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Evolutionary perspectives on the capability accumulation process

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Abstract *There has been an increasing call from academics specialising in operations management to integrate different strategic management perspectives into operations strategy research. Recently some pieces of operations strategy research have used the resource-based view. It is often suggested that the incorporation of resource-based view ideas into the field of operations strategy is a search for a new paradigm, yet the ever-increasing literature suffers from a lack of empirical research. Moreover, operations strategy research from the evolutionary perspective, using longitudinal field data, is almost completely neglected. This paper attempts to make two contributions. The first is to stimulate debate about the incorporation of resource-based view and dynamic capabilities within operations strategy research. The second is to present a model based on in-depth field research where the dynamics of the capability accumulation process is explored.*

Introduction

The fundamental motivation for this paper is twofold: to advance the conceptual debate on the resource-based view (RBV) in the area of operations strategy, and to present research that aims to explore longitudinally the relationship between external environment and the process of capability accumulation. Based on in-depth fieldwork, the results of the research provide a model that describes and explains the dynamics of the capability accumulation process.

The emergent idea in operations management literature is to incorporate RBV into operations strategy. The RBV perspective on strategic management focuses on scarce, firm-specific assets whose services are difficult-to-imitate (Wernerfelt, 1984). It assumes that the heterogeneity in performance is owing to the ownership of different resource bundles with differential productivity (Amit and Schoemaker, 1993; Barney, 1986; Conner, 1991; Mahoney and Panadian, 1992; Penrose, 1959). The dynamic capabilities approach pioneered by Teece *et al.* (1997), which is distinctly built on the legacy of RBV, shifted the emphasis from static firm-specific assets to the dynamic process of developing capabilities. The focus here is on how firms develop firm-specific capabilities that allow them to respond to shifts in the business environment (Eisenhardt and Martin, 2000; Nelson and Winter, 1982; Winter, 2000). Capabilities are typically characterised as unique and idiosyncratic processes that emerge from



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unique and path dependent histories of individual firms. They must be firm specific, since they are embedded in the firm's processes and routines and embeddedness implies that the capability cannot be transferred in the same way that certain resources can. The basic tenets of RBV can be summarised within Barney's (1991) framework, which implies that to represent sources of competitive advantage, relevant resources and capabilities must be valuable, rare, inimitable and nonsubstitutable.

Clark (1996) argues that the traditional model of operations strategy (Skinner, 1969; Anderson *et al.*, 1989; Ward and Durray, 2000), concerned with linking operations structure and infrastructure to business strategy, is becoming less powerful in explaining corporate success and failure. Moves to popularise resource-based operations strategy have been made ever since operations strategy researchers confronted phenomena that cannot be explained using the traditional concept, yet they remain limited to discussions on the future of operations strategy and to challenging basic tenets of the traditional perspective (Amundson, 1998; Corbett and Van Wassenhove, 1994; Gagnon, 1999; Hayes and Pisano, 1994, 1996; Miller and Roth, 1994; Mills *et al.*, 1995; Roth, 1996; Spring and Boaden, 1997; Swink and Hegarty, 1998; Tranfield and Smith, 1998). Moreover, operations strategy scholars fall short of contributing to RBV. Recently, Schroeder *et al.* (2002) tested some basic assumptions of RBV in the manufacturing context. Research carried out by Coates and McDermott (2002) represents an isolated effort to illustrate the creation of new capability inductively. It seems that operations strategy scholars interested in RBV see their research agenda as making the perspective more operational (Slack and Lewis, 2001; Mills and Platts, 2002; Mills *et al.*, 2003). While this is undoubtedly of value, academics are less willing to confront those attributes of RBV that make the perspective less operational, such as the idiosyncrasy, path-dependency and context-dependency of a capability. They recognise the dynamism of capability accumulation, yet do not explore it.

The majority of operations strategy scholars endeavour to define capabilities precisely, prescribing how they should be built, as opposed to describing how they are actually accumulated. It seems to be broadly accepted that generic manufacturing capabilities (Swink and Hegarty, 1998) are in themselves valuable in the market, and result from a coherent stream of rational decisions made through formalised analyses of the external environment. How firms actually develop capabilities in order to be valuable in the market receives little attention in operations strategy research.

We need more knowledge of how capabilities are accumulated before attempts are made to produce descriptive statements or taxonomies. This research attempts to examine the phenomenon in order to create understanding about its dynamics.

