs on the computer screen. See Figure 3 for an example of a Pareto Race screen.

The purpose of using Pareto Race in DEA is to find the most preferred point (a virtual unit), which has the values of the input and output variables pleasing the DM most. Of course, it is possible to search a part of the frontier by considering some variables as constraints. When a unit is inefficient, Pareto Race provides a DM with

freedom to find the most preferred target point for the unit, instead of mechanically using a radially projected point as a target.

Pareto Race is based on the assumption that the most preferred target point maximizes the value function of the DM at the moment of termination. Evaluation could easily be done, if it were possible to explicitly know DM's stable value function. In many problems this is not a realistic assumption, and Pareto Race does not assume value function to be known, nor does it need to be estimated. The value function is even allowed to change during the search process. The only assumption that we make about the DM's value function is that it is pseudoconcave for all outputs and for negative inputs at the moment when the search for the MPS is terminated.

The pseudoconcavity assumption is needed at the moment of termination in order to be able to interpret the quality of the final solution. The weaker these assumptions are, the better. We assume that the value function is pseudoconcave, because then a local optimum over a convex set is also global (Bazaraa and Shetty, 1979, p. 510). The solution is the local optimum, if the DM is not willing to move to any direction from the current solution. Thus, Pareto Race guarantees that the most preferred solution is optimal at the moment of termination. For more detailed discussion about the assumptions concerning the existence of a stable value function, see Steuer (1986).

In the next section, we use a modified Pareto Race as a research tool to observe which most preferred target point i.e., most preferred future position the subjects choose when they are allowed to explore an efficient frontier.

3. Description of the Experiment

3.1. Preliminaries

Our research hypothesis is that the radially projected current position is generally not the same as the most preferred future position. Accordingly, when setting future targets, the radial projection of an inefficient DMU to the efficient frontier is too restrictive a technique. Namely, we are interested in goal setting, and not in the actual change in the process that will occur when action is taken to reach the targets. Below, in Figure 1, we have illustrated our hypothesis. In summary, our goal is to study the location of the most preferred future position compared to the radially projected target point on the efficient frontier.

To study our hypothesis, we conducted an experiment at the Helsinki School of Economics using students as DMUs. Our purpose was to observe how DMUs behave when they are asked to find the most preferred input and/or output values on the efficient frontier for a future planning period. Individually, each student used Pareto Race to seek a most preferred efficient solution for his/her next year's time allocation problem. The efficient frontiers were generated individually for each student so that the current time allocation was inefficient, efficient, or super-efficient in relation to their individual efficient frontier.

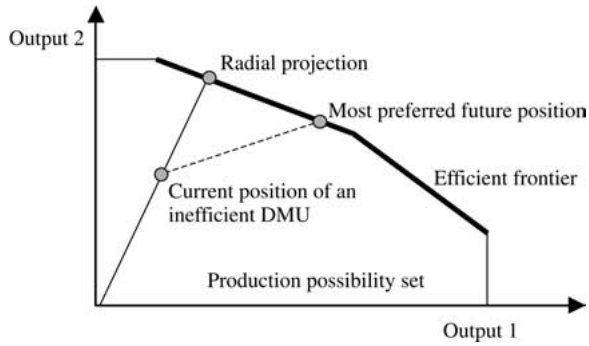

Figure 1. Illustration of a possible location of the most preferred future position.

As the experiment was conducted in the spring before the end of the school year, students had to estimate some of the information for the current position. In setting the experiment this way we emulated budgeting situations in companies. Targets for next year are set even if not all information about the current situation has yet been realized.

A total of 199 undergraduate students took part successfully in our experiment. The students were motivated to take the experiment seriously by explaining to them that the model they used was particularly developed for each individual, and moreover, it was specially made to help them plan better their time use next year. All students were participants of an introductory Management Science course, and they had little experience in using computer models.

3.2. Design of the Experiment

The students participated in the experiment in two phases:

Phase 1: The students were asked to fill in a web-based questionnaire inquiring about background information, and about the current values of their time allocation criteria. Since the time period for this current data was the entire academic year 2000–2001, and this experiment was conducted in the spring, they had to partially estimate this information.

Phase 2: Each student was provided with an individual MOLP model, as a time management tool, to help him/her to plan his/her next year's activities. To solve their MOLP problems, they used Pareto Race.

The students' time allocation problem was formed using the following five criteria:

- Number of credits
- Number of credits with excellent grades

- Free time per day (h)
- Salary per month (1,000 FIM)
- Time used on professional activities (other than studying) per week (h)

In previous studies, these criteria have been found to be relevant to the students. Students think in numbers of credits, as the degree consists of a certain amount of credits and also their government aid is tied to the credits. They also set targets for numbers of credits with excellent grades. Free time is included to capture the non-professional and extra-curricular activities

In our experiment, the value of criterion ''Number of credits'' also includes the criterion ''Number of credits with excellent grades''. It means that our production possibility set cannot include the solutions for which ''Number of credits'' is less than ''Number of credits with excellent grades''. We could use the independent criteria ''Number of credits with non-excellent grades'' and ''Number of credits with excellent grades'', but then we should have inserted an extra preference relation into our model: the multiplier for ''Number of credits with non-excellent grades'' is smaller than for ''Number of credits with excellent grades''. However, there is a one-to-one correspondence between the models, and we think that it is more natural to a student to maximize ''Number of credits'' than ''Number of credits with non-excellent grades''.

With the verified values the students provided in Phase 1, we diagnosed the efficient students using an output-oriented CCR model (see Table 1, Model 1) and used them to characterize the efficient frontier. All five criteria listed above were used as outputs, and time was used as input. The choice of the model type was clear, since all units used the same amount of input. The students were assumed to be homogeneous, except for their efficiencies.

To construct individual models for all the students, we proceeded as follows:

1. We calculated the efficiency scores $\theta_i, i = 1, 2, \ldots, 199$ for each student. For an output oriented CCR-model (Table 1, Model 1), the efficiency score $\theta = 1/\sigma$. Hence, to the assessment of the current efficiency of the students, we used radial projection.
2. Individually for each student, the output values corresponding to the efficient frontier were multiplied with the student's efficiency score $\theta_i, i = 1, 2, \ldots, 199$, which placed the efficient frontier on the level of each student's current position. (See arrow 2 in Figure 2.)
3. To get different degrees of efficiencies, we randomly divided the students into seven groups. In each group, the output values corresponding to the efficient frontier were further multiplied by values (ξ) 0.79, 0.86, 0.93, 1, 1.07, 1.14 or 1.21. (See arrow 3 in Figure 2.) These values correspond to efficiency levels $1/\xi$ that are called synthetic efficiency scores. In this manner, i.e., by proportionally scaling the efficient frontier, we obtained a personalized efficient frontier for each student. The calculations rendered three groups of inefficient students in relation to the personalized efficient frontier ($\xi = 1.07$, 1.14, and 1.21), and one

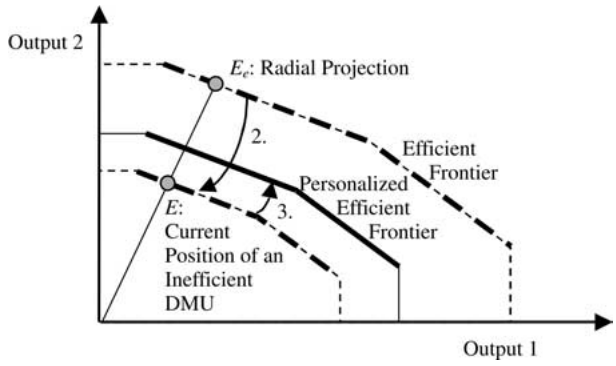

Figure 2. Illustration of the construction of personalized efficient frontiers for an inefficient unit E.

group of efficient students ($\xi = 1$), and finally three groups of super-efficient students ($\xi = 0.79$, 0.86, and 0.93). The efficient group was three times bigger than the other groups. This change of the efficient frontier can also be interpreted as a simulation of technology change.

4. Further, the following MOLP model was constructed for each student to characterize the personalized efficient frontier:

$$\begin{aligned} &\max\ y_i^{\text{new}} = \theta_i \xi_i \mathbf{Y}\boldsymbol{\lambda}, i = 1, 2, \ldots, 199, \\ &\quad \mathbf{1}^T\boldsymbol{\lambda} = 1, \\ &\quad \boldsymbol{\lambda} \geq \mathbf{0}. \end{aligned} \tag{1}$$

Finally, the following simpler form of this model was used to facilitate generating individual models for all students.

$$\begin{aligned} &\max\ y_i^{\text{new}} = \mathbf{Y}\boldsymbol{\lambda}^*, \\ &\quad \mathbf{1}^T\boldsymbol{\lambda}^* = \theta_i \xi_i, i = 1, 2, \ldots, 199, \\ &\quad \boldsymbol{\lambda}^* \geq \mathbf{0}, \\ &\text{where } \boldsymbol{\lambda}^* = \theta_i \xi_i \boldsymbol{\lambda}. \end{aligned} \tag{2}$$

In the above MOLP model only one number, $\theta_i \xi_i$, needs to be changed to construct each model. In this manner, individual MOLP models were constructed for each student.

The frontier was personalized to assure meaningfulness of the task for the students. This was necessary, as the range of the original efficiencies was large. This also allows us to observe the behavior of the students independent of their original efficiencies.

In Phase 2, using the model (4), the students were able to evaluate trade-offs between different time demanding activities on their personalized efficient frontier. To find a solution, the students used a modified Pareto Race interface (Korhonen

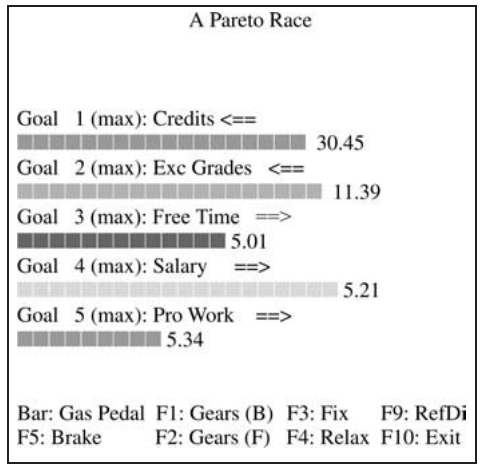

Figure 3. Pareto Race interface.

and Wallenius, 1988).[2] Pareto Race enabled students to move on the efficient frontier and, thus, find the most preferred y^{new}. We used a random point on the efficient frontier as a starting value. Figure 3 shows an example of the Pareto Race screen.

In Pareto Race the DM sees the objective function values on a display in numeric form and as bar graphs, as (s)he travels along the efficient frontier. The keyboard controls include an accelerator, gears and brakes. The search on the non-dominated frontier is like driving a car. The student can, e.g., increase/decrease the speed, and brake at any moment (s)he likes. It is also possible to change direction by giving aspiration values for objectives. The student discontinues the search when (s)he feels that the values of time allocation criteria are most preferred. The final solution, i.e., the most preferred future position of each student was saved.

4. Results

Each student used a MOLP model to find their most preferred values y_i^{new} (M in Figure 4) for the time allocation criteria for the next academic year on their personalized efficient frontier. The model was solved by using Pareto Race. How this solution is related to their original values $\mathbf{y}_i$ (E in Figure 4) and its radial projection $\mathbf{y}_i/\theta_i$ (E_e in Figure 4) is analyzed in this section.

First, we compared the values of the current position (E in Figure 4) to the values of the most preferred future position on the personalized efficient frontier (M in Figure 4). A natural way to do this is to investigate their dominance relation. If the most preferred future position dominates the current (inefficient) point, then a DM has used a win-win strategy in reaching an efficient frontier. Because radial

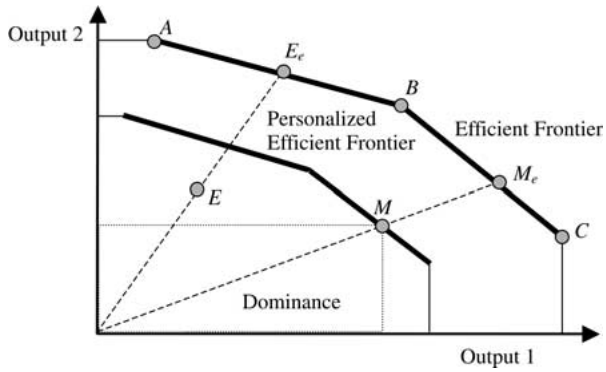

Figure 4. Illustration of the positions and frontiers used in constructing the measurements.

projection is a special case of a win-win (''lose-lose'') strategy, dominance relation is one way to evaluate deviation of the final choice from the original point.

