



Strategic toolkits practice and performance: a German SME perspective

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Abstract

Purpose – This paper aims to explore to what extent senior executives, particularly within the German machinery and equipment small- and medium-sized enterprises (SMEs), gather and apply knowledge pertaining strategic management (SM) tools. Furthermore, the study aims to provide research evidence as to whether or not the companies derive any performance enhancing benefit from the appliance of said with the knowledge.

Design/methodology/approach – The research relied on a self-administered questionnaire mailed or posted to the entire population of about 6,000 enterprises. The resulting data were analyzed with the statistical package for social science (SPSS) statistical software package.

Findings – Executives within the sector, especially those with a predominantly engineering background, lack both knowledge and understanding of SM in general and strategic tool-kits in particular. Interestingly, educational background, in association with toolkit usage, appears to enhance organizational performance.

Research limitations/implications – The German educational system, in conjunction with the associated professional development infrastructures, may impact the generalizability of the research findings.

Practical implications – The results from this study can be used for lobbying policy-makers and shapers, e.g. government, higher education, industry and professional bodies, to improve and expand engineering management education so that practitioners have the knowledge of and competency in SM.

Originality/value – The study provides an insight look of how executives in one of Germany's most successful industries deal with the knowledge and application of SM tools and their impact on performance. Extant research has not dealt with Germany or this sector in relation to the appliance of strategy-related knowledge and performance.

Keywords Knowledge, SMEs, Machinery and equipment sector, Management education, Strategic management, Strategic toolkits

Paper type Research paper



1. Introduction

Business Schools, in-house trainers, consultants and management educators have, for around five decades, extolled the virtues of acquiring and applying knowledge relating to particular strategic toolkits. Over the years, these toolkits, consisting of an array of business/management analytics, frameworks, models and approaches designed to enhance knowledge and understanding of both the internal and external business environment, have expanded and contracted reflecting fads, trends and personal agendas. But how often have the toolkit protagonists really taken stock, asking questions along the lines of: to what extent do practitioners engage in the strategic process and how do they acquire the associated knowledge and understanding?

Assuming some level of engagement, what tools do they deploy? Does any of this actually impact upon performance? Only recently have the authors detected any academic endeavor to address such questions. Many scholars and, indeed, practitioners have expressed general disquiet regarding the usage of particular tools, or occasionally, commented upon the danger of over simplifying complex problems. However, often the critiques are really questioning the appliance of the tools, casting doubts on the practitioners or consultants' knowledge and understanding, rather than appraising the actual tools/benefits. Even a brief literature review reveals that much of the criticism is based more on supposition rather than hard facts, with the *occasional* critique often being an attempt to promote an alternative solution methodology.

Empirical research, given the growth in all things strategic, into the appliance and value of toolkits is relatively limited. A number of studies have explored the topic, these have been summarized and evaluated in the following paragraphs.

Graves (1994) surveyed 463 companies and found that the most popular management tools were mission statements, customer surveys, total quality management (TQM), benchmarking and reengineering. The study did not reveal any correlation between tool popularity and financial performance. Withrow (1995) built on Graves work, 500 companies were requested to rank the *value* of the tools used, a similar array of tool-sets were identified. Gillies (1995) expanded the research to cover seven countries; similar results were obtained, in that mission statement, customer satisfaction surveys and TQM proved popular; however, the research also indicated that this tool set usage was associated with enhanced company performance.

In further surveys in the USA, the popularity of, and satisfaction with, management toolkits were investigated (Rigby, 2001a, 2001b): strategic planning (SP), mission/vision statements as well as benchmarking were the most popular. Respondents agreed that the use of the right tool not only enhances performance/outcomes but also felt that tools promise far more than they deliver. Nohria (2003) examined the profitability of 160 US companies over the course of 10 years and identified 200 common management practices, but found no link between them and profitability. Rigby (2003), in a global survey, found that companies employ on average 16 management tools, when compared to a previous study in 2000, knowledge-based approaches such as customer relationship management (CRM) and codes of ethics had gained in popularity, with a need to enhance existing customer revenues and a desire to avoid corporate scandal being cited as the causes. In 2005, a survey of 960 companies worldwide revealed that executives concentrate on tools for acquiring and keeping customers and for outsourcing (Rigby, 2005). Rigby and Bilodeau (2007), based on a 2006 survey of the most popular tool sets, reported that respondents considered SP, CRM and customer segmentation to be the *power* tools. Chen and Jones (2007) surveyed 101 Master of Business administration (MBA) students at two US universities, respondents claimed to use a range of about a dozen tools, with benchmarking, TQM and SP being the most commonly cited. Williams and Lewis (2008) investigated the applicability and effectiveness of two strategy tools, value chain management and stakeholder analysis in seven public sector projects. They suggest that the usage of both tools improved strategic outcomes.

Jarzabkowski *et al.* (2009) conducted research into use and popularity of the strategic toolkit. They first, by asking the opinions of 66 UK academics, identified a list of the top 20 tools. Then, they surveyed the tools' usage and popularity by questioning more than 2,000 alumni from some of the *best* UK business schools. The top-ranked tools were

strengths, weaknesses, opportunities, threats (SWOT) analysis, key success factors, core competence analysis and scenario planning. Wagner (2011) surveyed 700 manufacturing firms in Germany and The Netherlands and noted that tools and practices associated with the balanced scorecard seemed to have a positive impact upon performance. Rigby and Bilodeau (2011) surveyed companies on a worldwide basis to determine tool usage patterns, they found that usage patterns varied by country and company size.

The above studies suggest a strategic toolkit, in a variety of shapes and forms, is being used widely and that certain tools may be more popular than others, with popularity apparently varying over time, across contexts and location. Few studies address the link between usage and organizational performance, but none have dealt with the associated linkage with the source of toolkit knowledge acquisition and understanding.

In an effort to complement the research noted above and to contribute to the strategy appliance and usage debate, this paper seeks, within the context of the German small-and medium-sized enterprise (SME) machinery and equipment sector, to establish the extent to which senior executives are knowledgeable of the tools and, possibly more importantly, to what extent and to what effect are they deployed. In addition, can any link be found between the appliance of the knowledge associated with a particular toolkit and enhanced organizational performance? The authors are not seeking to identify nor quantify a causal relationship, but rather to establish whether or not some form of indicative relationship exists. Given, as shown later, that within the context of this study, strategic knowledge and understanding is somewhat limited; the papers ultimate aim is to raise awareness, harness support and influence policy and practice. However, in pursuing this aim, the paper also adds significantly to the field of strategic management (SM), in that it not only identifies the tools practitioners' have the most knowledge of and capability in but also suggests that this can be linked to organizational performance.

The paper is structured as follows. First, the subject of SM is briefly addressed and its status within Germany examined, this is followed by the introduction of the strategic toolkit used for the empirical study. The paper then examines the research context, namely, the German machinery and equipment sector. This, in turn, is followed by the research methodology and the study itself. Finally, we close with the findings, conclusions and recommendations. The authors note that the context of the study may limit the capacity of certain findings, in particular, those associated with the German educational system, which promotes highly specialized engineering courses and degrees, with little inter-disciplinary input (Bundesagentur fuer Arbeit, 2013). However, those findings relating to toolkit appliance, usage and performance impact, can, in the authors view, be generalized more widely.

2. SM in Germany

Formalized and structural strategic thinking and action had predominantly been the preserve of the military, at least until midway through the 20th century (Meyers, 1990; PBW, 2007). Cyril and Magee (1953) introduced game theory and proposed, by its application, the development of strategic concepts, *strategy* had entered the business and management arena. Shubik (1955, p. 42) stated that: "A strategy in war or in business is the same. It is a general plan of action, containing instructions as to what to

do in every contingency". Cyril, Magee and Shubik may have borrowed *strategy* from the military, but they presented its potential to the world of business.

The remainder of the 1950s and 1960s saw an explosion of interest in all things strategic. For example, Payne (1957) introduced long-range planning; Ansoff (1957) coined the term corporate strategy; and Chandler suggested that structure followed strategy (Chandler, 1962, p. 39). Peter's (1984) and others returned to Chandler's notion, casting doubt on its universal validity, giving rise to one of the first, but by no means last, strategic debates. Needless to say, the interest in strategy has scarcely abated. Scholars, for example, Malik (1981), Bleicher (1991), Amann (1995), Hinterhuber (1996), Hahn and Taylor (1999), Welge and Al-Laham (2003) and Steinle (2005), have suggested and encouraged the use of particular strategic approaches/models. These models tend to emphasize certain characteristics of the strategic process, such as an iterative approach, environmental structures, early warning systems or an integrated or holistic view. The point being that from humble beginnings there is now a strategic knowledge base offering a myriad of tools, models and philosophies.

Turning now to the research context, German SMEs, there appears to have been a general lack of interest in SM, as evidenced by the abbreviated literature review which follows.

3. Management knowledge and practice within Germany

Albach (1983) noted that German SME management systems lacked formality and focused on operational rather than strategic issues, in addition, leadership appeared to be lacking. Geiser's (1983) study of 397 enterprises identified the main obstacle to SME growth was "poor" management and leadership. However, on a more positive note, both researchers noted that managerial and strategic knowledge and capability appeared to improve with SME size. Later in the 1980s, Kayser (1987) picks up a similar theme, complaining that SMEs lack the managerial knowledge required to successfully negotiate growth and change. Also, Hamer (1990), through a number of empirical studies, noted that SME leaders have little or no experience, or theoretical knowledge, of SP.

The 1990s saw increasing interest in SP capability, with Kriegbaum (1995) investigating the impact of business cycles on SMEs in the machinery and equipment sector, he argued that a lack of sufficient control instruments and early warning systems led to a delayed reaction ("reaction lag") to business cycles. A research study in 1996 revealed that SMEs neglected SP, market intelligence and environmental screening (Menke *et al.*, 1996).

The turn of the millennium saw no sign of improvement. Waldmann and Wagner (2003) surveyed 512 enterprises and found that SME leaders often failed to react a timely fashion to strategic change, pointing to a lack of managerial capability as the cause. A research study involving 1,051 SMEs revealed that 55 per cent of them had no written strategies (BDI, 2003) and a survey of 4,500 enterprises discovered that almost 30 per cent of SMEs do not engage in SP (KfW, 2004). Schluechtermann and Pointner (2004) suggested that SMEs are reluctant to engage in SP, with the "owner" adopting a highly personal view of the future. The BDU (Association of German Management Consultants) 2005 SME survey found that almost 50 per cent had no means of spotting impending strategically significant events.

Held *et al.* (2007) noted that many SMEs saw no link between SP and competitive advantage. Dembkowski (2007) concluded, from a qualitative study of 20 cases, that a lack of strategic thinking, experience and action, was a common weakness of German managers in both large-scale enterprises (LSEs) and SMEs. In short, there has been little improvement in the management capability of SMEs over the past two or more decades, particularly with regard knowledge relating to SP and control. A European study, carried out by Verein Deutscher Ingenieure [VDI (2014)], provided evidence that German machinery and equipment sector companies have sufficient “knowledge” but fail to fully exploit as a resource. VDI call for the adoption of advanced knowledge management systems to enhance strategic performance. Such recommendations are echoed by studies linking knowledge management to organizational success, for example, Starns, 2006; Van Berten and Ermine, 2006; Lyons *et al.*, 2008.

4. Management practice and performance within Germany

Between 1982 and 1986, Schmidt and Freund (1989) studied over 300 SMEs from the manufacturing sector. They discovered that many pay scant attention to the process of SP and when they do the planning horizon is far too short. However, they once again point out that size does matter, with larger enterprises more likely to engage. Furthermore, they found evidence of the positive impact of long-term strategic plans on success. An empirical study of 865 manufacturing SMEs revealed that successful ones have sustainable strategies (Fieten *et al.*, 1997). Becker *et al.* (2006) surveyed 347 business leaders and discovered that the majority of successful companies have explicitly formulated and widely communicated strategic objectives, often built on a strategy mix of innovation and market leadership. Euler-Hermes (2007) interviewed 125 insolvency administrators who, to date, had handled about 19,000 insolvencies (predominantly SMEs). They cite poor control, communication and planning as the major reasons of company failure.

There is some evidence to support the proposition that successful SMEs engage in some form of SP, for example, Borch and Madsen (2007) focus on dynamic capabilities in relation to entrepreneurial flare; while Grimaldi *et al.* (2013) concentrate on capabilities in relation to innovation; Duhan (2007) investigated the organizational capability and associated information systems (ISs); finally, Greco *et al.* (2013) took a more holistic view producing a strategic framework driven by values and associated interferences. Success, when measured, focused on the achievement of financial or innovatory goals. However, no effort has, until now, been made to identify what tools are being used and, indeed, whether some may be effective and/or more popular than others. In addition, research has failed to address the extent to which German SME managers are aware of, and employ, toolkits. There are clearly, as witnessed in the previous section, issues arising relating to knowledge, understanding and capability. A comprehensive quantitative analysis of German SMEs within the strategically significant machinery and equipment sector, relating to the acquisition and utilization of SM capability, is long overdue.

5. The strategic toolkit selected for the empirical research

Management scientists and consultants, 1950s onwards, have developed and proposed many strategy-related tools and approaches. Many of these tools may also be identified with general management or functional/operational areas. Managers use SM tools to:

“resolve uncertainties, understand the market and technology, map out the existing project/portfolio and ultimately inform strategic choices about investment” (Jarzabkowski and Kaplan, 2008, p. 1).

There are many published descriptions and evaluations of these tools, for example, Kappeller and Mittenhuber (2003); Wagner (2007); Jarzabkowski *et al.* (2009) and Rigby and Bilodeau (2011) have all attempted to classify and evaluate. Kappeller and Mittenhuber (2003) provide a useful listing, arranging 330 management tools alphabetically in their publication “Management Konzepte von A bis Z” (Management Concepts from A to Z).

To provide a framework for an empirical study 31 management tools were selected, based on both the need to fully cover the SM process and to reflect general popularity and usage (as identified by the research studies noted above). The strategy process has several phases, as described by various models (McCarthy *et al.*, 1975; Welge and Al-Laham, 2003; Wagner, 2001). Figure 1 details the phases as strategic analysis; premises and settings; formulation of strategic direction; business strategies for the functional areas (operations management, human resources [HR], marketing, R&D and finance); and strategy execution and controlling. It also indicates the tools selected as being representative of each phase.

The management tools used in the questionnaire were selected according to the following criteria: all phases of the process had to be covered with a minimum of two and a maximum of five tools; tools had to be strongly aligned with strategy rather than

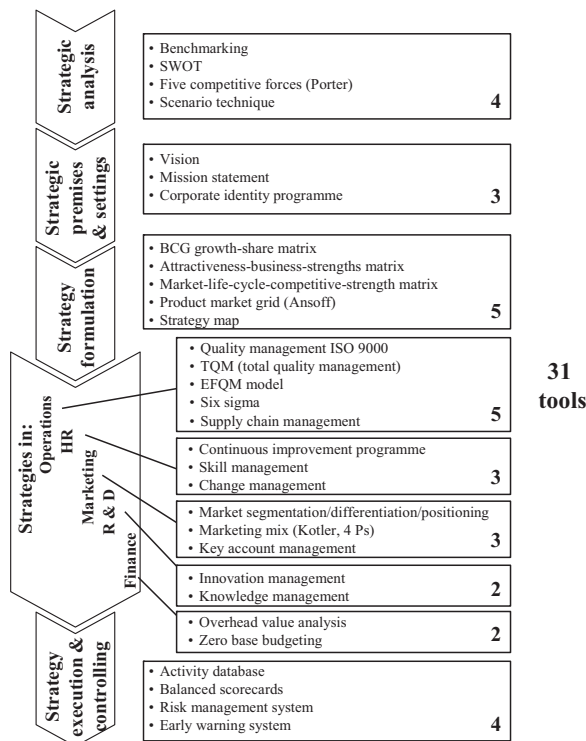


Figure 1. Strategy toolkit reflecting the phased approach

general management, plus they also had to be drawn from both commonly known and less well known sources, so as to test practitioner knowledge and understanding ranges; also they had to be generic, non-specific to any industry, so as to ensure potential relevance to the machinery and equipment sector. Finally, to ensure the questionnaire was not unwieldy and that it could be completed in a timely fashion (Saunders *et al.*, 2003), there had to be a limit placed on the overall number included, a pilot exercise suggested that around 30 would be an optimal number.

6. The German machinery and equipment sector

The machinery and equipment sector, according to the latest available figures, accounts for 6,000+ enterprises with a combined turnover (TO) of € 206.9 billion (VDMA, 2013). According to the Verband Deutscher Maschinen- und Anlagenbau (VDMA), this accounts for 2.1 per cent of all enterprises, 8.7 per cent of manufacturing TO and 3.1 per cent of all industry sectors. Further, the sector provides employment to approximately 1 million and contributes in excess €4 billion to the economy. In addition, the export rate, the highest in Germany, in 2012 was 72.2 per cent (IDW, 2005; VDMA, 2013). The machinery and equipment sector is faced with strategic challenges, particularly from India and the Far East (Baron, 2005; Sieren, 2006; Ihrcke, 2007; Impuls, 2007; VDMA, 2007). The sector predominantly comprises, according to German classifications (Wiechers, 1995), SMEs (90 per cent plus). The German IfM (Institute for SME-Research) classification is as follows: small enterprises employ nine staff and have a TO of up to €1 million; medium-sized companies employ 10-499 persons and a TO not exceeding €50 million (Guenterberg and Kayser, 2004). IfM further states that this equates to 3.38 million enterprises, which accounted for 99.7 per cent of VAT registered firms, 70 per cent of employment and 82 per cent of apprenticeships (Guenterberg and Kayser, 2004). These later statistics further reinforces the importance of SMEs and the machinery and equipment sector to the German economy.

It is vital for the German economy that this SME-dominated sector continues to prosper and grow. By understanding the sectors strategic capability and potential enterprises, management and government agencies will be better placed to shape and enhance the sectors performance, thus the author's interest in both the topic and context.