In the case of inefficient DMUs, we observed if the most preferred future position weakly dominates the current position. Thus, the values of the five different outputs of the most preferred future position are not worse and at least one is better than the values of the current position. In Figure 4, a DMU's most preferred future position M does not dominate his/her current position E. In the case of super-efficiency, we observed if the original point weakly dominates the most preferred future position. Naturally, dominance relation is not relevant if the current position is on the personalized efficient frontier, i.e., the student is efficient relative to the personalized efficient frontier. The results are given in Table 2.

The results in Table 2 are very evident. Only four out of 68 super-efficient DMUs' current position dominated the most preferred future position. Correspondingly, only eight of all 67 inefficient DMUs chose the final point that dominated the original point. It means that in 91% of 135 cases, a dominance relation did not appear. Hence, there is strong evidence that radial projection poorly corresponds to the most preferred target values set by the DMs for their future plans.

Table 2. Occurrence of weak dominance relation.

Status	Coefficient ξ_i	Synthetic Efficiency Score $1/\xi_i$	No. of Students	No. of Dominance Relations
	1.21	0.83	21	4
Inefficient	1.14	0.88	23	3
	1.07	0.93	23	1
	0.93	1.08	22	0
Super-efficient	0.86	1.16	24	1
	0.79	1.27	22	3
Total			135	12

Secondly, this finding prompted further investigation of the location of the most preferred future position, and we calculated a weighted Euclidean distance between the radially projected current position (E_e in Figure 4) and the radially projected most preferred future position $\mathbf{y}_i^{\text{new}}/(\theta_i\xi_i)$ (M_e in Figure 4).[3] To eliminate the size effects of the personalized efficient frontier, we calculated the distances on the "real" efficient frontier, i.e., on the frontier characterized by the original efficient units (A, B, and C in Figure 4). Furthermore, the distance was calculated in proportion to the range of the values of the efficient DMUs (range is determined by means of A and C in Figure 4). In summary, the formula we used was as follows:

$$\mathrm{D}_i = \sqrt{\sum_{j=1}^{5}\left(\frac{(y_{ij}/\theta_i) - (y_{ij}^{\text{new}}/(\theta_i\xi_i))}{\Delta y_j}\right)^2}, \quad i = 1, 2, \ldots, 199,$$

$$\Delta y_j = \max_{i\in \text{Eff}} y_{ij} - \min_{i\in \text{Eff}} y_{ij}, \quad j = 1, 2, \ldots, 5,$$

where y_{ij} is the original values of student, i; $y_{ij}{}^{\text{new}}$ is the most preferred values found by student i on the personalized efficient frontier; θ_i is the original efficiency score of student i; $1/\xi_i$ is the synthetic efficiency score for the student i; Eff is the index set of efficient DMUs.

As mentioned before, radial projection may lead to weakly efficient frontier. To analyze the effect of this phenomenon, we also calculate the distance from the most preferred future position to the efficient reference point. The used measure is similar to D_i, but we replace y_{ij}/θ_i with the efficient reference point that was defined when the efficiency was calculated.[4]

The averages and the standard deviations of the distances in each of the seven groups are reported in Table 3.

Table 3 provides similar results to those in Table 2. The subjects had chosen a most preferred future position (e.g., M in Figure 3), which we radially projected onto

Table 3. Relative distances from the most preferred future positions to the radially projected current positions and to the efficient reference points.

Status	Coefficient ξ_i	Synthetic Efficiency Score $1/\xi_i$	No. of Students	Distance D_i to Radial Projection Average (St. Dev.)	Distance to Efficient Reference Point Average (St. Dev.)
	1.21	0.83	21	0.59 (0.23)	0.52 (0.25)
Inefficient	1.14	0.88	23	0.54 (0.22)	0.46 (0.26)
	1.07	0.93	23	0.54 (0.24)	0.49 (0.24)
Efficient	1	1	64	0.49 (0.23)	0.42 (0.25)
	0.93	1.08	22	0.53 (0.25)	0.43 (0.30)
Super-efficient	0.86	1.16	24	0.52 (0.32)	0.45 (0.34)
	0.79	1.27	22	0.46 (0.31)	0.38 (0.32)
Total			199		

the efficient frontier (e.g., M_e in Figure 3). Results show that these points (e.g., M_e in Figure 3) on average are located quite far from students' radially projected current positions (e.g., E_e in Figure 3). These average relative distances vary from 0.46 to 0.59. Since the theoretical maximum value between two points on the efficient frontier is $\sqrt{5}(\approx 2.24)$, the average distance is 21%–25% of that theoretical maximum. The relative distances to the truly efficient reference point are somewhat lower, but are still 17%–23% of the theoretical maximum. However, there are large individual differences in the distances, as the standard deviations indicate.

It is notable that efficient DMUs have also changed their position on the efficient frontier. Most of this change may be caused by the time effect. The students were asked to find the most preferred criteria values for the next year. Hence, we may assume that their value structure has changed. Part of the change can also be caused by the fact that the current position does not necessarily correspond to the targets that were set the previous period. Possibly, it also is a result of learning from the search. The result questions the use of radial projection in goal setting since, when aspiring for targets, time effect is always present.

Obviously, the most preferred target values selected by the student could be unachievable in practice. Although the target is selected from the personalized efficient frontier that describes feasible production plans, the student cannot necessarily move to this point in the next period, due to adjustment costs or other practical restrictions. However, by using preference information some of these restrictions have been taken into account.

In summary, our experiment shows very clearly that radial projection is quite far from what students would have liked to achieve next year. We claim that in most cases radial projection is too restrictive an assumption to depict a DMU's desired direction for future improvement in case it has control over its goal setting.

5. Discussion and Conclusions

The aim of this study was to cast light on target setting in DEA environment. The conclusions in our paper are based on an empirical experiment at the Helsinki School of Economics. We asked students to assess their current position and then observed the most preferred criteria values students chose for next year's time allocation problem. The problem was formulated as a MOLP problem, and it was solved by using Pareto Race software developed for this purpose.

With the results of the experiment we studied the appropriateness of radial projection for target setting by comparing a radially projected target position to a position that DMUs chose themselves. The key difference between these two methods is that radial projection does not take into account DMs preference information, and the multiple objective approach does.

In general, in addition to preferences, also time frame affects the choice of target values, which are set for future goal attainment. Hence, in our experiment, time frame played a central role. A corresponding situation in companies to our experiment could be annual budgeting. Before the end of the year, current situation

is taken as basis of the planning, and future targets are set. The current situation is partly known and partly estimated. Perhaps even the technology of the coming year can change, but nevertheless the targets need to be set. In our experiment, we simulated the technology change by random changes of the efficient frontier.

Radial projection is vastly used for measuring efficiency and valuable in that. Thus, we measured the original efficiencies of the current positions by radial projection. The planning phase in our experiment was done with MOLP to take advantage of the possibility to gain preference information. This preference information takes partly into account the possibilities in the reality.

The results from our experiment show, that radial projection is too restrictive when a time frame is present. We compared the relationship of the original values and the final point by using dominance relation and relative distance. The distance between radial projection and the radially projected final, most preferred, choice was computed proportionally to the range of the values of the originally efficient solutions. These results show that the radial projection is a poor approximation for targets that decision makers preferred.

Although we show that the radial projection does not correspond to the preferences of the DM, the use may still be motivated. For example, Bogetoft (2000) shows that in a standard principal-agent setting with no communication it is not in the interests of the agent to reveal true information on the values and thus the radial target provides with an optimal incentive structure.

It would be interesting to research what prompted the DMUs to the change from current position to the future goal. For example technological development and changes in the economic situation could be easily understood, in general, as causes for these changes. Clearly time and future conditions affect the preferences. Furthermore, the behavior of the students could also be explained by bounded rationality (Simon, 1976). Perhaps the students learnt about their possibilities while exploring the efficient frontier, and with this new knowledge found a better position. However, it cannot be concluded from our experiment that preferences are unstable. We do not know what the target was that led to the current position. Goals, if they do exist, are not always achieved, and perhaps the current situation, irrespective of its efficiency, can have been non-satisfactory.

The relevance of the findings to business areas can be speculated. Although the subjects of our experiment were students, the results are clear and our setting was similar to budgeting in businesses. Thus, it is presumable that results of a study of the behavior of business managers would give parallel results. According to our experience, business managers are constantly trying to improve and the goals they have can be of very different mix than their current situation. It is another issue what they will actually achieve. Goals are not necessarily realized, and in business, changes can take a long time to be accomplished. We do think that this also depends on the maturity of the business and on the business field.

In summary, we propose that when setting targets, and in case a DMU has control over some input or output variables, a multiple objective linear programming approach should be considered to find the most preferred solution instead of projecting inefficient points onto the efficient frontier.

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Notes

1. Super-efficiency, introduced by Andersen and Petersen (1993), is an approach where the assessed unit is excluded from the reference set. This allows a unit to be located above the efficient frontier i.e., to be super-efficient.
2. In original Pareto Race the steering mechanism is implemented in a different manner.
3. Månsson (2001) uses a corresponding measure to select the most suitable benchmark unit for an inefficient unit from the efficient units.
4. The efficient reference points were calculated using OnFront software.

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Essay Five

Korhonen P., Mano H., Stenfors S. & Wallenius J.

Inherent biases in decision support systems: The influence of optimistic and pessimistic DSS on choice, affect, and attitudes

Inherent Biases in Decision Support Systems: The Influence of Optimistic and Pessimistic DSS on Choice, Affect, and Attitudes

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ABSTRACT

This study investigates the influence of a decision aid on decision makers' model-based choices, emotions during the use of the model, and attitudes towards the model. A time allocation decision model was biased to purposefully provide optimistic or pessimistic criterion levels, on which subjects based their allocations. The results of our experiment indicate that the degree of "optimism" and "pessimism" inherent in the decision model had a significant impact on the decision maker's choices of criterion values, with optimism leading to higher criterion level choices and pessimism to lower levels. Furthermore, compared to pessimistic models, optimistic models significantly improved the decision makers' emotional states and, to some degree, their attitudes towards the decision aid. The implications of these conscious and sub-conscious influences on decision makers' choices, emotions, and attitudes are discussed and the need for model-builders and users to be aware of them is highlighted.

Key words: Decision Support Systems, Optimism/Pessimism, Affect, Attitudes, Multiple Criteria Decision Making

INTRODUCTION

Complex managerial decisions are often the result of deliberative human judgment and decision support tools. The complexity of decision problems often makes use of some type of decision support necessary. Since the 1950's, management science researchers have developed mathematical models designed to improve the quality of decisions involving conflicting objectives. However, it is well accepted that outputs from systematic models should not be seen as the sole determinants of future action but as aids and guides of subjective judgment that can improve decision quality (cf. Keeney, 1992).

Decision aids can be crucial and there are many reports documenting their successful use in important and complicated managerial decisions (e.g., Bell, Anderson & Kaiser, 2003). Yet, decision support aids are often biased. These biases may be intentional or unintentional and are caused by nonrandom fluctuations in the system (e.g., specification errors such as omitting important independent variables, or specifying linear relationships when curvilinear relationships are appropriate).

The persistence of biases in decision support systems stems from challenges in model validation. A central theme in the model-validation literature is the accent on the importance of the data used in model specification. In addition, data collection and the construction of the relationships between the model's variables can be plagued by an array of problems, including data complexity, variable misspecification, or the decision maker's inability to properly use the

model (van Bruggen, et al., 2001). The optimization literature is replete with examples of problems—and their possible corrections—where 'optimal' solutions suggested by methods are unattainable because of input-data inaccuracies, problems in implementing the solution, model errors, parameter variations, or dynamic complexities in static models. For example, consider two possible sources of error in real-world optimization procedures: (a) inaccurate model formalization, or (b) the model builder's own biases, whereby, because of misspecification or deliberate intention, the model's outputs could be either too 'optimistic' or too 'pessimistic' (e.g., under-estimation of future costs in government construction projects, which are often intentionally biased in order to secure initial funding).

The possibility that a decision support model contains, *unbeknownst to the decision maker*, unintended or systematic biases raises the question of how these biases affect the decision maker. Despite the widespread use of DSSs (and other aids) and the topic's importance, to date, very little is known as to how a model's inherent features, biases, or errors can influence actual model-based decisions and the decision maker's emotional reactions and attitudes vis-à-vis the model.

As little previous research of this kind has been conducted, we decided to design an experiment to study the influence of a purposefully biased decision model on its user's decision quality, emotions, and attitudes. Specifically, subjects seeking to allocate their resources (time) to a number of future activities were assisted by a "biased" computerized DSS. The bias was the grade of inherent 'optimism' or 'pessimism' in the model. Subjects received either "too high" (deliberately inflated by a constant) or "too low" (deliberately deflated by a constant) criterion values from the decision support model on which they based their final choices. That is, some decision makers were provided with a "rosier" and more positive basis for their future choices, while others were provided a more "pessimistic" outlook for their choices. Of course, subjects were kept in the dark as to their model's bias. Our primary theoretical and empirical goals were to examine the effects of the levels of induced "optimism/pessimism" on subsequent performance in the decision task as well as on emotions and attitudes vis-à-vis the decision support model.