7. Methodology

The research relied upon a self-administered questionnaire to collect respondent data on such matters and items as managerial position, educational status, strategic knowledge and related tool application and, finally, organizational performance. A professionally based and comprehensive industry listing, the Hoppenstedt database (Hoppenstedt, 2005; 2006), was used to identify the respondents; this gave the researchers confidence that they were dealing with the owners and senior executive officers. The industry listing also provided detailed and audited performance indicators, which assisted greatly in determining enterprise performance.

The research context was SMEs (10-500 employees) within the German machinery and equipment sector, as classified by Eurostat's subsection DK and by Nomenclature statistique des Activités économiques dans la Communauté Européenne (General Industrial Classification of Economic Activities within the European Communities) (NACE) codes 29 through 29.72 (Eurostat, 2006). The research excluded armaments (NACE 29.6-29.60) and appliances (NACE 29.7-29.72). The Hoppenstedt offered the most

robust, current and comprehensive listing: NACE classification, addresses, fax/phone number, e-mail/Internet addresses, year founded, number of employees, TO, return on sales (ROS), investment ratio, equity ratio and given the desire to reach corporate decision-makers; it also provided the names, titles and functions of the senior executives.

Hoppenstedt indicated that there were 6,000 enterprises that met the SME and sector specifications. Having pilot tested and refined the questionnaire with 50 SMEs and with the expectation of a low response rate (W. Friedrich, personal communication, 1 August 2008), it was decided to approach all 6,000 enterprises by postal and Web-based routes; by the end of the survey, 290 responses had been received (January 2009), with a postal return a rate of 6.9 per cent and Web of 3.0 per cent. Return bias assessment (postal vs Web-based, e.g. age of respondents, knowledge and application of tools), using statistical package for social science (SPSS) compare means modeling and ANOVA and produced no significant outcome. The non-response bias (Filion, 1975; Colombo, 2000; Socha, 2006), assessed by the comparison of response values (e.g. number of employees, TO and equity ratio) with known population values (Armstrong and Overton, 1977), was negligible.

The statistics software SPSS (v.15) was used for the entire data analysis and evaluation. For descriptive statistics (Elsner, 2003; SPSS, 2006a, 2006b; Diehl and Staufenbiel, 2007), graphics and lists were applied to describe counts and categories of variables. To analyze the variable relationships, the following inference statistics (Fisher, 1959; Pryce, 2005; SPSS, 2006a, 2006b; Moutinho and Hutcheson, 2006, 2008; Diehl and Staufenbiel, 2007; Kinnear and Gray, 2008) were applied: for exploring relations between continuous variables linear regression; for evaluating the relation between continuous variables and categorical variables (ordinal, dichotomous and nominal) comparison of means; for evaluating the relation between categorical variables (ordinal, dichotomous and nominal) cross-tabulation and Pearson chi-square test; Scatter plots to display and calculate the relation of continuous variables; and for the significance level for hypothesis testing – ANOVA.

By analyzing the open-ended questions, the researchers managed to further develop an understanding of the respondent's knowledge and attitude toward the subject at hand.

8. Results and discussion

The results are presented in the following order: respondent profile; tool acquisition sources; and then an analysis of toolkit knowledge and application. The presentation of the findings continues with the perceptions of and approaches to SM, followed by motives and obstacles to the SP process, which leads to a review of the enterprises strategic capability. The section concludes with the findings regarding practice and toolkit application in relation to performance outcome and company size.

8.1 General results

About 60 per cent of the respondents are managing partners or owners and 31.5 per cent are managing directors, 91.5 per cent are senior executives: the decision-makers and the remainder (8.5 per cent) second-tier executives. Senior positions are dominated by men (93.3 per cent) and the average age is 49 years, with an age range of 23-75 years. On average, partners have approximately 13 and executives 10 years service in their current positions, those with a technical education around 15 and engineers 12 years.

Compared to the others, MBAs seem to be the “job hoppers” with about six years’ service. Of the senior executives responding, their highest degree awarded was 42 per cent university degree in engineering [Diplomwirtschaftsingenieur (business engineer) – Dipl.-Ing.], 27.1 per cent business economist degree [Diplomkaufmann (business economist) – Dipl.-Kfm.], 10.0 per cent pre-graduate vocational qualification (Facharbeiter, Meister, Techniker), 9.3 per cent business engineering degree [Diplomingenieur (diploma engineer)]; academic degree for German engineers – Dipl.-Wirtsch.-Ing.], 6.3 per cent MBA degree.

8.2 Sources of strategy toolkit knowledge

Executives acquired their strategic knowledge in a number of ways. Educational area A, pre-graduate, plays a minor role (0.6 per cent). Educational areas B and C represent important sources of tool-related knowledge acquisition with 16.5 and 5.5 per cent, respectively. More knowledge of tools was acquired in seminars (17.2 per cent) and via self-study (17.4 per cent). However, knowledge of 19.5 per cent of the tools is lacking and 23.4 per cent of them are not known at all.

8.3 Knowledge and application of strategy toolset

Table I lists the percentages and Figure 2 ranks the tools acquired and applied. The average knowledge rate is at 57.1 per cent; however, only 16.5 per cent of the total tools were acquired during graduate education.

Quality management ranks highly, as most enterprises are ISO 9001-certified, this is not surprising. Other tools such as continuous improvement or risk management are also widely applied. Tools, such as European foundation for quality management (EFQM), Ansoff or Six Sigma, are rarely applied. Marketing-related strategic tools do not score highly (26.2 per cent). The average application rate is 36.6 per cent. The rate appears low and is related to the lack of SM knowledge. Executives appear to absorb/apply about two-thirds of their acquired toolkits.

The relationship between toolkit knowledge and application was also investigated. For tool application, MBAs achieved the highest score (47.1 per cent), followed by business engineers (41.0 per cent) and economists (40.7 per cent). Engineers, and those with another technical education such as Facharbeiter (professional), Meister (master) and Techniker (certified technician), show the lowest rates (32.7 per cent and 30.8 per cent respectively). The differences between the groups are statistically significant (significance 0.015).

8.4 Strategic perceptions

The respondents were asked about their perception of SM. Of the total sample, 72.5 per cent responded and in so doing provided 564 response elements, which were then coded and evaluated.

The responses regarding the value of SM/the toolkit were mixed. Some respondents expressed concern, stating that the strategic tools and approaches were overly complex and too theoretical and that the academic phraseology was unhelpful. Particular concerns were raised regarding the use of English terminology. There was clear evidence that those with an engineering education tended to be more negative. An indicative sample of responses included:

Phase of SM	SM tool	Acquired Count	Total (%)	Applied Count	Total Count	Acquired (%)	Total Count	
<i>Functional areas</i> Strategic analysis and assessment	Benchmarking	198	76.7	258	143	56.1	255	
	SWOT	141	55.3	255	102	40.6	251	
	Five competitive forces (Porter)	86	34.0	253	36	14.6	247	
	Scenario technique	138	54.3	254	82	32.8	250	
	<i>Total strategic analysis and assessment</i>	563	55.2	1,020	363	36.2	1,003	
	Strategic premises and settings	Vision	175	68.4	256	130	52.4	248
		Mission statement	118	47.4	249	76	30.8	247
		Corporate identity program	192	75.3	255	166	65.9	252
		<i>Total strategic premises and settings</i>	485	63.8	760	372	49.8	747
	Strategy formulation	BCG growth-share matrix	143	56.7	252	63	25.3	249
Attractiveness – business – strengths matrix		111	43.9	253	37	14.7	251	
Market – life-cycle – competence – strength matrix		164	63.8	257	66	26.1	253	
Product market grid (Ansoff)		85	33.7	252	28	11.3	248	
Strategy maps		90	35.7	252	44	17.6	250	
<i>Total strategy formulation</i>		593	46.8	1,266	238	19.0	1,251	
Operations strategy	Quality management ISO 9000	246	95.0	259	206	80.5	256	
	TQM	178	69.3	257	98	38.9	252	
	EFQM model	62	24.6	252	11	4.4	248	
	Six Sigma	107	42.0	255	28	11.3	247	
HR strategy	Supply chain management	172	67.5	255	104	41.1	253	
	<i>Total operations strategy</i>	765	59.9	1,278	447	35.6	1,256	
	Continuous improvement program	231	89.5	258	199	78.7	253	
	Skill management	86	34.1	252	35	14.3	245	
	Change management	115	45.8	251	68	27.3	249	
	<i>Total HR strategy</i>	432	56.8	761	302	40.4	747	
Marketing strategy	Market segment/different/position	168	66.7	252	128	51.0	251	
	Marketing mix (Kotler, 4 Ps)	112	44.4	252	65	26.2	248	
	Key account management	185	72.8	254	148	58.5	253	
	<i>Total marketing strategy</i>	465	61.3	758	341	45.3	752	

(continued)

Table I.
Knowledge and application of SM tools

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Knowledge and
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Phase of SM	SM tool	Acquired Count	Total (%)	Applied Count	Total Count	Acquired (%)	Total Count
R&D strategy	Innovation management	174	68.5	254	126	50.2	251
	Knowledge management	163	63.4	257	97	38.5	252
	<i>Total R&D strategy</i>	337	66.9	511	223	44.3	503
Finance strategy	Overhead value analysis	187	72.8	257	138	55.2	250
	Zero base budgeting	87	34.3	254	38	15.2	250
	<i>Total finance strategy</i>	274	53.6	511	176	35.2	500
Strategy execution and controlling	<i>Total functional areas</i>	2,273	59.5	3,819	1,489	39.6	3,758
	Activity database	94	37.2	253	63	25.3	249
	Balanced scorecards	142	56.1	253	57	22.8	250
	Risk management system	192	75.0	256	148	58.7	252
	Early warning system	159	62.6	254	103	41.5	248
	<i>Total strategy execution and controlling</i>	587	57.8	1016	371	37.1	999
	<i>Grand total</i>	4,501	57.1	7,881	2,833	36.6	7,758

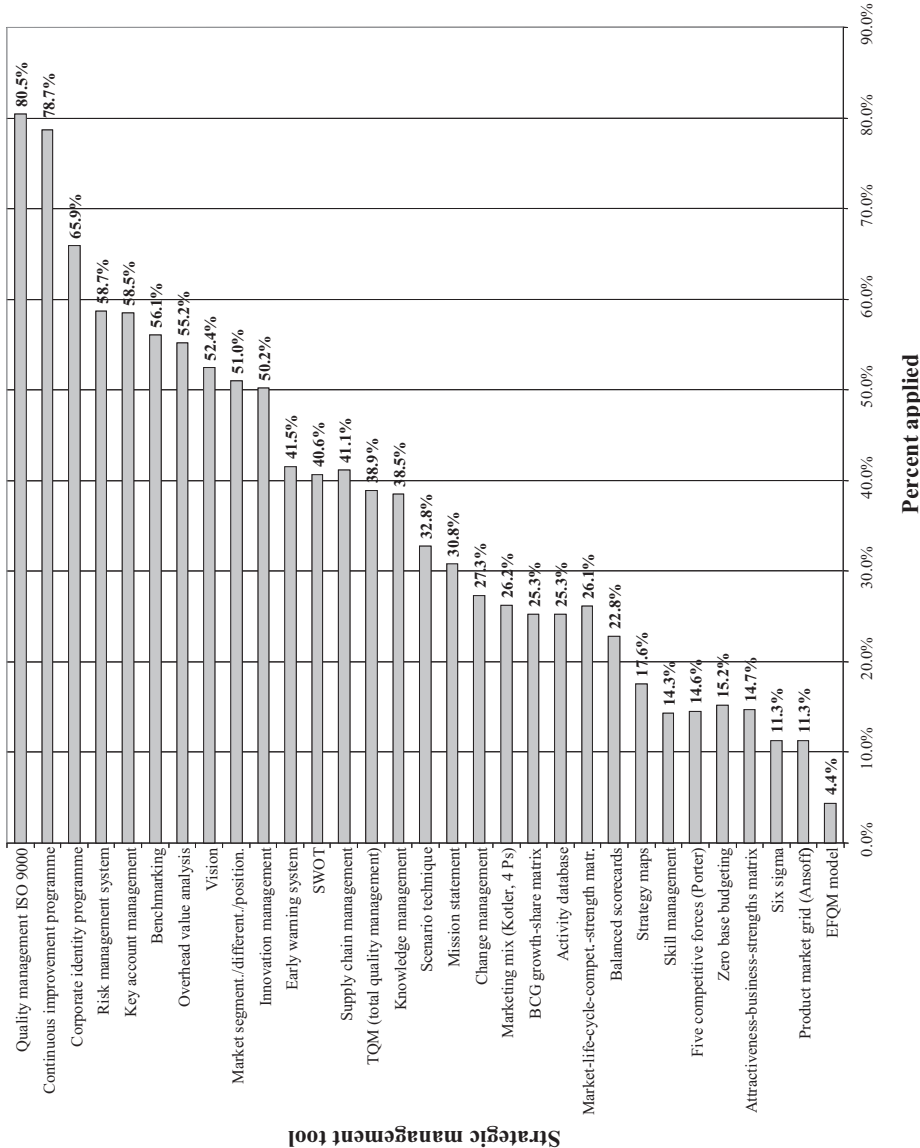


Figure 2. Strategic management tools applied

Case 77, Dipl.-Ing., managing partner, perception of strategic management:

It is a term not defined in the company but it is done; most of the decisions and actions in the company will be derived from the necessities of the normal workday; with 42 employees strategic management is not normally necessary.

Case 100, Dipl.-Ing., managing director:

The ultimate ability of a manager consists of the interlink of communication, information, motivation and decisions as well as the success controlling for the advantage of the company and its employees. The type of methods and models used is totally unimportant.

Case 141, Dipl.-Ing., Dr Ing., managing partner: "Until today I ask myself what strategic management is! An open word from an engineer coined by natural science: for me it is an empty cliché! Sorry!"

Case 161, Facharbeiter, managing partner: "Strategic management is an empty cliché; management tools are not necessary; the use of phrases in English language is bad".

Case 208, Dipl.-Ing., managing partner: "Give me the specific value of strategic management and the expected result for a small company".

Case 214, dipl.-ing., managing partner: "Strategic management tools are feasible for large companies".

Case 217, Dipl.-Kfm., financial manager commenting on strategic management tools: "Too many English terms in strategic management; not praxis orientated, something for large companies".

8.5 *The approach to SM*

Of the 269 responding companies, 82.5 per cent of the executives had SM responsibility, 14.5 per cent did not, while just over 5 per cent stated that the company did not engage in such activity.

In about 86 per cent of companies, the managing partner or director is solely responsible for strategy, on average, the SP process was introduced to companies in the machinery and equipment sector in 1998.

Most of the companies (42.0 per cent) carry out SP annually in combination with operational planning, a further 90 (33.5 per cent) annually and on demand, with 12 per cent planning on demand. Over 92 per cent of the responding companies engage in some form of SP.

It is one thing to state a commitment to an approach or process, but quite another to carry it through to real action. Some of the responses cast doubt on the overall quality of the SP process, for example:

Case 9, Dipl.-Ing., managing director, applies no management tools, turnover €5.3 million, strategic planning once in a while, perception of SM: "Sales planning, personnel planning, productivity planning".

Case 24, Dipl.-Ing., managing partner, applies four management tools, turnover €5.4 million, strategic planning once in a while, perception of SM: "Set and follow up objectives".

Case 214, Dipl.-Ing., managing partner, applies six management tools, turnover €4.1 million, perception of SM: "Prepare plans and realise".

About 55 per cent of the responding companies mentioned that they use their normal management meetings to follow up on activities from the strategic plan, while about 42 per cent use special strategy meetings. Around 43 per cent have a top-down system of objectives in place and key figure tables are used by 27.5 per cent. The other options, such as the balanced scorecard or external consultants, play a minor role in the execution of strategic plans.

About 43 per cent of the companies communicate to all employees, around 40 per cent to those in managing positions and 14.5 per cent to the top management only. Major

creditors (36.7 per cent) and equity owners (24.2 per cent) are also informed about important elements of the strategic plan. Other stakeholders, such as major customers (19.7 per cent), suppliers (10.4 per cent) and partner companies (5.9 per cent) may also be informed. Companies tend to retain strategic knowledge and intent within the management cadre (53.2 per cent).

8.6 *Motives and obstacles to the SP process*

Most executives (86.2 per cent) plan strategically because they feel it is important for the future success. Nevertheless, external motives play an important role: a strategic plan may be required from banks that finance the company (16.4 per cent) or from the owner (12.6 per cent) or from the parent company (11.9 per cent).

Barriers to SP include factors such as time constraints and lack of resources; however, many perceive it to be both overly theoretical and complex, 12 executives do not think it of any value at all!

8.7 *Improving SM knowledge and practices*

The majority of the executives (60.6 per cent) turn to seminars, workshops or training to update their knowledge base. Exchange of experience (50.2 per cent) also plays an important role. About one-third of the companies purchase management literature for self-study and around one-fifth engage an external consultant. Less than 10 per cent of the companies assign a SM budget and similar number adopt team based planning. However, almost one-fifth of the executives consider their management knowledge base to be sound.

8.8 *SM practice and performance*

In the following section, the respondent's SM tool application rate and the associated year of adoption are examined with regard to associated performance outcomes, employing linear regression and ANOVA. Evaluated variables with a significance level of significance ≤ 0.050 , respectively, borderline cases, were further analyzed with a scatter plot.

For the following statistical models: TO per employee = total TO/average number of employees; ROS = (profit or loss before tax/TO) \times 100; equity ratio = (equity/total assets) \times 100; R&D ratio = (R&D expenditures/TO) \times 100; continuous improvement rate = number of suggestions per year/average number of employees. Only executives in-charge of SM and companies applying SP are considered.

Table II addresses tool application and performance, by listing the results of the linear regression analyses. For ROS, equity ratio and continuous improvement rate, the null hypothesis is proven. There is no significant relation between the application of the toolkit and these dependent variables.