Psychological Factors in DSS Use

There is relatively little research on psychological factors that may influence DSS use (cf. Larichev, 1984; Simon, 1989). A number of factors can play an important role in the interface of decision aids and subjective decision processes (cf. Wierenga, Van Bruggen & Staelin, 1999) including cognitive style and past experience (Huber, 1983; Spence & Brucks, 1997); prior

beliefs about the success or failure of new products (Boulding et al., 1997; Boulding et al., 1998); the joint roles of individual decision strategies, cognitive effort, and personality (Todd & Benbasat, 2000); the role of different decision aids in reducing cognitive effort and influencing decision strategy selection (Benbasat & Todd, 1996); and individual differences and personality characteristics (Benbasat & Dexter, 1982; Zinkhan et al., 1987). Blattberg and Hoch (1990) suggested that, since decision makers have access to decision elements not incorporated in the decision aid, a combination of the model and the decision maker can outperform just the model.

Optimism and Pessimism

Optimism is the tendency to hope for the better. The positive effects of optimism are pervasive. For example, those who believe that positive outcomes are probable, are more likely to work harder and, not only achieve their goals, but also more likely to reap additional positive outcomes, such as better moods, better achievements, and even better health (Seligman, 1991; Chang, 2001). Optimism correlates with measures of positive (and negative) emotions, subjective well-being, and life satisfaction (Lucas et al., 1996). Personality and individual differences can lead to a more optimistic/pessimistic outlook, denoted by the disposition that good/bad things will happen independent of ability (Chang et al., 2001; Marshall et al., 1992). Scheier and Carver (1985, 1993) provided important links between personality and well-being by suggesting that dispositional optimism influences well-being through expectations about the future. Finally, Lovallo and Kahneman (2003) highlighted optimism's pervasiveness in managerial decisions and suggested that optimism is unavoidable and often leads to "overoptimism", an inflated belief in one's chances of success.

There are two interrelated facets of optimism (and pessimism) that are central to the present study: a cognitive facet, regarding the notion of learned optimism, and an affective facet, regarding the possible emotional and attitudinal consequences of one's optimism.

Learned Optimism

Learned optimism is based on Seligman's (1991) theory that optimism is a 'thinking style' that can be learned via cognitive activities and that can be reinforced or stifled—and in extreme cases, can even lead into learned helplessness. Seligman suggests that the enhanced self-efficacy associated with optimism relies heavily on thought processes involving logical deliberation on available facts. The notion that optimism is a learned process that can be reinforced (or stifled) suggests that providing a decision maker using a decision-aid with more 'optimistic' outcomes is likely to lead the decision maker to adopt a more optimistic outlook and

thus aim at higher levels of future performance. Similarly, an induced pessimistic outlook provided by a DSS is likely to stifle the quality of the aspired choice levels in the subsequent decision task.

Emotional and Attitudinal Consequences of Induced Optimism

Optimism and pessimism are, respectively, associated with positive and negative feelings regarding the future. Scheier, Carver and Bridges (2001) described the strong links between positive thinking and positive emotions and suggested optimism's powerful manifestations on psychological well-being (see also Chang, 2001). In the present study, we expected that the degree of "optimism" incorporated in a decision support model would generate more positive emotions in the decision maker; on the other hand, the degree of "pessimism" in the model would generate more negative emotions. Similarly, we expected that the positivity generated by a DSS's "optimism" would enhance the favorability of attitudes vis-à-vis the decision support model.

MULTIPLE CRITERIA DECISION SUPPORT MODEL

In this section we briefly present the Multiple Criteria Decision Support Model, the DSS used in the present study. The purpose of the Multiple Criteria Decision Support Model is to help the decision maker consider alternative allocation plans on an efficient frontier. Multiple Criteria Decision Making (MCDM) refers to an operations research/management science methodology for solving decision and planning problems involving multiple and, generally, conflicting criteria subject to a limited resource "budget" (e.g., total funds, available time resources, etc.). In MCDM, interactive tools assist the decision maker to find the 'best' solution from among a set of available 'reasonable' alternatives. These alternatives are evaluated using several criteria by means of a mathematical model. Multiple Objective Linear Programming (MOLP) problems dealing exclusively with linear models are considered part of MCDM.

In MCDM, any efficient plan has the following property: one cannot find plans which are better on at least one criterion, and not worse on any criterion. The first task for reaching an efficient allocation plan is to formulate a MOLP model using the points on the efficient frontier (for a more detailed description of the interactive method used here see the Appendix).

In the present study, subjects faced a resource allocation decision involving five competing criteria. A MOLP model was first tailored for each subject and subsequently individual models were altered to reflect the bias in our research design. Specifically, unbeknownst to the subject, a bias was generated in the model by inflating or deflating the

criterion values in a subject's frontier by a constant (1.21, 1.14, 1.07, 1, 0.93, 0.86 or 0.79), thus creating the experimentally induced ("optimistic" or "pessimistic") bias.

HYPOTHESES

Users of the optimistic models should become more ambitious while pessimistic models would lead their users to either reduce or adjust the values of their plans to a lesser degree. Formally,

H1: Compared to subjects exposed to the "pessimistically" biased decision models, subjects exposed to the more "optimistic" decision models would subsequently aim at higher levels of future goals.

As suggested earlier, the positivity generated by optimism is likely to influence subjects' feelings during the use of the model. Compared to subjects using pessimistic models, users of optimistic models are likely to experience more enhanced positive feelings and, at the same time, experience less negative feelings during and after the use of the DSS. Formally,

H2: Compared to subjects assigned to "pessimistic" models, users of "optimistic" models would develop more positive feelings following the use of the decision model.

Similarly, the "optimistic/pessimistic" bias of the decision model is likely to enhance the positivity of attitudes vis-à-vis the decision support. Specifically, it can be expected that an optimistic model would generate positive attitudes vis-à-vis the decision support and that pessimistic DSS models would lead to negative attitudes. Formally,

H3: Compared to subjects assigned to pessimistic models, users of optimistic models would develop more positive attitudes towards their decision model.

THE EXPERIMENT

Subjects

Two hundred twenty five freshmen and sophomores at the Helsinki School of Economics participated in the experiment. All subjects were students in an introductory Management Science course with some experience in using computer models. They were recruited on a voluntary basis and received credit for participating. They were motivated to participate and the task was of interest, highly relevant, and important to them. For students, time-allocation is a

major decision that has many long-term consequences. The experimenter explained to them that the model they used was tailored for each individual specifically according to her/his achievement level.

The DSS Experimental Task

Subjects were asked to plan their use of limited time among five different criteria for the next academic year (2001-2002). Total daily available time was the major constraint in reaching one's goals. The criteria to be maximized and their ranges (in parentheses) were: Total number of credit units (0-80 units); Average free time per day, excluding 8 hours of sleep (0-13 h); Total number of credit units with excellent (A) grades (0-56 units); Average time used for professional work (excluding studying) per week (h) (0-48 h); and Average monthly income during the school year, excluding the summer (0-60,000 FIM; approximately 0-10,000 €). These criteria were pre-tested in a pilot study and chosen because they quite well captured the essence of the time allocation task and represented measurable concepts familiar to the subjects.

Procedure

A preliminary phase was conducted about a month before the main experiment aimed at familiarizing subjects with the nature of the experimental task and the DSS software. The main experiment took place in the beginning of March 2001 and lasted about 1.5 hours.

Instructions. The session commenced with a 15-minute instructions phase consisting of a presentation stressing the importance of conscious individual decisions and provided instructions on using the DSS.

Initial unaided planning phase. Next, the experimenter requested the subjects to plan and record on paper their planned values for the five criteria for the next academic year (2001-02). The responses were collected before proceeding with the next phase.

Computer-assisted planning phase. At this phase, each subject used the computerized individual Multiple Criteria Decision Support model to find his/her most preferred values for the five criteria. Subjects were not informed that some of their models were intentionally biased. After completing their interaction with the DSS, the computers were turned off. During this phase, subjects had no access to paper and pencil to record the DSS-derived solution.

Final unaided planning phase. After 5-10 minutes, subjects were again asked to plan and record their values for the five criteria for the next (2001-02) academic year.

Emotions, Attitudes, and Manipulation Check Assessments. Following the recording of their final choices of future criterion levels, subjects responded to a questionnaire which

assessed, among others, their emotions following the use of the DSS, and their attitudes towards the DSS. Emotions were assessed with a six-item checklist scale (yes/no format) indicating whether, during the experiment, they felt surprised, satisfied, relieved, disappointed, distressed, and irritated (Mano, 1996). Then, using seven point bipolar scales, subjects reported their attitudes vis-à-vis the decision support aid. (How satisfied were you with the solution of this program?; How clearly did you understand the basic idea of the method?; How credibly do you think the method is able to find the optimum?; How easy was the method to use?; Do you think the method gave you a possibility to advance to the direction you wanted?; Did this method provide information and guidance for the advancing to the most sensible direction?; and How much time did it take you to find the final solution?). These items were generated and pre-tested in a pilot study involving discussions among the authors and a number of students similar to the subjects in the present study. At the end of the session, subjects were asked to report their perceptions of the degree of realism of the decision model they used (1= too pessimistic … 7= too optimistic), a variable used as a manipulation check.

At the end, the subjects were fully debriefed, the bias in their models was revealed to them, and they were thanked for their participation.

Subject Assignment to the Optimistic/Pessimistic Bias Conditions

Subjects were randomly split into 3 optimistic groups, with 25 subjects in each; 3 pessimistic groups, with 25 subjects in each; and 75 subjects in the neutral group. In order to manipulate their "optimistic" or "pessimistic" bias, the groups had their DSS models prepared as follows:

Neutral group. The tailored efficient frontier of a subject's MOLP model in this group was not manipulated.

"Optimistic" groups. The tailored efficient frontier of a subject's MOLP model was inflated ("pushed" north-east) by multiplying its values with a constant exceeding one: 1.07 in the first group; 1.14 in the second; and 1.21 in the third, most "optimistic", group.

"Pessimistic" groups. The tailored efficient frontier of a subject's MOLP model in these three groups was deflated by a constant less than one, (0.93, 0.86, and 0.79—for the most "pessimistic" condition). The equidistant inflation-deflation coefficients were derived in a pilot study which tested the appropriateness of different coefficients.

RESULTS

Due to technical problems, 201 students were included in the analyses. Some of the analyses had slightly fewer subjects due to a few missing values.

The presence of seven degrees (.79, .86, .93, 1.0, 1.07, 1.14, and 1.21) of bias on the pessimism-optimism continuum calls for correlation analyses which offer a more refined examination (Cohen & Cohen, 1983) of "optimism's" influence on decision making, emotions, and attitudes. Complementary ANOVAs compared the values of our dependent variables for the seven experimental groups.

Manipulation Check and Decision Model Perceptions

At the end of the experiment, subjects were asked to report their perceptions of the degree of realism of their decision model. The correlation between actual and perceived optimism (pessimism) was significant ($r = .362$, $p < .001$) indicating that, overall, subjects in the more "optimistic" conditions were judging their models as more optimistic than subjects in the more pessimistic conditions. This finding was reinforced by an ANOVA which revealed considerable incremental differences among the seven experimental groups ($F(6, 193) = 7.53$, $p < .001$).

Nonetheless, it is important to note that despite the balance of subjects in the experimental conditions, the mean of perceived realism was 4.67, a value higher than the scale's midpoint of 4 (the difference between the mean and the scale's midpoint was significant; $t(199) = 7.47$, $p < .001$). This suggests that, overall, subjects perceived their model as more optimistic than pessimistic, a result consistent with Lovallo and Kahneman's (2003) notions of "overoptimism" (when decision makers, due to an unavoidable tendency towards optimism, consistently overestimate the rates of success of their future projects).

Besides suggesting a slightly "slanted" perception by subjects, these results are important for our subsequent analyses for two reasons. First, while subjects were, overall, in the right direction in sensing their models' actual degree of optimism/pessimism (as suggested by the relationship between actual and perceived optimism), they were also, overall, perceiving their individual model as more optimistic than it actually was. Moreover, this effect was particularly pronounced for the subjects assigned to the pessimistic models. Thus, any support for the hypotheses, if obtained, would come despite subjects' positively biased views of their individual DSS model, a factor that could considerably attenuate the effects of and relationships between the experimental manipulation and our dependent variables.

Optimism's Impact on Decision Making

The influence of the decision models on choice was assessed by the correlation between the degree of optimism and the degree of change in the values of the decision variables; for each criterion, we correlated the change scores with the subject's model's degree

of pessimism-optimism. In line with H1, subjects assigned to the more optimistic models had higher increases in the levels of their future criterion values for four of the five variables: Credit Units, r = 0.221 (p < 0.001); Grades, r = 0.146 (p < .02); Free Time, r = 0.223 (p < .001); Work, r = .153 (p < .015); and Income, r = 0.009 (n.s.).

To shed more light on optimism's effects, change scores were first standardized allowing for a common metric for across-variables assessments. Each subject's five z-scores were added, allowing for the examination of the model's *aggregate* impact on the decision process. The correlation between the decision model's degree of "pessimism-optimism" and this index of aggregate level of improvement was 0.306 (p < 0.001). To visually illustrate optimism's aggregate effects on decision improvement, Figure 1 shows the average change on the aggregate of z-scores for each of the seven levels of the independent variable.

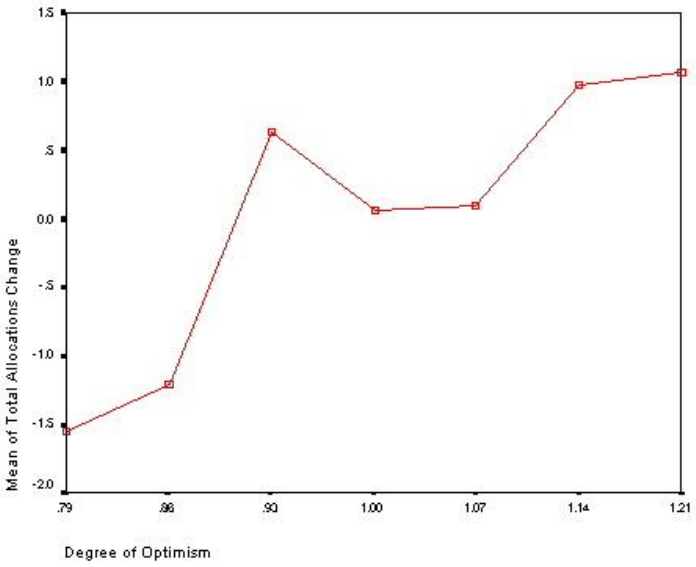

Figure 1. Aggregate (summated z-scores) changes for all five allocation activities

Complementary repeated-measures ANOVAs for each decision criterion revealed results essentially identical to the correlation analyses (the pre- and post-DSS exposure decisions served as the within-subject variable and the optimism-pessimism categorical variable as the between-subjects factor; the within- and between-subjects interaction indicates whether the experimental groups had different changes across experimental conditions). Four of the five interactions were significant (Credit Units (F(6, 194) = 2.2, p < .05), Grades (F(6, 194) = 1.98, p

< .07), Free Time ($F(6, 194) = 2.05$, $p < .05$), and Work ($F(6, 194)=2.1$, $p < .05$)). Overall, the pessimistic groups had negative or smaller change scores, while the optimistic groups had positive or larger change scores. For all five ANOVAs, neither the within-subjects nor the between-subjects effect reached significance.

Optimism's Influence on Emotions

Principal component analysis of the six adjectives revealed one major factor (eigenvalue = 1.7). Of the five items loading on this component, two were positive (Content, Relieved) and three negative (Distressed, Disappointed, and Irritated). The sixth item (Surprised) did not load to this component and was not included in further analyses. A subsequent principal component analysis of the five items revealed a dominant principal component (eigenvalue = 1.7) explaining 34% of the variance (all item loaded (absolute values) above .54: disappointed = .54, relieved = -.55, irritated = .57, distressed = .63, and satisfied = -.63). A CFA of the five items indicated unidimensionality (TLI = 0.91; GFI = 0.986, AGFI = 0.95. RMSEA= .0637, RMR = .037, chi square of one-component sufficiency = 7.14, n.s.). After appropriate reversals, the items were combined into their principal component score of a positive emotion measure (reliability=.79, based on Raykov, 2001).

The correlation between the principal-component emotion index and the degree of optimism in one's model was significant ($r = 0.238$, $p < 0.001$). ANOVA of this index by the experimental variable was also significant ($F(6, 199) = 2.87$, $p < 0.011$). Figure 2 depicts the average emotion scores for each experimental group. These findings support H2 and suggest that the degree of inherent optimism in the model had a considerable impact on subjects' overall emotional reaction to the model.

Taken together, the results concerning the impact of the DSS's optimism on the choices and emotions experienced help clarify how and why optimism led subjects to aim at higher resource allocations. The seemingly "objective" recommendations in the optimistic conditions led subjects to aim higher and feel better. Note that subjects in the optimistic conditions were unaware of the inherent bias in their models' recommendation; similarly, their counterparts in the pessimistic conditions were also unaware of the suppressed goals in their models. This lack of awareness was due to the experimental scenarios which portrayed the DSS as a system that would provide efficient and effective guidelines for resource allocation.

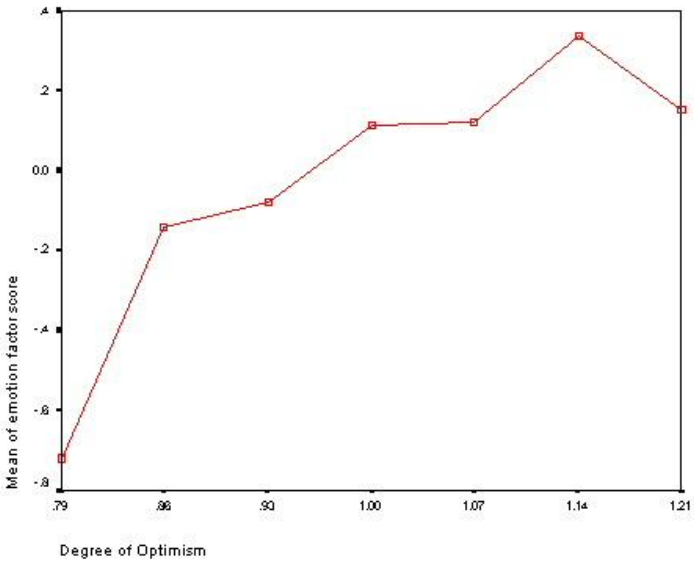

Figure 2. The Impact of pessimism-optimism on the emotion principal component score

Even though subjects had a correct perception of their particular model's direction, at the same time, they were unaware of their model's objective distortion, and, overall, perceived their models as quite optimistic. The task's unobtrusive "rational orientation" led them to deliberate on their choices and consider different allocations while interacting with an "optimization" model. Optimism's and pessimism's emotional influences were manifested despite the fact that subjects were in a "cognitive mode" and believed that they were using a "rational model". Thus, while subjects remained essentially unaware of their model's bias, the DSS-provided suggestions led them to different choices and, at the same time, influenced their emotional states.

Optimism's Influence on Attitudes towards the Model

Principal component analysis of the seven attitudes towards the model revealed one principal component with eigenvalue greater than one (2.92) explaining 42% of the variance (loadings ranging from .52 to .81). The seven items were added to form the attitude scale; alpha = 0.76. A CFA of the five items indicated appropriate unidimensionality; TLI = 0.91; GFI = 0.96, AGFI = 0.91 RMSEA = 0.08, and RMR = 0.05.

The correlation between optimism and attitudes towards the DSS approached significance ($r = 0.108$, $p < 0.07$, one-tailed) providing limited support for H3 that higher optimism leads to more positive attitudes. The ANOVA of the attitude scale by the experimental variable was not significant. The borderline significance may be explained by Davis and Kottemann's (1994) suggestion that DSS users' attitudes may not relate to its actual effectiveness.

DISCUSSION

Our research demonstrates the potential of DSSs to influence decision-makers' choices, affect, and attitudes and reinforces the need to understand the importance of psychological factors when using seemingly objective decision aids.

In this paper we aimed to develop a better understanding of optimism's and pessimism's impact on future aspiration levels based on a DSS containing a systematic bias. Unbeknownst to our subjects, model-provided recommendations were optimistically or pessimistically biased. The effects of our inflations or deflations were considerable. As naturally expected, a purposefully biased decision support system strongly influenced aspiration levels. However, equally important, it brought subjects to a more positive (negative) emotional state and led to somewhat more positive (negative) attitudes towards the decision model. This is interesting because, unlike more traditional emotional stimuli, our subjects were immersed in the cognitive activity of planning future goals. Interaction with a DSS hardly has any emotional overtones, let alone the fact that emotional changes observed here occurred because of computerized feedback based on the subjects' own initial choices. These results reinforce the strong ties between optimism-pessimism and positive-negative affect (Chang, 2001; Marshall et al., 1992).

Psychological experimentation can provide insights into the interactions between decision makers and DSSs. Hoch and Schkade (1996) suggested that DSS developers often pay little attention to whether these systems are compatible with the psychology of the decision maker and might, under certain circumstances, lead to significantly inferior performance. The present study looks at a different side of this phenomenon by focusing on DSSs that, unbeknownst to the decision maker, contain biases. This point of view is especially relevant in the current organizational context where rapid advances in information systems often make a huge amount of data and a plethora of seemingly correct algorithms easily accessible to decision makers.

The organizational aspects of the method used here should also be highlighted. If choice quality can be improved by environmental factors that foster optimism, organizations can

take advantage of such mechanisms. Historically, many aspects of the interaction between scientific management models and individual decision-making have been in the realm of the respective discipline, management science or decision making psychology. An objective of our paper is to demonstrate that through the joint application of decision support techniques and psychological theory, a joint decision science can emerge that better encompasses both domains and which can assist managers to apply insights obtained from both domains.

Our research highlights the importance of psychological factors in the implementation of decision support aids. The neglect of human factors in DSS use is not warranted. Experimental studies of psychological factors involved in decision aids may shed light on how and why managerial decisions are influenced by external factors completely unrelated to the theoretical underpinnings of the "objective" decision aid. Accordingly, management science researchers and practitioners should examine the role of psychological factors that can influence the outcomes of decision aids. Hopefully, such future research would improve human interactions with DSSs.

Decision support models do influence their users and interactions with these models will alter the user's points of view. Organizations often provide DSSs to their managers in order to enhance their insights into the decision problems and allow for a structured communication medium. But DSS use may lead to conscious and unconscious influences not only on the decision maker's performance but also on her/his emotions and well-being.

It is widely reported that validation determines the credibility of decision models (Waikar & Pattanaik, 1992). Among others, Wierenga, Van Bruggen and Staelin (1999) suggested the distinction between technical and organizational validation of DSSs and recommended that the ultimate criterion for validation is not how the decision model technically works but rather how it impacts organizational performance. Our results further reinforce this notion and show how difficult yet essential it is to study the validity of a model. Given that models may influence the decision maker's behavior, feelings, and attitudes, the risk inherent in biased models should be taken into account in model evaluation and validation. Furthermore, both model builders and decision makers need to assume the responsibility of correctly validating DSSs.

In this paper we have demonstrated the influence of biased DSSs. One may very well ask: What can DSS designers do about it? In many respects, DSSs and their recommendations act as anchors. As Tversky and Kahneman (1974) point out, anchoring may be a useful heuristic. In the case of DSSs, their very purpose is to aid the decision maker by providing good recommendations ("a good anchor"). However, one must exercise judgment when basing decisions on anchors. As Hammond, Keeney and Raiffa (1998) suggest, the best protection

against psychological traps is awareness. Forewarned is forearmed! Hammond et al. (1998) further suggest that one builds tests and disciplines into our decision making process to uncover traps and biases. Regarding DSSs, what these tests and disciplines would be calls for additional research. It certainly helps to view a problem from multiple perspectives. And, decision support systems designers must be open minded and careful not to bias the very tools designed to steer decision makers into making better decisions.

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APPENDIX 1
DESCRIPTION OF THE RESEARCH INSTRUMENT

Individual MOLP models

Each subject in our experiment was provided with a DSS, which comprised of their individual MOLP model and the Pareto Race interface, to help her/him resolve the allocation problem at hand. The following four steps summarize the process of building the MOLP models.

Step 1. We mapped each subject in the five-dimensional 'activity' (criterion) space according to their actual current values on the five 'activities' (for a two-dimensional illustration, see Figure 3).