For Model 4, R&D ratio, the null hypothesis is rejected in favor of the alternative hypothesis – *H1*. The relationship between tool application rate and the R&D ratio variables is significant.

Model 1, TO per employee is a borderline case, with a significance level 0.053, which positively links tool application rate with this dependent variable.

Scatter plots suggest that the R&D ratio and the TO per employee increase with the tool application rate of the leading executive. This suggests that executives with a higher application rate put more emphasis on innovation and are more efficient by generating a higher TO per employee.

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484

Model; dependent variable ^b	ANOVA(b) Sum of squares	df	Mean square	F	Significance ^a
<i>1. TO per employee</i>					
Regression	48,625,657	1	48,625,657	3,785	0.053
Residual	2,659,140,326	207	12,846,089		
Total	2,707,765,983	208			
<i>2. ROS</i>					
Regression	1.745	1	1.745	0.131	0.718
Residual	2,285,566	172	13,288		
Total	2,287,310	173			
<i>3. Equity ratio</i>					
Regression	0.784	1	0.784	0.003	0.956
Residual	41,472,844	162	256,005		
Total	41,473,628	163			
<i>4. R&D ratio</i>					
Regression	38,134	1	38,134	6,166	0.014
Residual	1,230,762	199	6,185		
Total	1,268,896	200			
<i>5. Continuous improvement rate</i>					
Regression	0.032	1	0.032	0.260	0.611
Residual	15,601	126	0.124		
Total	15,633	127			

Table II.
ANOVA, relation of SM tool application with key performance indicators

Note: ^aPredictor: (constant), SM tool application rate (persons in charge SM, companies applying SP); ^bdependent variable

Also, worthy of note is that the research also discovered a significant relationship between the R&D ratio and ROS. Companies investing more in R&D created a higher ROS.

With regard to the year of introduction and performance indicators, [Table III](#) lists the results of the analyses with the aid of linear regression. For TO per employee, R&D ratio and continuous improvement rate the null hypothesis is proven. There is no relationship between the year of introduction and these dependent variables.

For Model 2, ROS, the null hypothesis is to be rejected in favor of the *H1*. The relation of the year of introduction with the dependent variable ROS is significant.

Model 3, equity ratio, is also a borderline case. The significance level 0.072 suggests a tool application rate relationship with this dependent variable.

Scatter plots indicate that ROS decline and the equity ratio is lower the later SP was introduced.

The relationship between the knowledge and appliance of individual strategic tools and performance was also investigated. Relationships with a high significance were further analyzed. Responding companies using benchmarking, SWOT, mission statements, overhead value analysis, balanced scorecard and risk management have a significantly higher TO per employee (27.0-28.4 per cent higher). TQM-enabled enterprises seem to be more innovative and spend 34.6 per cent more on R&D.

Model; dependent variable ^b	ANOVA(b) Sum of squares	df	Mean square	F	Significance ^a
<i>1. TO per employee</i>					
Regression	2,760,152	1	2,760,152	0.210	0.648
Residual	2,909,889,947	221	13,166,923		
Total	2,912,650,099	222			
<i>2. ROS</i>					
Regression	95,372	1	95,372	8,467	0.004
Residual	2,094,984	186	11,263		
Total	2,190,356	187			
<i>3. Equity ratio</i>					
Regression	767,386	1	767,386	3,284	0.072
Residual	40,654,063	174	233,644		
Total	41,421,449	175			
<i>4. R&D ratio</i>					
Regression	2,611	1	2,611	0.378	0.539
Residual	1,457,652	211	6,908		
Total	1,460,263	212			
<i>5. Continuous improvement rate</i>					
Regression	0.340	1	0.340	2,760	0.099
Residual	16,990	138	0.123		
Total	17,330	139			

Notes: ^a Predictor: (constant), year SP was introduced; ^b dependent variable

Table III.
ANOVA, relation year SP was introduced with key performance indicators

Companies carrying out overhead analysis show an average ROS of 7.1 per cent compared to other companies (6.7 per cent).

8.9 Company size: Tool application and absorption

The company's size and tool application and absorption were evaluated with the aid of linear regression and ANOVA. Table IV lists the results of the analyses with the aid of linear regression. For both models, the null hypothesis is rejected in favor of the *H1*. The relationship between size and the toolkit application and absorption rate is significant.

Scatter plots indicate that the application and absorption rate (ratio applied/known tools) increase with size: this suggests that larger SMEs, as their toolkit knowledge and application rates are greater, actively engage in SM.

9. Conclusions

This paper has endeavored to shed more light on and provide greater insight into the current knowledge and status of SM practice within the German machinery and equipment sector. The importance of this sector to the German economy has been noted, as have the competitive pressures it faces from manufacturers in China and India, who are both logistically better placed and constantly enhancing their product and service offering (Bitzer *et al.*, 2004; Koehler *et al.*, 2006; Steingart, 2006; Impuls, 2007). The research study suggests that the sector could be better prepared, from the perspective of

Table IV.
ANOVA, relation of
company size with tool
application and
absorption

Model; dependent variable ^b	ANOVA ^a Sum of squares	df	Mean square	F	Significance ^a
<i>1. SM tool application rate</i>					
Regression	14,964,361	1	14,964,361	37,811	0.000
Residual	101,317,491	256	395,771		
Total	116,281,853	257			
<i>2. SM tool absorption rate</i>					
Regression	2,815,119	1	2,815,119	4,231	0.041
Residual	167,660,730	252	665,320		
Total	170,475,849	253			

Note: ^a Predictor: (constant), TO of the company in [euro] million; ^b dependent variable

strategic knowledge and practice, to deal with a more competitive and turbulent future. Indeed, many practitioners and the enterprises they serve, appear to lack strategic awareness, capability and both knowledge and understanding. This research, at least in the authors view, should be seen as a *wakeup call* for the sector and associated stakeholders. In addition, to highlighting sectorial concerns, the paper provides more generalizable insights into toolkit application and performance.

9.1 Knowledge of SM tools and their application

Ramirez (2004, p. 441) stated that “German managers appear to develop their managerial skills almost wholly in-house”. Nothing appears to have changed, this study identified, given the respondents status, relatively low toolkit knowledge rate of 57.1 per cent and noted that this was acquired mainly post-graduation. In addition, the senior executive respondents admitted to only applying 36.6 per cent of the listed strategic tools (Engineers reported only 32.7 per cent). This supports the assertions made by Dembkowski (2007), namely, the main weakness of German managers lies in their lack of strategic thinking.

9.2 Perception of SM

The findings from the analysis of the qualitative data suggest that engineers lack understanding of, and fail to practice, SM. This corresponds to the finding that engineers have a low strategic tool knowledge and application rate. In addition, there is evidence that the quality of the SP process is questionable.

9.3 Approach to SM

SM, when practiced, is the domain of senior management within this sector. Management teams play a minor role in the process. On average, SP was introduced in 1998. As management scientists introduced this process toward the end of the 1950s, the German strategy journey appears to be running about 40 years late! About 92 per cent of the responding companies claim to carry out SP on a regular or on demand basis. However, there is evidence that some executives confuse operational and SP. Companies tend to execute their strategic plan with established procedures and limit dissemination to management only.

9.4 SM motives and obstacles

Barriers to SP have been previously identified (O'Regan and Ghobadian, 2002a, 2002b; Held *et al.*, 2007; Wang *et al.*, 2007): time constraints, resources deficiencies and competence/capability problems: the German machinery and equipment sector experiences similar barriers/difficulties. Many of the respondents acknowledged the importance of SP, but were not necessarily knowledgeable of associated tools and approaches. Interestingly, over 16 per cent of the enterprises prepared a strategic plan as a *banking* prerequisite. About 20 per cent of the responding executives see the principle barriers to SP as being cost and time. One could argue that lack of time is insufficient excuse for neglecting SP. The fact that some SME executives see SP and strategy tools as too theoretical/complex and the complaint about the use of too many English terms is worthy of note.

9.5 Improving strategic capabilities

Executives see a need to maintain and enhance strategic capability, by attending seminars, training and networking events, some use *off the shelf* materials and consultants, few appear to turn to formal education. The executives appear to be turning to their institutes, contemporaries and secondary sources; this could be of concern given the comparatively low industry knowledge and understanding; possibly a case of the blind leading the blind!

9.6 SM practice and performance

The research study both confirms and complements existing literature that suggests there are potential linkages between the formulation and application of strategic practice (Schmidt and Freund, 1989; Fox and McLeay, 1991; Cockerill, 1993; Griggs, 2002; BDU, 2005; Becker *et al.*, 2006; Cheese *et al.*, 2007). SMEs appear to benefit from the application of SM practices through enhanced financial/business performance. There is evidence that companies who engage in SP generate more profit and have a higher equity ratio. In addition, companies appear to benefit from knowledge and application of certain strategy tools. For example, executives and enterprises who engage in benchmarking, conduct and act on SWOT analysis, create and maintain a mission statement, implement overhead value analysis, plan and act utilizing the balanced scorecard and risk management, have a significantly higher TO per employee. SMEs that have embedded TQM principles and practices seem to be more innovative and spend more on R&D.

9.7 SM practice and company size

Through empirical research, Geiser (1983) came to the conclusion that larger SMEs have greater management capabilities than smaller ones, this research study confirms this still to be the case. There is strong evidence that the company size is related to tool application and absorption.

9.8 The bigger picture

The authors recognize that the German educational systems, in conjunction with the associated professional development infrastructure, may impact the generalizability of the research findings, however, a recent paper by (Paton *et al.*, 2012), points to efforts, from across the globe, to embrace management knowledge within the engineering curriculum. There clearly are concerns, expressed by both educationalists and

practitioners, across the engineering profession that there is a need to integrate both engineering and management disciplines and knowledge bases within the curriculum. Are engineers fully prepared for business and management responsibility? In addition, one should not ignore generic, non-German, SME research, dealing with strategic issues and capabilities, for example, researchers such as Wong and Aspinwall (2005), Borch and Madsen (2007), Duhan (2007), Greco *et al.*, (2013) and Grimaldi (2013), to name but a few, all point to the value of knowledge, the need to build and exploit capabilities and to adopt a professional strategic approach. SMEs research from across the globe seems at odds with the German machine tool phenomena.

9.9 *The research outcomes in context*

The research reported in this paper constitutes a significant proportion of what was a far wider and ongoing study. Figure 3 summarizes the outcomes to date of both this papers and the wider projects research agenda. It endeavors to visualize the nature and strength of the relationships between the key variables. Relationships with statistical significance are denoted by either a positive (+) or negative (−) sign, with the former indicating a positive relationship, such as *high* seniority relates to a *high* ROS or R&D ratio, and the later a negative relationship, such as *high* age relates to *low* tool knowledge. For instance, there is evidence that the education is related to tool knowledge, application and absorption rates. Engineers have a low knowledge and application rate and produce lower profitability. Most responding engineers are not satisfied with their university management education and recommend that greater attention be paid to knowledge of management/practice. Interestingly, age or at least service does matter, although executives toward the upper ends of the age and service profiles exhibit less tool knowledge and a lower application rate, their enterprises outperform those with fewer years on the job.

10. Recommendations

The research has clearly identified knowledge and skill gaps within the senior executive cadre regarding SM practices. This applies in particular to engineers who dominate top management positions in Germany's machinery and equipment sector. Less than one-fifth could attribute acquired management knowledge to their graduate education, suggesting that German Engineering faculties may have neglected the subject. A recent review of engineering faculty curricula suggests this may be more than a German phenomenon (Paton *et al.*, 2012).

What is required is a shift in the educational mindset, we recommend the lobbying of the German policy shapers (e.g. industry, professional bodies and government agencies). First, we would call on the Engineering faculties to embrace management education. Second, engineers should be exposed to the strategic process and toolkit in a contextually relevant manner. Ultimately, the economy, society and the engineers themselves would benefit from an enhancement of management knowledge and capability.

German executives complain about complex and theoretical SM tools and the extensive use of English terms and phrases. Non-German speaking academics, consultants and publishers need to be aware of the language and cultural barriers that may impinge upon the profitable dissemination of their wares. More importantly, German educators, academics, professional bodies and consultants should bridge the

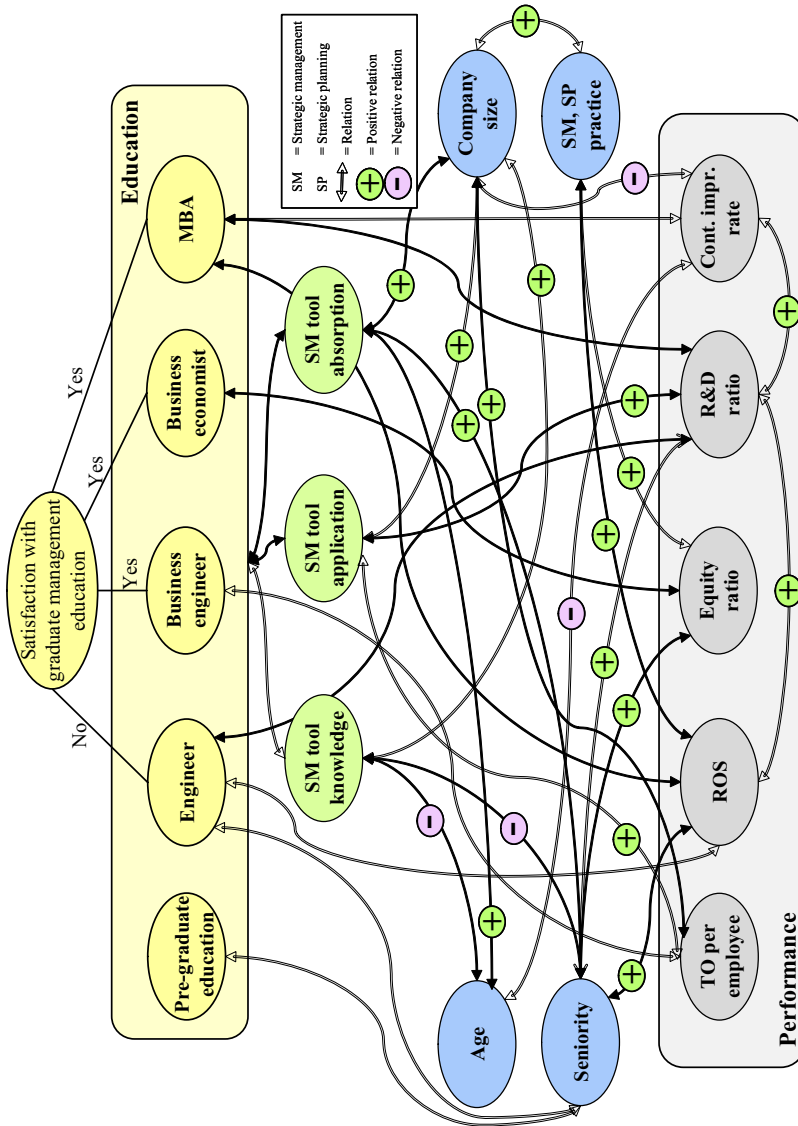


Figure 3. Relation map and conclusion map of research key findings

gap. However, *translating* the tools will not solely address the capability gap, as it is the educationally enabled “intelligent” toolkit deployment that brings results.

As we previously noted, there is evidence, beyond Germany, of an ongoing debate as to how best equip professional engineers for practice. As professional engineers manage projects, enterprises and organizations in general, there is a need to ensure that they are fit for purpose. The research reported in this paper suggests that they may not be and that, across the board, Engineering faculties and professional bodies, must develop and face the realities of global competition.

The research findings suggest, albeit non-causally, a relationship exists between the appliance of a strategic toolkit and enhanced performance. Further, certain tools and/or approaches appear to offer users a considerable advantage. Such findings could be used as leverage to encourage engagement and adoption. The toolkit appears to work when placed in the right hands. More needs to be done to ensure this message is disseminated to academics and practitioners.

We note the increasing interest, from the UK and the European Union (EU), in moving toward a form of accreditation for senior boardroom executives. Corporate governance is clearly topical, we would suggest that enhanced governance practices and accountability maybe all well and good, but of little use if the executives lack the strategic capability to exploit opportunities, avoid threats and provide a sustainable future for stakeholders.

The authors sincerely hope that this paper, the research it is based on, and future publications, will encourage praxis/academia engagement and reform. We note the influence that the researches context has played and that an empirical study of this nature cannot delve fully into the nuances of the respondent’s feedback; however, the performance/toolkit relationship, together with the role education plays in securing and enhancing toolkit absorption and usage, are worthwhile exploring further. The authors are currently engaged in revisiting the mini-cases and the host companies to gain further insights regarding adoption, usage patterns and causal relationships with performance.