Step 2. Using the MOLP procedure (see Korhonen et al., 2003) we 'enveloped' the mapped points in such a way that the 'best' points formed the 'north-east' boundary. This boundary is called the efficient frontier in the MCDM literature (Steuer, 1986). All points on or 'below' the efficient frontier are assumed to represent possible allocation plans. However, points below the efficient frontier are not reasonable, since on the efficient frontier one can find alternatives which are better on at least one criterion, and not worse on any criterion. The relative efficiency score of each point was obtained as follows. First, we drew a ray from the origin to the efficient frontier through the point under consideration. Then we calculated the proportion of the length of the ray from the origin to the point to the length of the ray from the origin to the efficient frontier. The efficiency score of point A in Figure 3 is approximately 0.6.[1]

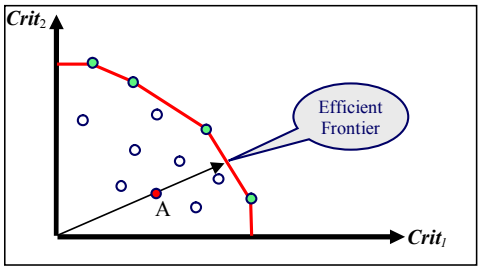

Figure 3. Illustration of efficient frontier

[1] The idea and method to measure relative efficiency originates from Data Envelopment Analysis (DEA) (Charnes, Cooper and Rhodes, 1978).

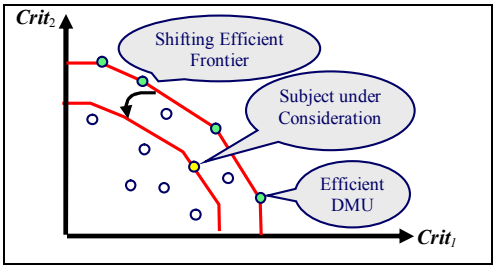

Figure 4. Construction of the tailored efficient frontier for a subject

Step 3. A tailored efficient frontier was constructed for each subject by multiplying the overall efficient frontier with the person's own efficiency score. This causes the efficient frontier to shift. In Figure 4 the arrow represents the shift. Hence, after the shift, each 'point' (in Figure 4, see the dot for subject under consideration) is located on the efficient personalized frontier, no matter how (relatively) efficient the subject initially was.

Step 4. We altered the tailored models to introduce the bias needed in our experiment design. Specifically, unbeknownst to the subject, the bias was generated in the model by multiplying all the activity values in a subject's frontier obtained in the third step by a constant (1.21, 1.14, 1.07, 1, 0.93, 0.86 or 0.79), thus creating the experimentally induced (optimistic or pessimistic) bias. That is, for subjects in an optimistic-bias experimental condition, their efficient frontiers were pushed north-east by multiplying them with a constant exceeding one, while for subjects in a pessimistic-bias condition their efficient frontiers were "squeezed" in the opposite direction.

For a more thorough description of the MOLP model's theoretical underpinnings and the tailoring, see Korhonen et al. (2003).

Pareto Race Interface

In the present study, we used a variant of Pareto Race (Korhonen & Wallenius, 1988) in implementing our MOLP research instrument. Pareto Race is an interactive interface that enables subjects to move freely on the efficient frontier and, thus, work with the computer to find the most preferred values for the output variables ('activities'). In Pareto Race the subject sees the objective function values (output variables, 'activities') on a display both in numeric form and as bar graphs, as s/he travels along the efficient frontier. The search is analogous to driving an automobile. The 'drive' starts from a random point on the efficient frontier and the subjects use keyboard controls to accelerate, shift and brake. It is also possible to change direction by

providing new aspiration values for the objectives. The subject discontinues the search when s/he is not able to identify output variable values that are more preferred.

In our experiment, it is important to note that throughout their iterative interactions with the DSS outputs (Figure 4), subjects were cognizant of the fact that the model simply suggested—and did not dictate—various solutions. Moreover, they also realized that, eventually, they would have to make their own choices as to their final allocations to the different competing activities.

Essay Six

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Evaluating strategy tools through activity lens

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EVALUATING STRATEGY TOOLS THROUGH ACTIVITY LENS

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Abstract

Strategic level management tools - strategy tools - have generated much interest in organizations as potential ways of supporting modern strategizing. Strategy tools such as Porter's five forces, SWOT Analysis, Scenario Analysis, and the Balanced Scorecard are designed to support organizations in dealing with the complex demands of competitive markets and the quest for maintaining and creating strategic advantage. While hundreds of different strategy tools are available, increasingly in computerized form, reports concerning their usefulness remain ambiguous. This paper takes a new approach to evaluating strategy tools by focusing on strategizing activities. In other words, instead of concentrating on outcome expectations and the tools' prescribed tasks, we look at how the tools are actually used. We argue that the usefulness of strategy tools should be conceptualized as a form of activity, and that such a framework allows us to evaluate, explain and expect different experiences and consequences of strategy tool use in organizations. In addition to contributing to evaluation literature, our paper also adds to neo-institutional management tool discussions by connecting institutional forces to micro-level activities. Our practical contribution is to facilitate and draw attention to the process of choosing strategy tools.

Keywords

Management tools, strategy-as-practice, evaluation, executive use, multi-level issues.

Introduction

"When adopting a [strategy] tool, the main challenge is to recognize situations in which its application is appropriate – where it adds value and where it doesn't."
Strategy director of a large Finnish company

To support modern strategizing, organizations are adopting strategic-level management tools, i.e. strategy tools. Hundreds of such tools are available (Bain&Company, 2005) increasingly in computerized form and tools such as Executive Information Systems, SWOT (strengths, weaknesses, opportunities and threats) Analysis, Scenario Analysis, and the Balanced Scorecard can be found in organizations all over the world (Rigby and Bilodeau, 2005).

Traditionally, strategy tools have been promoted by management consultants, popular management literature, business school courses and management scholars geared towards practical solutions (e.g. Sahlin-Andersson and Engwall, 2002). For researchers, strategy tools offer the possibility of implementing academic theories in practice. Many prevailing management theories, e.g. Porter's Five Forces, Value Chain and Real Options, have been developed into strategy tools. Recent improvements in information technology techniques have accelerated the development of strategy tools, and the scope of disciplines offering strategy tools has also broadened.

In general, strategy tools are a heterogeneous group of products designed to support organizations in dealing with the complex demands of competitive markets and the quest to create and maintain strategic advantage. The idea behind a strategy tool is to transform 'best practices' or theoretical know-how into steps that are integral to the tool. Ideally, using the tool then releases knowledge in a practical and contextual form that supports more effective strategies and facilitates strategizing.

In practice, the usefulness of strategy tools is not completely clear, i.e. how they actually benefit the user organization. Mainstream management and organization literature does not focus on the use of tools or assessments of tool value. In the main body of literature dealing with strategy tools in general terms, the literature concerning management fads and fashions, a neo-institutional view is taken. This view depicts tool adoption as a macro-level phenomenon. Evaluation of usefulness is implicitly not seen as intrinsic to the adoption of a tool (e.g. Abrahamson, 1996; Kieser, 1997) since choices of tools cannot be explained by rational behavior. However, some literature in this category does depict organizations as active agents (e.g. Benders and van Veen, 2001; Clark, 2004) and some literature, usually geared more for readers who are practitioners, offers warnings about short-lived tool fashions and suggests that closer attention should be paid to the selection of tools (e.g. Shapiro, 1995). User-oriented literature highlights the question of usefulness, but often lacks the depth required for strategy tool evaluation.

In the following, we have collected five other central issues from literature on the evaluation, usefulness and value of strategy tools. Taken together, they form a confusing, scattered, and difficult-to-interpret picture, and are of little help in evaluating tools in practice.

Firstly, in spite of the broad diffusion of strategy tools, many studies show that senior managers rely on their intuition and do not use tools (e.g. Kasanen, Wallenius, Wallenius, and Zionts, 2000; Miller and Ireland, 2005; Nutt, 2002). Often these studies only look for prescriptive use of tools and do not take into account the reports that business practitioners use tools in creative ways that may not have been intended or imagined by the tools' developers (Frost, 2003; Jarzabkowski, 2004; Morecroft, 1992; Workman, 2005). In addition to traditional hands-on use, tools are for example used both cognitively and linguistically, but these different ways of employing tools are seldom taken into account in evaluation literature.

Secondly, tool evaluation is traditionally treated as a part of tool-development validation routines and often defined as assessment of the outcomes of use of a tool (Hamilton, 1991). However, tool developers repeatedly blame a lack of quantitative data, confidentiality issues, and the complexity of circumstances for not carrying out thorough evaluations (e.g. Eden, 1995; Strauss, 1960). Instead, user testimonials relating to success are often used to demonstrate performance gains and other positive outcomes following from use of a tool. Since research by Davis (1989) and Davis and Kottemann (1994) show that subjective perceptions of tools are not necessarily indicators of actual performance, user evaluations alone do not provide irrefutable evidence concerning the actual value of tools.

Thirdly, evaluation criteria and procedures for strategy tools have been widely debated (Borenstein, 1998; Finlay and Wilson, 1997; Landry, Banville, and Oral, 1996) and many researchers have concluded that as strategic-level situations are unique, traditional evaluation is simply not possible (Eden, 1995; Rosenhead and Mingers, 2001). Olphert and Wilson (2004) also claim that the context in which tools are used becomes of great importance and cannot be separated from the tool in the process of evaluation. Déry, Landry, and Banville (1993) suggest that social relationships need to be taken into account and Mingers (2001) points out that political, social, and personal views should be included. Miser (1993) notes that, in addition to sociological facts, history is an important component of evaluation. Overall, uniform canons of evaluation have not been established and the evaluation of strategy tools is viewed as a highly contextual task that cannot be carried out by tool developers alone.

Fourthly, in spite of the unclear evaluation processes, groups promoting strategy tools have taken an active role in attempting to prove that strategy tools have value. For example, consulting companies have come up with novel ways to show the relevance of tools. Matheson and Matheson (2001) have discovered that using best practices creates profits, and Dorgan, Dowdy and Rippin (2006) have been able to link the

use of management techniques to productivity. Also, specific types of strategy tools have been shown to be useful. For example, in the field of decision analysis (DA) Clemen and Kwit (2001) have illustrated that using DA techniques in strategic decisions brings clear economic advantages, and in the field of operations research (OR) Bell, Anderson and Kaiser (2003) have proven that using strategic OR tools can bring sustainable strategic advantage. However, while these studies prove that strategy tools can be useful in some situations, they neglect to describe in any exact way how they are used to create value and when they are less beneficial.

Fifthly, the discipline of Decision Support Systems (DSS) has been focusing on the effectiveness of computer-based decision models since the 1970s (Shim, Warkenting, Courtney, Power, Sharda, and Carlsson, 2002). DSS aims to provide a structure for ill-structured decisions, and DSS literature therefore provides a generous number of articles concerning strategic-level tool use. Even so, the evidence concerning tool value is not conclusive. Use of DSS tools is shown to affect performance either positively (e.g. Benbasat and Dexter, 1982), negatively (e.g. Kottemann and Remus, 1987) or to have no effect (e.g. Fripp, 1985). Notably, this body of literature points out that the practical effectiveness of tools is tightly linked to different patterns of use that involve, for example, users' psychological styles, the incompatibility of the human-tool interface, and the profundity of tool use and adoption.

This paper suggests that examining evaluation from activity viewpoint will make sense of these apparently-inconsistent findings. In other words, instead of focusing on outcome expectations and the tools' prescribed tasks, we look at how the tools are actually used in practice. We argue that the usefulness of strategy tools should be conceptualized as a form of activity, and that employing such a framework allows us to evaluate, explain and expect different experiences and consequences that follow from the use of strategy tools in organizations.

Furthermore, we maintain that the evaluation of strategy tools is an important but neglected part of organizational and management studies, and hope to provoke dialogue in this area. As the opening quotation in our paper highlights, evaluation has an elevated importance when seen from the user organization's viewpoint (see also Roy, 1993). However, evaluation is not only a practically-oriented instrumental view of model validation, it is also an attempt at further understanding and improving predictive ability - the goals of the academic community (Dubin, 1969). How do we improve our work if not by learning about how the theories we generate are used in practice? How do we plan to bridge the gap between theory and practice if not by evaluating the realization of current theories? How do we set out to help organizations and managers if not by studying what they find useful? In our field, all of these are valid questions which require answers.

We construct our evaluation framework through an empirical study of more than 300 strategy tool users and non-users. We begin with describing the link between strategy-as-practice research and evaluation. We then unfold our empirical study and its findings. Finally, we form our evaluation tenets and discuss them.

Usefulness as an activity

This study examines strategy tool evaluation from the strategy-as-practice viewpoint (Jarzabkowski, 2005; Whittington, 2003). In an article that describes activity-based strategy-as-practice research agenda, Johnson, Melin, and Whittington (2003) point out that the value of a resource depends not on its existence but on how it is utilized and that the study of these acts of utilization is intrinsic to the strategy-as-practice view. We therefore study the acts that make strategy tools valuable.