References

- Albach, H. (1983), *Das Management System und das Marketing System, in Kleinen und Mittleren Unternehmen der Bundesrepublik Deutschland*, Institut fuer Mittelstandsforschung, Bonn.
- Amann, K. (1995), *Unternehmensfuehrung, Strategisches und Operatives Management*, Verlage W. Kohlhammer GmbH, Stuttgart.
- Ansoff, H.I. (1957), “Strategies for diversification”, *Harvard Business Review*, Vol. 35 No. 5, pp. 113-124.
- Armstrong, J.S. and Overton, T.S. (1977), “Estimating nonresponse bias in mail surveys”, *Journal of Marketing Research*, Vol. 14 No. 8, pp. 396-402.
- Baron, S. (2005), “Der diebstahl geistigen eigentums ist teil des Chinesischen Entwicklungsmodells”, *Wirtschaftswoche*, No. 27, p. 3, 30 June 2005.
- BDI (2003), *Research Study: der Industrielle Mittelstand – ein Erfolgsmodell*, Bundesverband der deutschen Industrie e.V., Berlin.
- BDU (2005), *Studie des BDU Regionalkreis Baden-Wuerttemberg zu Fruehwarnindikatoren fuer den Mittelstand*, Bundesverband Deutscher Unternehmensberater e.V., Bonn.
- Becker, R., Kaerkes, W.M., Sommerhoff, B., Holicki, S., Venohr, D. and Dzick, D. (2006), *Excellence Barometer Study 2006*, Forum fuer Marktforschung GmbH, Deutsche Gesellschaft fuer Qualitaet, Frankfurt.
- Bitzer, A., Sun, W., Wack, O., Wang, L., Tan, J., Chang, J., Koch, G., Ketteler, F. and Baumgarten, N. (2004), *The Emergence of China as and International Competitor to German Machinery and*

- Equipment Manufacturers*, Impuls Stiftung fuer den Maschinenbau den Anlagenbau und die Informationstechnik, Frankfurt.
- Bleicher, K. (1991), *Das Konzept Integriertes Management, das St. Galler Management Konzept*, Campus Verlag GmbH, Frankfurt.
- Borch, O.J. and Madsen, E.L. (2007), "Dynamic capabilities facilitating innovative strategies in SMEs", *International Journal of Technoentrepreneurship*, Vol. 1 No. 1, pp. 109-125.
- Bundesagentur fuer Arbeit (2013), *Studien- und Berufswahl, Informationen und Entscheidungshilfen*, BW Bildung und Wissen Verlag, Nuernberg.
- Chandler, A. (1962), "Strategy and structure", in *Handelsblatt Management Bibliothek, Die Bedeutendsten Management-Vordenker*, Campus Verlag, Frankfurt, Vol. 3, pp. 39-41.
- Cheese, P., Thomas, R.J. and Craig, E. (2007), "Performance Anatomy, das leistungsorientierte unternehmen, den wichtigsten aktivposten fuer die gemeinsame Sache nutzen", *Accenture Outlook The Journal of High Performance Business*, pp. 1-9.
- Chen, C.C. and Jones, K.T. (2007), "Management tools", *The CPA Journal*, Vol. 77 No. 8, pp. 50-55.
- Cockerill, A.P. (1993), "Validation study into the high performance managerial competencies", in Burgoyne, J. et al. (Ed), *The Development of Management and Leadership Capability and its Contribution to Performance: The Evidence, the Prospect, and the Research Need*, Research Report No. 560, Lancaster University, Lancaster, p. 30.
- Colombo, R. (2000), "A model for diagnosing and reducing nonresponse bias", *Journal of Advertising Research*, January-April, pp. 85-93.
- Cyril, H.C. and Magee, J.F. (1953), "Operations research for management", *Harvard Business Review*, Vol. 31 No. 4, pp. 100-112.
- Dembkowski, S. (2007), "Staerken und Schwaechen deutscher manager", *Harvard Business Manager*, Vol. 29 No. 4, pp. 45-47.
- Diehl, J.M. and Staufenbiel, T. (2007), *Statistik mit SPSS fuer Windows, version 15*, Verlag Dietmar Klotz GmbH, Eschborn.
- Duhan, S. (2007), "A capabilities based toolkit for strategic information systems planning in SMEs", *International Journal of Information Management*, Vol. 27 No. 5, pp. 352-367.
- Elsner, F. (2003), *Statistische Datenanalyse mit SPSS fuer Windows*, Rechenzentrum Universitaet Osnabrueck, Osnabrueck.
- Euler-Hermes (2007), "Mit managementfehlern in die Pleite", *Mittelstand Direkt Newsletter*, 20 August 2007, available at: <http://mittelstanddirect.de> (accessed 21 August 2007).
- Eurostat (2006), "European Commission, Eurostat, RAMON classification server, classification subsection DK", available at: http://ec.europa.eu/eurostat/ramon/index.cfm?TargetUrl=DSP_PUB_WELC (accessed 9 January 2006).
- Fieten, R., Friedrich, W. and Lageman, B. (1997), *Globalisierung der Maerkte, Herausforderungen und Optionen fuer Kleine und Mittlere Unternehmen, Insbesondere Zulieferer*, *Schriften zur Mittelstandsforschung*, Nr. 73, Institut fuer Mittelstandsforschung, Bonn.
- Filion, F.L. (1975), "Estimating bias due to nonresponse in mail surveys", *Public Opinion Quarterly*, Vol. 39 No. 4, pp. 482-492.
- Fisher, R.A. (1959), *Statistical Methods and Scientific Inference*, Oliver and Boyd, London.
- Fox, S. and Mcleay, S. (1991), "An approach to researching managerial labour markets: HRM, corporate strategy and financial performance in UK manufacturing", in Burgoyne, J. et al. (Ed), *The Development of Management and Leadership Capability and its Contribution to Performance: The Evidence, the Prospect, and the Research Need*, Research Report No. 560, Lancaster University, Lancaster, p. 31.
- Geiser, J. (1983), *Wachstumshemmnisse Mittelstaendischer Betriebe*, Institut fuer Mittelstandsforschung, Bonn.

- Gillies, C. (1995), "Managing the management tools", *Management Accounting*, Vol. 73 No. 10, pp. 28-29.
- Graves, J.M. (1994), "Management tools that work", *Fortune* 5/30/94, Vol. 129 No. 11, p. 15.
- Greco, M., Cricelli, L. and Grimaldi, M. (2013), "A strategic management framework of tangible and intangible assets", *European Management Journal*, Vol. 31 No. 1, pp. 55-66.
- Griggs, H.E. (2002), "Strategic planning system characteristics and organizational effectiveness in Australian small-scale firm", *Irish Journal of Management*, Vol. 23 No. 1, pp. 23-51.
- Grimaldi, M., Quinto and Ripa, P. (2013), "Enabling open innovation in small and medium enterprises: a dynamic capabilities approach", *Knowledge and Process Management*, Vol. 20 No. 4, pp. 199-210.
- Guenterberg, B. and Kayser, G. (2004), *SMEs in Germany Facts and Figures 2004*, Institut fuer Mittelstandsforschung, Bonn.
- Hahn, D. and Taylor, B. (1999), "The concept of strategic management", in Steinle, C. (Ed), *Ganzheitliches Management, Eine Mehrdimensionale Sichtweise Integrierter Unternehmensfuehrung*, Betriebswirtschaftlicher Verlag Dr TH. Gabler, Wiesbaden, pp. 228-231.
- Hamer, E. (1990), "Unternehmensfuehrung", in Pfohl, H.C. (Ed), *Betriebswirtschaftslehre der Mittel- und Kleinbetriebe*, Erich Schmidt Verlag, Berlin.
- Held, H., Ruppert, M. and Ziegenbein, F. (2007), *Strategische Unternehmensplanung, in Kleinen und Mittleren Unternehmen*, Hochschule fuer Technik und Wirtschaft, Aalen.
- Hinterhuber, H.H. (1996), *Strategische Unternehmensfuehrung, 1. Strategisches Denken*, Walter de Gruyter and Co, Berlin.
- Hoppenstedt (2005), *Hoppenstedt Top Business Adressen, Adress Katalog 2005*, Hoppenstedt Firmeninformationen GmbH, Darmstadt.
- Hoppenstedt (2006), Hoppenstedt Company History and Profile, available at: www.hoppenstedt.de/ (accessed 5 June 2006).
- IDW (2005), *Deutschland in Zahlen 2005*, Institut der deutschen Wirtschaft, Deutscher Instituts-Verlag GmbH, Koeln.
- Ihrcke, J.H. (2007), *Der Schlaue Riese, Chinas Weg zum Innovationsschwergewicht*, Verband Deutscher Maschinen- und Anlagenbau e.V., Frankfurt.
- Impuls (2007), *China's Strategies to Become an Innovation Juggernaut*, Impuls Stiftung fuer den Maschinenbau den Anlagenbau und die Informationstechnik, Frankfurt.
- Jarzbakowski, P. and Kaplan, S. (2008), "Using strategy tools in practice: an exploration of technologies of rationality in use", *Academy of Management Annual Meeting Proceedings*, pp. 1-6.
- Jarzbakowski, P., Giulietti, M. and Oliveira, B. (2009), *Building a Strategy Toolkit, Lessons from Business*, AIM Advanced Institute of Management Research, London.
- Kappeller, W. and Mittenhuber, R. (2003), *Management Konzepte von A - Z*, Betriebswirtschaftlicher Verlag Dr TH. Gabler, Wiesbaden.
- Kayser, G. (1987), *The Stages of Growth in Small and Medium Businesses: The Current Demand and Supply of Economic Services*, Nr. 56, Institut fuer Mittelstandsforschung, Bonn.
- KfW (2004), *Unternehmensfinanzierung: Noch kein Grund zur Entwarnung aber Fortschritte bei der Anpassung an neue Spielregeln des Finanzmarktes*, Kreditanstalt fuer Wiederaufbau, Frankfurt.
- Kinnear, P.R. and Gray, C.D. (2008), *SPSS Made Simple*, Psychology Press Taylor and Francis Group, East Sussex, England.
- Koehler, A., Blaeske, G., Esterhazy, Y., Kamp, M., Matthes, S., Salz, J., Wettach, S. and Wildhagen, A. (2006), "Unternehmen und management, modernes maerchen, Indien erobert Weltmaerkte", *Wirtschaftswoche*, No. 6, pp. 34-47.