The strategy-as-practice viewpoint is a micro-level approach that concentrates on practices carried out by a wide range of strategy practitioners, for example, in connection with strategy tools. We look at the practitioners – primarily executives, but also board members, middle managers, assistants, consultants, customers, shareholders, regulators etc. - as social individuals interacting with the social circumstances that surround strategy tools. The focus is on how practitioners use the tools, what work they do with them, with whom they interact through use of the tools, and what practical reasoning they apply in the different methods of using strategy tools (Chia, 2000; Ezzammel and Willmott, 2004; Jarzabkowski, 2005).

To summarize, we look at the different activities around strategy tools that shape and are shaped by the society within which tool use occurs. To gain a better understanding of the activities, we let the practitioners define the tools used in strategy work, and view strategy-tool use as consisting of a range of somewhat mundane strategizing activities (see also Jarzabkowski, 2005). The tool itself is not the center of attention, the way in which it is used is. Furthermore, neither the actors nor the associated activities can be considered separately from the tool-use situation since that situation provides an interpretive context for the action (Brown and Duguid, 1991; Lave and Wenger, 1991).

This activity-based view allows strategy-tool use to be viewed as a flow of organizational activity that incorporates rationality and irrationality, content and process, intent and emergence, thinking and acting as reciprocal, intertwined and often inseparable parts. Furthermore, the strategy-as-practice viewpoint adopted in our study also contributes to an understanding of how micro-level activities are dominated by macro-level societal forces (see Abrahamson, 1996).

Most importantly, however, the strategy-as-practice viewpoint offers us an opportunity to study strategy tools as "…mediators of action, examining their consequences for the strategy, the actors who use them,

and the interactions that are conducted." (Jarzabkowski, 2005:10). In other words, the accent is on analyzing strategizing activities that are mediated through strategy-tool use, and also on studying the consequences of tool use in these activities in a diversity of social settings. These consequences, some positive and some negative, permit us to analyze the usefulness of strategy tools.

On the other hand, this approach does not provide information concerning the amount of usefulness, and although it may not be able to link the usefulness of a tool to organizational performance in a direct manner, the strategy-as-practice view can reveal how routines, tools and processes are configured to provide sustainable and competitive advantages (Johnson et al., 2003). Also, the scope of the study and the units used in analysis are natural limitations on this approach. Strategy tools are however common in all modern organizations and to some extent, their use across organizations is comparable.

Data and analysis

In this study, we decided to use the methodology of grounded theory (Glaser and Strauss, 1967; Strauss and Corbin, 1998) in collecting and analyzing data on strategy tool use. More specifically, we chose to follow Charmaz' (2000) approach to grounded theory that does not assume an objective external reality but rather paints a picture of an interactive process and its temporal, cultural and structural contexts. In adopting Charmaz' (2000) approach, we have focused on describing everyday strategizing activities in modern organizations. In overall terms, the main goal of choosing grounded theory was to enable a dynamic description of strategy tool use that captures complexity and allows the linking of theory with practice.

Locke (2001) points out that grounded theory is particularly valuable at capturing complexity in contexts as action unfolds. Constant comparisons of data, the iteration of research questions, and the interactive emergence of categories have allowed the complexities of strategic-level work to widen our perspectives on strategy-tool use. During the process, we have recognized the mutual creation of knowledge by us and our informants, and aimed at an interpretive understanding of subjects' meanings (Lincoln and Guba, 2000; Schwandt, 1994).

We used theoretical sampling (Glaser and Strauss, 1967:45) and collected data using a variety of methods. The iterative data collection, coding and analysis took place at the same time as concepts emerged and guided us in deciding what data would next offer opportunities to reveal variations and refine our concepts of strategy-tool use.

Our study is based on five different types of data:

I. Survey

To create a wide view on strategy tool use, we studied 182 questionnaire answers from the 500 largest companies in Finland (Talouselämä, 2002). A short, open-ended questionnaire (paper and web form) was sent to top-level managers involved in strategic management. The questionnaire was returned by 172 companies. In some companies, more than one respondent answered the questionnaire independently, increasing the number of returned questionnaires to 182. Approximately 70 percent of the respondents were identified as company executives. Each respondent was asked to record all the strategy tools used in supporting the making of major decisions in their companies. They were also asked to define the different purposes for which strategy tools were used. Finally, respondents described in their own words the advantages and the disadvantages of using such tools. All statements were coded.

II. Unstructured e-mail and phone interviews

Some respondents did not wish to fill in a form and some wanted to provide additional information concerning their strategy process. Thus, 92 of the executives, managers or assistants working with strategy tools either sent open-form e-mail replies or phoned in their responses. This data varied from short statements about why strategy tools were not used to lengthy descriptions of strategy routines. All data was transcribed.

III. Themed face-to-face interviews

Interviews were conducted with 16 executives and five managers working in large and medium-size companies in Finland. Four follow-up interviews were also arranged to check on some key concepts. Interview themes range from general strategy work to specific points concerning strategy-tool use. Four interviews could not be recorded, but notes were made either during or immediately after these interviews. All other interviews were recorded and either fully or partly transcribed.

Some interviewees also showed us documents related to their strategizing and strategy-tool use. These included slides and plans concerning the strategy process, documents from strategy meetings, and printouts of strategy-tool results. Notes were taken.

IV. Presentations on strategy tools

Seven organizations were invited to give a presentation in a university course on the use of strategy tools. Two of these organizations were consulting companies that reflected on their client's tool use. One presenter was from a military organization and the four remaining presenters represented large Finnish companies. The presentations were videotaped and transcribed in part.

V. Participant observations

Researcher A acted as a complete participant (Gold, 1958) for 21 months at executive level in one of Finland's 500 largest companies. The company employed two strategy tools and was in the process of adopting a new tool. Researcher A took part in both strategizing and strategy tool use. Notes were taken of formal and informal meetings at different levels in the company. Other material includes minutes taken at executive and board meetings, and printouts of strategy tool results.

Researcher B participated as a consultant in strategy process projects in three organizations. In these collective-learning projects, which began by defining the problems together with the organization, the aim was to contribute to both practical actions and academic theory (Argyris, Putnam, and Smith, 1985). Notes were kept.

The research questions have evolved as the research progressed. Our interest in finding out how strategy tools are useful in strategy work has guided our quest.

Both the authors of this paper were involved in the iterative process of coding, grouping and categorizing the collected data throughout the entire period of the study. We have coded the data selectively (Strauss and Corbin, 1990:116), formed categories, and generated concepts by making continual comparisons. In our interpretation of the data, we have examined views, values, acts, facts, beliefs, ideologies, intentions, motives, purposes, situations, structures, rules and tacit meanings. In spite of the rich data set we have acquired, this situated, context-dependent perspective of our study makes causality somewhat suggestive, incomplete, and indeterminate.

However, the aim of our study is to elaborate on strategy-tool use and its usefulness. We look at strategizing, the use of strategy tools in organizations, and most importantly, the role that strategy tools play in strategizing. We do this by focusing primarily on the executives, the work they do and the ways that they use strategy tools in their organizations.

Multi-level strategizing with strategy tools

This section introduces the findings of our study. We first indicate why the focus of our study is on strategizing activities. We then elaborate these activities and finally connect strategy-tool usefulness to changes in carrying out strategizing activities.

Background information on strategy tool use

First, we highlight some results from our survey (for complete study, see Stenfors and Tanner, 2006; Stenfors, Tanner, Syrjänen, Seppälä, and Haapalinna, 2007) and initial interviews that led us to use a strategizing-based multi-level view as our platform for assessing usefulness.

On average, the surveyed companies used just less than five strategy tools (the median and mode were also five) and the standard deviation within the 172 companies was only 2.2. It is however important to note that 13 % of the responding companies told us that they did not use any kind of tools in connection with strategic issues. Many such "non-user" organizations explained that their company culture either did not support or even prohibited the use of tools. We interpreted this finding to mean that decisions concerning strategy tool use are dependent not only on institutional fashions (e.g. Abrahamson, 1996) and individual preferences (Benbasat and Dexter, 1982), but also on organizational issues, and proceeded to study strategy-tool use using a multi-level view.

In our survey, tool use was defined by the respondents by listing the tools that in their opinion were employed in the company when making major decisions. In a similar open-ended manner, we asked respondents to list the tasks for which each tool was used. We classified the lists of tools provided by the 182 respondents into the tool categories presented in Table 1.

Even though our questionnaire did not have the word strategy in it, respondents used notions belonging to typical strategy discourse in their descriptions of strategy-tool tasks. For example, strategy, strategic planning, strategy analysis and strategy work featured 80 times in the 137 answers concerning SWOT Analysis. The tasks for which the tools were used were therefore a convenient fit to a strategy process chart (see Stenfors and Tanner, 2006). On the other hand, establishing where tools were used in the strategy process did not lead to a better understanding of how useful the tools were and what practical activities were accomplished by using them. Following Brown and Duguids' (2000) observation that practice is what is inside the process, we focused our studies on practical micro-level strategizing activities.

We also asked respondents questions concerning the advantages and disadvantages of the tools they used, but rather surprisingly, we received very similar types of answers and were unable to detect any obvious differences between a diverse range of tools. The different technical and theoretical aspects of strategy tools did not seem to play an important part in opinions about a tool's usefulness. An interview with a tool specialist in one of the surveyed companies is illuminating:
Interviewer: "Why did you choose the Expert Choice"
Specialist: "No specific reason"
Interviewer: "So, it just was?"

Specialist: "[The tool] is not important. [pause]. And Expert Choice has a sensitivity analysis, but we don't really know how to use it." [laughter]
(Tool specialist IJMALENOD2)

We proceeded to treat strategy tools as mediators of action, not as separate units of study. More specifically, our focus is on strategizing activities that strategy tools mediate.

Support tool group	Frequency
SWOT Analysis	136
Spreadsheet Applications	120
Balanced Scorecard	104
Risk Analysis	66
Analysis of the Financial Statements or Investments	63
Quality Methods	51
Scenario Planning	46
Environment Analysis	40
Brainstorming	37
Statistical Analysis	33
Life Cycle Analysis	25
Optimization	23
Project Management Tools	20
Simulation	20
Value Chain Analysis	10
Human Resource Management Tools	7
Management Information Systems & Business Intelligence	7
Enterprise Resource Planning	7
Number of tools classified (94 %)	**815**

Table 1. Groups of support tools listed by executives (Stenfors et al., 2007)

Strategy tools mediating strategizing activities

For the executives who took part in our study, strategy tools are instruments used to facilitate strategizing. Furthermore, according to the executives' discourse, the tools allow the bridging of abstract concepts to specific practicalities and add meaning to the strategizing activities that they mediate. When asked specific questions about strategy-tool use, executives talked about strategy processes, performance metrics, their company's competitive advantage, teamwork, intangible assets, stakeholders, and the scale and scope of their company's operations. For them, strategy-tool use is embedded in strategizing activities, and the tools are not meaningful in isolation. The strategizing activities accomplished with and through the use of tools are what interest organizations, not the tools per se.

The practical uses of strategy tools are diverse. It is often difficult to point out when the use of a strategy tool begins and when it ends, since use can take cognitive, linguistic and collective forms. In their daily routines, executives often use printouts, figures or specific information produced by using strategy tools, they also attend strategy days at which strategy tools are used, and they take part in different meetings where strategy tools provide information and structure. One of the interviewed managers described the practice of using a strategy tool in the following way: *"…then we have to relate the results [of using the strategy tool] to the operational environment. It is not really ever what the numbers show, they always need to be adapted… and sometimes also recreated and orchestrated to fit the current situation and moment in time." (Executive HEMÄ17.10.1)*

We discovered that executives rarely use strategy tools in ways that the tool developers intended them to be used, but rather exploit in a flexible way those components of the tools that can be used to answer their needs or to advance a particular cause. These needs and causes make up the strategizing activities for which strategy tools are used (see also Garud, Jain, and Kumaraswamy, 2002).

From our data, we identified twelve different classes of this type of strategizing activity (see Table 2). Furthermore, we were able to identify four different levels of social context in which the strategizing activities take place (Table 2).

Level of social context	**Strategizing activities mediated by strategy tools**
Individual	- Planning efficiently - Dealing with time - Making sense and exploring new ideas
Interpersonal	- Facilitating communication - Motivating others and playing political games
Organizational	- Enabling learning and innovation - Leading, guiding and coordinating work - Enacting organizational culture
Societal	- Keeping up with competition, technological improvements and professional techniques - Meeting industry standards, codes and laws - Responding to political issues and power structures - Creating stakeholder value

Table 2. Strategizing activities in different levels of social context

The different levels of social context can take place simultaneously, and the strategizing activities that take place within them may affect each other. An excerpt from our field notes illustrates the levels of social context:

Executive Jansson is checking Balanced Scorecard outputs using a computer screen that summarizes monthly information. After checking the outputs he copies some of the numbers to a spreadsheet

program. He then e-mails a request for more information to one of the people in charge of the functions that contribute to the Balanced Scorecard outputs. He then calls a colleague: "…Did you see the BSC values?... As I've said before, we should close down that operation." (Executive IDBMSKHE03)

Executive Jansson is functioning at an individual level of social context when interpreting the Balance Scorecard outputs. When he communicates with his colleagues, he is working at interpersonal level. His actions appear be guided by the strategy tools he is using, thus he also functions at organizational level. Furthermore, if his motives are to create stakeholder value by working towards closing an operation, he acts at societal level.