- Kriegbaum, H. (1995), "Konjunkturzyklus – schicksal des maschinenbaus", in VDMA (Ed.), *Maschinen- und Anlagenbau im Zentrum des Fortschritts*, Verband Deutscher Maschinen- und Anlagenbau e.V., Fankfurt, pp. 58-59.
- Lyons, K., Acsente, D. and Van Waesberghe, M. (2008), "Integrating knowledge management and quality management to sustain knowledge enabled excellence in performance", *VINE*, Vol. 38 No. 2, pp. 241-253.
- McCarthy, D.J., Minichiello, R.J. and Curran, J.R. (1975), *Business Policy and Strategy, Concepts and Readings*, Irwin, Homewood, IL.
- Malik, F. (1981), "Management-Systeme", *Schweizerische Volksbank, Die Orientierung*, No. 78, pp. 12-27.
- Menke, A., Wimmer, S., Wolter, H.J. and Wallau, F. (1996), *Wettbewerbsbedingungen auf Neuen Maerkten fuer Mittelstaendische Unternehmen*, Nr. 69, Institut fuer Mittelstandsforschung, Bonn.
- Meyers (1990), *Meyers Grosses Taschenlexikon*, 3rd ed., Bibliographisches Institut and F.A. Brockhaus AG, Mannheim.
- Moutinho, L. and Hutcheson, G. (2006), *Statistical Models for Management*, University of Glasgow Seminar handout, Glasgow.
- Moutinho, L. and Hutcheson, G. (2008), *Statistical Modeling for Management*, Sage Publications, London.
- Nohria, N. (2003), "Why most management tools don't work", in Jacobs, P. (Ed.), *Harvard Management Update*, pp. 3-4.
- O'Regan, N. and Ghobadian, A. (2002a), "Effective strategic planning in small and medium sized firms", *Management Decision*, Vol. 40 No. 7, pp. 883-671.
- O'Regan, N. and Ghobadian, A. (2002b), "Formal strategic planning, the key to effective business process management?", *Business Process Management Journal*, Vol. 8 No. 5, pp. 416-429.
- Paton, R., Wagner, R. and MacIntosh, R. (2012), "Engineering education and performance: the German machinery and equipment sector", *International Journal of Operations and Productions Management*, Vol. 32 No. 7, pp. 796-828.
- Payne, B. (1957), "Steps in long range planning", *Harvard Business Review*, Vol. 35 No. 2, pp. 103-104.
- PBW (2007), *Prosopography of the Byzantine World PBW*, Centre for Computing in the Humanities, King's College London, available at: www.pbw.kcl.ac.uk/content/reference/glossary.html#S (accessed 24 March 2007).
- Peters, T.J. (1984), "Strategy follows structure: developing distinctive skills", *California Management Review*, Vol. 26 No. 3, pp. 111-125.
- Pryce, G. (2005), *Inference and Statistics in SPSS: A Course for Business and Social Science*, GeeBeeJey Publishing, Glasgow.
- Ramirez, M. (2004), "Comparing European approaches to management education, training and development", *Advances in Developing Human Resources*, Vol. 6 No. 4, pp. 428-450.
- Rigby, D. (2001a), "Putting tools to the test: senior executives rate 25 top management tools", *Strategy and Leadership*, Vol. 29 No. 3, pp. 4-12.
- Rigby, D. (2001b), "Management tools and techniques", *California Management Review*, Vol. 43 No. 2, pp. 139-160.
- Rigby, D. (2003), "Management tools survey 2003: usage up as companies strive to make headway in tough times", *Strategy and Leadership*, Vol. 31 No. 5, pp. 4-11.
- Rigby, D. (2005), "The Bain 2005 management tool survey", *Strategy and Leadership*, Vol. 33 No. 4, pp. 4-12.

- Rigby, D. and Bilodeau, B. (2007), "Selecting management tools wisely", *Harvard Business Review*, Vol. 85 No. 12, pp. 20-22.
- Rigby, D. and Bilodeau, B. (2011), *Management tools and trends 2011*, Bain and Company, Boston, MA.
- Saunders, M., Lewis, P. and Thornhill, A. (2003), *Research Methods for Business Students*, FT Prentice Hall, Harlow.
- Schluechtermann, J. and Pointner, M.A. (2004), "Unternehmensplanung und Mittelstand – strategieumsetzung mit hilfe der balanced scorecard", in Schluechtermann, J. and Tebroke, H. J., *Mittelstand im Fokus*, Deutscher Universitaets-Verlag, Wiesbaden, pp. 21-27.
- Schmidt, A. and Freund, W. (1989), *Strategien zur Sicherung der Existenz Kleiner und Mittlerer Unternehmen*, Institut fuer Mittelstandsforschung, Bonn.
- Shubik, M. (1955), "The use of game theory in management science", *Harvard Business Review*, Vol. 2 No. 1, pp. 40-42.
- Sieren, F. (2006), "Von der konkubinenwirtschaft", *Schweinfurter Volkszeitung*, 3 January 2006.
- Socha, N. (2006), *Non-response in der Umfragepraxis*, available at: <http://eswf.uni-koeln.de/lehre/06/05/s9r.pdf> (accessed 4 June 2009).
- SPSS (2006a), *Statistical Package for the Social Sciences Base 15.0 User's Guide*, SPSS, Chicago, IL.
- SPSS (2006b), *Statistical Package for the Social Sciences Advanced Models 15.0*, SPSS, Chicago, IL.
- Starns, J. and Odom, C. (2006), "Using knowledge management principles to solve organizational performance problems", *VINE*, Vol. 36 No. 2, pp. 186-198.
- Steingart, G. (2006), *Weltkrieg um Wohlstand, wie Macht und Reichtum neu verteilt werden*, Piper Verlag GmbH, Muenchen.
- Steinle, C. (2005), *Ganzheitliches Management, eine Mehrdimensionale Sichtweise Integrierter Unternehmensfuehrung*, Betriebswirtschaftlicher Verlag Dr TH. Gabler, Wiesbaden.
- Van Berten, P. and Ermine, J.L. (2006), "Applied knowledge management: a set of well-tried tools", *VINE*, Vol. 36 No. 4, pp. 423-431.
- VDI (2014), "Deutsche haben das Know-How, machen aber zu wenig daraus", *VDI Nachrichten*, 11 April 2014, p. 15.
- VDMA (2007), "China's Aufstieg steigert druck auf deutsche maschinenbauer", *VDMA Press Release*, 12 November 2007, available at: <http://vdma.org> (accessed 12 November 2007).
- VDMA (2013), *Statistisches Handbuch fuer den Maschinenbau Ausgabe 2013*, Verband Deutscher Maschinen- und Anlagenbau e.V., VDMA Verlag GmbH, Frankfurt, p. 43.
- Wagner, M. (2011), "The roles of integration and use of management tools in economic performance: a comparative analysis of manufacturing firms", *International Journal of Management*, Vol. 28 No. 2, pp. 427-446.
- Wagner, R. (2001), *Unternehmensfuehrung*, Schaeffer-Poeschel Verlag, Stuttgart.
- Wagner, R. (2007), *Strategie und Managementwerkzeuge*, Schaeffer-Poeschel Verlag, Stuttgart.
- Waldmann, R. and Wagner, M. (2003), "Change Management im Mittelstand – Was kann eine systematische Beratung leisten", in Schluechtermann, J. and Tebroke, H.J. (Ed), *Mittelstand im Fokus*, Deutscher Universitaets-Verlag, Wiesbaden, p. 107.
- Wang, C., Walker, E.A. and Redmond, J. (2007), "Explaining the lack of strategic planning in SMEs: the importance of owner motivation", *International Journal of Organisational Behaviour*, Vol. 12 No. 1, pp. 1-16.
- Welge, M.A. and Al-Laham, A. (2003), "The conception of strategic management", in Steinle, C. (Ed), *Ganzheitliches Management, eine Mehrdimensionale Sichtweise Integrierter*

-
- Unternehmensführung*, Betriebswirtschaftlicher Verlag Dr TH. Gabler, Wiesbaden, pp. 236-238.
- Wiechers, R. (1995), *Maschinen- und Anlagenbau im Zentrum des Fortschritts*, Verband Deutscher Maschinen- und Anlagenbau e.V., Frankfurt.
- Williams, W. and Lewis, D. (2008), "Strategic management tools and public sector management", *Public Management Review*, Vol. 10 No. 5, pp. 653-671.
- Withrow, B. (1995), "Manage the management tools", *Canadian Business Review*, Vol. 22 No. 2, pp. 38-41.
- Wong, K.Y. and Aspinwall, E. (2005), "An empirical study of the important factors for knowledge-management adoption in the SME sector", *Journal of knowledge management*, Vol. 9 No. 3, pp. 64-82.

Further reading

- Sattelberger, T. (2007), "Bildungsoffensive fuer eine praxisnahe Ingenieur-Ausbildung", *VDI Nachrichten*, 23 November 2007.

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