Multi-level activities and usefulness

The different levels of social context bridge our micro-level study to institutional-level theories (e.g. Drnevich and Shanley, 2005; Mackey and Barney, 2005). Furthermore, the levels allow us to match consequences of strategy-tool use for each strategizing activity. The consequences in our study were reported by the users and then categorized by us (see Tables 3, 4, 5 and 6). They describe changes to ways that strategizing activities were carried out before using the tools and give us an opportunity to learn about the usefulness of the tools as a mediator of strategizing activity. Following, we have compiled separate tables for each level of social context and describe in greater detail the strategizing activities mediated by strategy-tool use. We also make general comments on the usefulness of tools based on our data.

Individual level

In the following table, we indicate an executive's individual-level strategizing activities that are mediated by strategy-tool use. These are strategizing activities that executives perform alone. The core categories of such strategizing activities are: Planning efficiently, Dealing with time, and Making sense and exploring new ideas (Table 3).

Executive discourse depicted ***efficient planning*** as the main strategizing activity mediated by strategy tools. Tool use is often legitimized by referring to the efficiency of systemized and rational routines. Typical tools that support efficient planning are Spreadsheet Applications, Risk Analysis, and the Analysis of Financial Statements. These tools are often part of an executive's reoccurring work routines. On the other hand, executive actions show that planning efficiently is often not the only motive for tool use - other motives are perhaps less rational and even though they may include a greater degree of feelings and intuition, are essential in explaining strategy-tool use.

Dealing with time was a much-talked-about strategizing activity. Saving time could perhaps be categorized under the activity described above, but for executives, time is both a resource that needs to be planned and managed efficiently and also an outside force that has to be dealt with. Executives talked about using the tools to "*keep up*" and to be "*time-efficient*" and "*proactive*" and attempted to use any

strategy tool to help them deal with time. In many cases, however, strategy tools are quite specific in their approach to time and executives struggled to come up with ways of using them to deal with time.

Strategizing activities mediated by strategy tools	**Positive consequences of tool use to strategizing activities**	**Negative consequences of tool use to strategizing activities**
Planning efficiently	• Better focusing of functions and tasks • Help in setting targets and objectives • Support for rational decision-making and systematic planning • Frameworks for structuring and clarifying processes • Aid in allocating resources • Financial advantage through gains in functionality and efficiency • Help in control and overseeing	• Thinking is narrow and limited • Difficulties in deciding and setting parameters • Functionality limited to simplified situations and assumed circumstances • Form triumphs over substance • Tools need to be customized and streamlined for good functionality • Theory and practice do not meet
Dealing with time	• Faster analysis, planning, controlling and running of operations	• Priority problem - tool use takes up time that should be used for dealing with actual business issues • No time to use tools efficiently
Making sense and exploring new ideas	• Clearer holistic view • Information that helps in analyzing relationships and specific points of interest • Awareness of the future and an understanding of risk	• Uncertainty and risk are not eliminated • Tools have limitations and can cause misunderstandings or misinterpretations

Table 3. Individual-level strategizing activities

When ***making sense and exploring new ideas,*** executives sought information from different sources, often in ways that appeared haphazard or coincidental. They used strategy tools, especially tools that compile information such as financial tools, Business Intelligence tools, ERP and CRM, to find proof of some idea they already had, to understand specific issues better, or to explore new possibilities. From the computer screens of the tool programs or by using printouts provided by the tool software, they look for quick answers, but at some points become interested in other items of information or contexts, and the sense-making or idea-generation process they are pursuing is interrupted by another stimulus. This highlights the non-linearity of both the sense-making and idea-generation processes, and in general, executives have many such processes under way at the same time. Strategy tools, however, do not appear to be flexible enough to handle the emergent qualities of executives' sense-making and idea-exploration processes. In spite of this, executives do take advantage of strategy tools at suitable moments to help in sense-making. Often this means that they use only some components of the strategy tools or use them in a modified manner.

Interpersonal level

By interpersonal-level strategizing activities we mean activities that an executive engages in with another person (e.g. other executives or subordinates) or a small group (project teams and meetings) supported by some form of strategy-tool use (e.g. hands-on, cognitive or linguistic use). Our data provides plenty of

examples of executives using strategy tools in broader connections and in networking between people, and we have named the two distinguishable core categories of interpersonal use Facilitating communication and Motivating other people and playing political games (Table 4).

Strategizing activities mediated by strategy tools	Positive consequences of tool use to strategizing activities	Negative consequences of tool use to strategizing activities
Facilitating communication	• Establishing common language and concepts • Accepted, therefore functional presentation devices	• New vocabulary difficult to understand • Communication problems • Tools are complicated and difficult to master
Motivating others and playing political games	• Getting the members of an organization to commit to issues presented with tools	• Outputs of tools do not lead to continuous or rapid action • Tools are used incorrectly and without proper care

Table 4. Interpersonal-level strategizing activities

According to the executive informants, communication, negotiation and discussion are the key pillars of strategizing. Strategy tools are also harnessed to serve these needs and they are often used simply to ***facilitate communication***. For example, one use for strategy tools can be hands-on participation by two people who send information to each other about an output provided by the tool, or who talk to each other about it. Tools support social interaction and mediate interpersonal issues and ideas. Often, tools provide a common vocabulary. They may also aid in structuring frameworks collaboratively and in forming shared concepts.

Interviewer: … have you had specific meetings at which you talked about [the strategy tool]?

Executive: Of course we have, there really are no weeks in which we do not, in one way or another, bring up [the strategy tool] and that starts from how we set up [the issues]…

(Executive STLEFO1.83)

Strategy tools are also used as a common point of reference, a means of translation and presentation, and as social platforms. This corresponds to Star's (1989) notion of a boundary object which describes a commonly-shared object that connects different participants' viewpoints and realities. One executive in our data stated: "*Yes... people talk as if they shared the same understanding but still they experience it in their own ways. Everybody has their own interpretation…"*

(Executive HEMÄ17.10.10-19)

When used as boundary objects, strategy tools may also support social creativity. However, to perform this function, strategy tools must be simple enough for everyone to understand and flexible enough to suit the purposes of different users.

In ***motivating others and playing political games***, executives use any type of strategy tools, their components, results, aspects and concepts to enhance compliance, obedience, and cooperation. The tools are usually used to improve communication, a sense of mutual purpose and motivation. Also,

executives may take advantage of the technical, cultural and linguistic legitimacy associated with the strategy tools (also Campbell, 1997). For example, strategy tools can be used as 'a gentle push' to create desired levels of motivation. Also, supplying 'facts' provided by a tool may justify specific needs and causes. Furthermore, the procedures dictated by strategy tools and the results they produce are occasionally used as an authoritative form of support for steering and shepherding other people. Playing political games can also be a motive for the use of specific strategy tools, perhaps in particular ways, or possibly provide reasons for not using tools at all. Typically, executives use the tools, interpret the tools and apply their outputs in ways that best serve their interests.

Organizational level

At organizational level in this study, we continued with our primary focus on the use of strategy tools by executives, but also studied the impacts of tool use in an organizational context. In this connection, "organizational context" means that strategy tools are implemented throughout the organization and that executives' strategizing activities are therefore also affected by these tools, or that executives use other tools which influence organizational activities. We identified three core categories of organizational-level strategizing activities: Enabling learning and innovation; Leading, guiding and coordinating work; and Enacting organizational culture (Table 5).

Strategizing activities mediated by strategy tools	**Positive consequences of tool use to strategizing activities**	**Negative consequences of tool use to strategizing activities**
Enabling learning and innovation	• New viewpoints • More abstract levels of thinking	• Fear of inflexibility, technical thinking, and loss of creativity • Abstractions can be meaningless or shallow
Leading, guiding and coordinating work	• More systematic and predictable ways of acting • Controlled roles and responsibilities	• Blind belief in the effectiveness of tools • Useless bureaucracy • Erroneous guiding effects • Much effort and time is used in updating tools that may not be helpful • Unlearning old procedures is difficult
Enacting organizational culture	• General understanding and approval of ways of acting • Enhanced team spirit • Motivation and improved appreciation of the company	• Not all tools are suitable for differing company cultures • Change resistance in the organization • Weakness of commitment to a tool throughout the organization

Table 5. Organizational-level strategizing activities

Linked to the previous interpersonal-level activity of facilitating communication and the notion of a boundary object (Star, 1989) at an organizational level, strategy tools perform a catalytic role by ***enabling organizational learning and innovation***. Tools encourage forward thinking, provide guidance for deeper understanding and more abstract levels of thinking, and support emerging viewpoints. As one of the executives articulated:

"Most of the tools work so that you don't get any kind of efficiency number, for example which you could use in an equation, but they give some indication, more for creating ideas. Usually, final deductions cannot be made. Well, [tools are] quite useful as such, since they force us to think."
(Executive STYAF70)
Strategy tools help organizations in idea creation and innovation, and they further social creativity. They also support executives in social re-evaluation, reflection and reconstruction, and in changing their minds. This activity corresponds to the notion of transitional objects (De Geus, 1988; Eden, 1992; Morecroft, 1990), and also to the notion of trialogy (Paavola, Lipponen, and Hakkarainen, 2004), both of which highlight organizational learning that is mediated by an object.

For ***leading, guiding and coordinating work*** strategy tools offer organizations common and systematic ways of acting. *"Uniform tools help in comparing different units and reading [of the reports] is faster when the tools are familiar" (Executive S126SWH1)*
The informants who provided our data emphasized the importance of establishing and maintaining approved procedures, and of having controlled roles and responsibilities for members of an organization. Strategy tools support these aspirations by providing a mechanism for monitoring organizational performance. Furthermore, they can be used as technologies for control through which contemporary institutional governance and organizational discipline are realized (see also Räisänen and Linde, 2004). Strategy-tool use can therefore be a work routine that offers easy procedures and utilizable outputs, or simplistic advances in the execution of mundane tasks. Furthermore, in addition to the technical organizational functions of the tools such as allocating and organizing resources, they also have social purposes such as legitimizing activity and signifying power relationships within the organization (also Bechky, 2003). In overall terms, the use of strategy tools can help organizations to focus and coordinate work that is being done, and a tool can even become part of the organizational spirit that motivates and leads such work. On the other hand, tools also impose behaviors, control and a sense of urgency on an organization.

All members of each organization pay attention to and are influenced by the cultural settings that exist inside that organization. Also, the strategizing activity of ***enacting organizational culture*** may lead to a specific manner of use or non-use of strategy tools. In such cases, strategy tools are most often used to generate communication, a sense of community and motivation, to build team spirit, to create new belief systems, and to facilitate a cultural change or changes. Introducing a new strategy tool into an organization and adapting it can be one way of doing this. On the other hand, organizations may have cultural reasons for not using tools at all. One executive explained why a particular tool component is not used in his company:
"That [part of the tool] was not met with enthusiasm. In my opinion, there is a cultural problem, not an operational problem. People do not want [the organization] to be a clear transparent pipe where

everything can be controlled. That causes apprehension and limits freedom. That is the real reason for not wanting to [introduce the component]. It is not necessarily that [executives] want to give [increased freedom], but this is so deep in our culture that [we] did not want to… take [any of] it away from the organization." (Executive HSKT28.13)

Societal level

Societal level is the highest level of social context and includes the entire social environment in which an organization is operating. Our study classifies four societal-level strategizing activities in the work done by executives which is connected to strategy-tool use: Keeping up with the competition, technological improvements and professional techniques; Meeting industry standards, codes and laws; Responding to political issues and power structures; and Creating stakeholder value (Table 6).

Strategizing activities mediated by strategy tools	**Positive consequences of tool use to strategizing activities**	**Negative consequences of tool use to strategizing activities**
Keeping up with the competition, technological improvements and professional techniques	• Necessary and natural part of modern work • Tools create credibility • Tools provide feedback	• The tool market is not buyer friendly -comparison of different tools is difficult, integration aspects are unclear, oversupply, needs for customization are not met • Tool fashions • Tools create demands on individual skills and users suffer from problems with usability • Knowledge of tools is inadequate or inaccurate
Meeting industry standards, codes and laws	• Specific industry needs are met	• Tools may create particular views • Problems with integrating different tools • Burden of building, updating and maintenance
Responding to political issues and power structures	• Owners or other political powers are satisfied	• Adopted tools may not be the most useful ones • Outputs difficult to interpret
Creating stakeholder value	• Improved efficiency	• Underestimation of the amount of work, resources, and data required • Total price of tools is high • Use of tools to obtain efficiency may reduce the use of brainpower

Table 6. Societal-level strategizing activities

For all contemporary organizations, a vital strategizing activity is ***keeping up with the competition, technological improvements and professional techniques***. Many executives in our study expressed a desire to learn more about strategy tools, especially about those being used in competing organizations. Furthermore, they choose to use tools that are up-to-date or trendy, ones which are more likely to at least keep them at the same methodological level as their competitors (Abrahamson 1991). This behavior does not necessarily guarantee that the best strategy tools are in use, but adopting the same tools that market-leading organizations may be a viable strategy. In general, the executives in our study were eager to talk to us, to see the results of our survey and to attend our seminars. Even executives who were not using any strategy tools expressed their curiosity about the possible advantages of using them. On the other hand, executives also complained about the complicated market for strategy tools and the difficulties of

comparing and understanding the tools that are available. Even so, their hunger to gain competitive advantage, or perhaps the fear of losing it, made executives eager to seek advances in strategy work practices.

Meeting industry standards, codes and laws can also affect each organization's choice of tools or the ways in which tools are used. One executive in our data said: *"With the exception of the scenario technique, all the tools have been used in our company for a very long time. In this industry it is almost impossible to carry on business without these tools." (Executive SSAM150H1)*
This strategizing activity is strongly industry dependent, and it may dictate organizations' strategy tool use fundamentally or have no effect at all.

Responding to political issues and power structures is a societal-level strategizing activity associated with power and politics. It differs from the interpersonal-level local political activities by being a force that both executives and other members of the organization respond to. Possible or actual changes in power structures external to the organization may prompt organizations to either adopt or retire specific strategy tools.
"External pressure is important. If there is a common threat, the issue emerges [in the organization] and makes [it] ready for using tools. One way is to build up pressure. The tools can [also] be used to do this …" (Executive HRAH87.30)
This last sentence in an executive interview also insinuates that an interpersonal-level power play can be disguised as a societal-level power structure that requires attention. Furthermore, ownership structures were also mentioned as forces that affect strategy-tool use. For example, family-owned companies often explained that they did not use strategy tools because of ownership structures or power issues: One executive of a family business affirmed this by commenting on our survey request: *"The right person [to answer your questionnaire] would be me, but I can confess that in our company there are no such tools in use intentionally. Planning happens mainly in the head of the CEO (i.e. the owner). In that sense, the right person [to answer] would be the CEO. In any case I strongly doubt that your questionnaire will be answered." (Executive SLIS6.5)*
The choice of a strategy tool can be thus affected by historical, cultural, social and political forces.

Creating stakeholder value is a powerful strategizing activity. The executives and organizations in our study went to great lengths to create stakeholder value. For example, one of the companies in our study had chosen the same strategy tools as their main customer. Furthermore, they attempted to attract customers who were using the similar tools to create stakeholder value and efficiency. Unfortunately, changes in the customer market forced the company in our study into bankruptcy. Creating stakeholder value can be a reason for choosing a particular strategy tool and also a reason for using it in a specific manner.

Evaluation framework for strategy tools

Our study shows that executives use strategy tools to carry out strategizing activities. These strategizing activities take always place in a social context. This also places strategy-tool use in a social context. For this reason, complex social, political, technical and cultural aspects in an organization (e.g. Blackler, Crump, and McDonald, 2000) affect strategizing activities and the usefulness of strategy tools. Furthermore, strategizing activities affect the choice of strategy tools i.e. which tools are chosen and whether they are used.

Strategy tools may make strategizing activities easier or more effective but they can also impact strategizing activities in a neutral or negative way. This study examines the usefulness of strategy tools as an activity. More specifically, it focuses on strategizing activities that are performed in an altered manner as a consequence of strategy-tool use. These altered procedures can be useful, neutral or impractical, but can only be judged in relation to the strategizing activity that is carried out with the strategy tool.

The main goal of our study was to construct a general framework for evaluating the usefulness of strategy tools in user organizations. Our study details the evaluation of strategy tools by investigating user reports on the consequences of strategy-tool use to strategizing activities, and then reflects on these by examining strategizing activities in a multi-level social context. We maintain that the usefulness of strategy tools has three intrinsic elements: strategy-tool use, strategizing activities, and different levels of social context (Figure 1), and that these can be translated into three different evaluation criteria: usability (strategy-tool use), significance (strategizing activities), and connections (the social context).

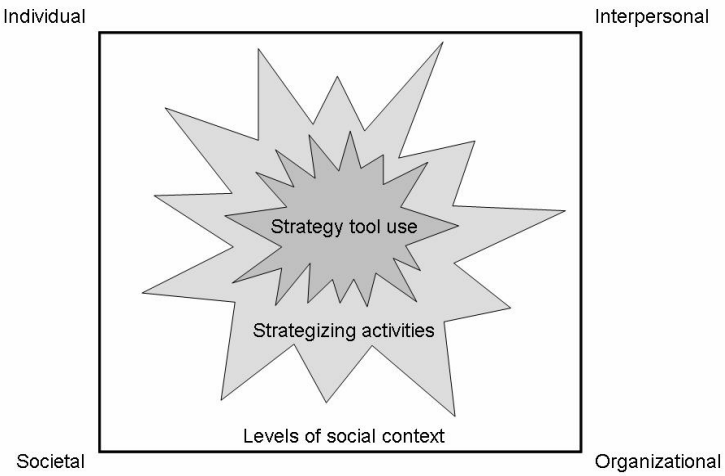

Figure 1. Evaluation elements for strategy-tool use

Usability

In order to understand usability, i.e. convenience in use, the notion of strategy-tool use must be redefined. In this study, tools were used in a wide variety of ways. Tool use was often conceptual, and in some cases, users had not even seen the actual tool. The extent of tool use and adoption, and other traditional ways of evaluating technical usability are therefore important, but perhaps not adequate ways of measuring usability. The practical adoption of a strategy tool, i.e. how that tool actually affects activities in an organization indicates the tool's true usability. Just by existing, a strategy tool may change how activities are carried out in an organization and result in use of the tool in its wide interpretation (e.g. Latour, 1988). We suggest that changes in activity patterns be the focus of examination. Furthermore, we suggest that the effectiveness, efficiency, and satisfaction with which all users can be involved in strategizing activities be investigated.

Significance

Although the purpose of strategy-tool use is to support strategizing activities, the prescriptive use of strategy tools only supports some strategizing activities. For example, support for an emergent strategy and support for political maneuvering are rarely referred to in the literature on strategy tools. Also, we only studied strategizing activities that were mediated via strategy tools. There may well be strategizing activities in which strategy tools are not used, and situations in which they perhaps could and should be used. Furthermore, the strategy tools used within an organization may not support the activities that are important for that organization. For example: Do the chosen tools support a balance between creativity and efficiency? Does the use of most-common tools provide the strategic advantages an organization is seeking? Moreover, one strategy tool may not support all of an organization's strategizing activities and a set of strategy tools is therefore needed. The significance of strategy tools should be viewed in a holistic manner, since different tools may complement each other. Our data indicated also that sometimes the tools do not work well together. The strategy tools should be evaluated as a set.

Connections

The respondents in our study used tools to serve individual, interpersonal, organizational and societal needs in a wide variety of ways. Tools are always used in a social setting. The multi-leveled social connections of strategizing activities pose not only communication challenges but also place cultural, political, and technical demands on strategy tools. Understanding the different connections that are forged by strategy tools can help in understanding which tools might be of use to an organization. For example, in organizational level there are very different needs for a tool than in personal level. Often a set of tools is needed to answer different needs.

Any one of the above three criteria – usability, significance and connections - can provide justification for an organization not using a strategy tool. The reason not to use a strategy tool is just as important as the

reason to use one. Furthermore, thorough evaluation of a particular strategy tool or an organization's strategy tool set will require the cooperation of both strategy-tool developers and strategy-tool users. Only users know the true context in which a tool is used, and only developers know the tool's theoretical background and modifications to it (see also Jarzabkowski, 2004).

Discussion and conclusion

Our study contributes to three distinct discussions around the subject of strategy tool evaluation. Firstly, it raises the questions concerning tool choice and the importance of evaluation in the area of management tool dissemination. Secondly, it makes sense of existing evaluation literature. Thirdly, it provides a new evaluation framework for the assessment of strategy tools. In the following, we discuss our input.

The literature on management fads and fashions explains the adoption of strategy tools through neo-institutional theory and isomorphic diffusion. Our data does not oppose this view. The strategizing activities in our study are limited by institutional forces (e.g. DiMaggio and Powell, 1991) and demonstrate normative and regulative structures that provide these activities with stability and meaning (Scott, 1995). In general terms, our study comprises interaction between macro and micro contexts in which activity is constructed (see also Whittington, 2002). The strategizing activities at higher-social-context level appear to dictate some lower-level strategizing activities. For example, societal-level ambitions concerning stakeholder value are clearly connected to individual-level needs to achieve efficiency.

However, neo-institutional theory does not portray the complete picture of strategy-tool adoption and use. New institutional theory has been criticized for its lack of ways of addressing emergent change (Dacin, Goodstein, and Scott, 2002) and agency (DiMaggio, 1988). The executives in our study were actively seeking new tools and new ways of using tools. They also initiated activities with the tools that could not be explained by institutional forces but by their personal motives and values. For example, political maneuvering involving tools was sometimes carried out to promote an individual's own pet projects. According to our data, agency is intrinsic to tool adoption and use (see also Clark, 2004) and leads us to the conclusion that organizations also actively choose tools they employ.

The activity view aspires to an understanding of activities, not the social phenomena that create the forces behind activities. It takes a neutral view of both neo-institutional theory and agency theory (e.g. Jensen and Meckling, 1976), and focuses on depicting strategizing activities regardless of their origins. The strategizing activities that we observed led us to believe that tools are both adopted in organizations because of institutional forces and also chosen for use in organizations as a result of active agency.

While the methodology employed in our study allows us to also describe strategizing activities that are irrational or foolish, the strategizing activities in our data are quite meaningful and surprisingly in line with the literature that describes high-level managerial activities (e.g. Kotter, 1982; e.g. Mintzberg, 1973). Our study adds two observations to the existing literature. Firstly, that strategy tools are capable of changing the ways that strategizing activities are carried out. The users in our data described changes that were positive and negative. Secondly, strategizing activities often explain why a certain tool is being used. Taken together, these observations mean that organizations take an active role in the adoption of strategy tools and that the usefulness of strategy tools plays an important role. This does not mean that tools are adopted through rational decision-making processes or that they are used in a rational manner, it simply means that we contest the implicit assumption in management-tool diffusion literature that the usefulness of tools is unimportant. From a strategy-as-practice viewpoint, the evaluation of strategy tools is central to the promotion of better strategizing.

Our evaluation frame starts with reconstruction of the notion of ***strategy-tool use***. Our study showed that this is a wide concept. For example, strategy tools are sometimes used just conceptually or to form vocabulary that enables discussion of issues that could not otherwise be conveniently talked about. This type of use is seldom taken into account when assessing strategy tool use in traditional evaluations. Furthermore, widening the notion of strategy-tool use enables the use of intuition in parallel with strategy-tool use and leaves room for each user's different psychological styles. It also widens the notions of man-tool interface and the profundity of tool adoption.

Traditionally, evaluation has been based on attempts to calculate savings, profit or other outcomes of tool use. Difficulties with gathering the required data have often reduced ***evaluation in practice*** to reporting user comments about the success of tool use. We suggest that the focus should move inside strategy processes by observing the strategizing activities that are mediated by the tool. More specifically, we suggest examination of usability, significance and connections related to the strategy tool in question. Data for this type of observation is easier to gather and can, for example, be triangulated to add reliability.

In regards to the ***debates in evaluation literature***, the evaluation framework we have built covers the features recommended for an evaluation model. Our framework takes into account the fact that strategy tool use may change the ways strategizing activities are carried out in positive, negative or neutral ways. Furthermore, our framework does not remove the evaluation process from the strategy tool context, and also takes into account social, political, personal, historical and social aspects. We maintain that while uniform evaluation canons can be set, tool developers and users should work together when evaluating strategy tools. The type of evaluation framework we propose would also benefit ***groups interested in promoting strategy tools*** since it describes how tools are used to create value and emphasizes that choice is possible when deciding which tool or tools to use.

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