Theoretical background

The process of accumulating capability is extremely dynamic and complex. This makes it difficult to provide operational definitions that can be precise in all contexts and at all stages of development. Dosi *et al.* (2000) define capability as organisational knowledge. They argue that organisations possess knowledge of how to do things, which implies that a firm's capability cannot be separated from action. The word "organisational" suggests that the relevant knowledge cannot reside with any one individual, but that it is held collectively by the entire organisation, supported by a social network (Black and Boal, 1994) of different inter- or intra-firm (Gulati, 1998) relationships. Nevertheless, capability and knowledge are ill-defined concepts. Any discussion of capabilities is, therefore, open to criticism of its ambiguity, and of its inability to provide clear definitions, obvious examples and straightforward prescriptions. Moreover, possessing a certain capability can be recognised through specific criteria or even values (Winter, 2000), which implies that its value depends on cognitive or collective perceptions. In other words, a capability and its value can together be described as a socially constructed phenomenon. Despite the conceptual ambiguity of capability, an increasing amount of the literature (Collis, 1994; Eisenhardt and Martin, 2000; Makadok, 2001; Zollo and Winter, 2002) do offer definitions.

It is understandable that the ambiguity of the phenomenon has delayed scholars in coming up with definitions. Yet it is less understandable why researchers have paid so little systematic attention to the process of capability accumulation itself. Although the notions of asset stock accumulation and time compression diseconomies introduced by Dierickx and Cool (1989) suggest that capability becomes valuable in the context of process, this has rarely been a subject for research and is, therefore, not well understood. As it stands, there are no adequate process theories (Langley, 1999; Zollo and Winter, 2002) that describe and explain the process of capability accumulation. What the literature does offer are some characteristics of the process, such as idiosyncrasy and path-dependency, and implications that the process is akin to logical incrementalism (Quinn, 1980), where emergent events (Mintzberg, 1978) and trial-and-error learning play an important role. Additionally, Winter (2000) argues that capabilities often emerge from dissatisfaction with current performance.

This paper presents an attempt to provide a coherent description of the capability accumulation process. However, to provide a theoretical contribution, a description needs, at least to some extent, to be accompanied by an explanation of why it happens. For this reason, we explore some possible influences on the process of capability accumulation. The available knowledge related to influence is also dispersed between isolated conceptual statements and theoretical traditions that refer indirectly to the capability accumulation process. Early RBV almost completely neglected the influence of the external

environment on this process. RBV scholars argued that resources and capabilities represented a far more stable basis for a firm's strategic identity than did a market determined by its dynamics, changes in technology and volatile customer preferences (Grant, 1991; Stalk *et al.*, 1992). By acknowledging the dynamic and evolutionary nature of the capability accumulation process in isolation, the way the external environment influences the whole process was ignored. It was assumed that valuable capabilities somehow develop.

At the same time, scholars admitted that capabilities are of no value in themselves, and that a particular capability can lose its value if it no longer matters to the market (Collis, 1994). More recently, Eisenhardt and Martin (2000), in their conceptual paper, argue that the evolution of capabilities is influenced by market dynamics. This suggests that the influence exists; yet the dynamics of this influence are inadequately explored. That an environment matters is accepted, while the question of how it influences and why remains largely unanswered.

The role of the market in the capability accumulation process can be even more strongly emphasised by incorporating the theoretical tradition of organizational ecology (Hannan and Freeman, 1988). This theoretical tradition, however, undervalues managerial decisions in capability accumulation. Although the dynamic nature of the capability accumulation process makes the model of rational planning start to look increasingly fragile, this does not mean that this research adopts organisational ecology's presumption of managerial irrelevance. Indeed, the significant influence of management decisions is recognised by Lovas and Ghoshal (2000), who argue that these can guide strategic processes. Managerial decisions directly influence the capability accumulation process, yet the market selects whether managerial decisions lead to the accumulation of capabilities (and so competitive advantage) or to an erosion of capabilities.

When managerial influence on the capability accumulation process is considered, another type of knowledge enters the debate. If a capability refers to the knowledge that enables a firm to perform different sorts of activities, managers need to obtain a knowledge that helps them to make sense of an accumulated capability and to perceive its value. In other words, there is knowledge in the form of capabilities, and knowledge about these capabilities. Little research has examined how the external environment helps managers to make sense of required or already accumulated capabilities. Whether, in the process of capability accumulation, the external environment helps to resolve the causal ambiguity (Lippman and Rumelt, 1982) related to a capability is inadequately explored. Managerial decisions and external environment are, therefore, not considered as two alternative mechanisms that influence the capability accumulation process. To explain this process, it is important to explore how the market's mechanisms influence decisions about the capability

accumulation process, and how the perceived value of a capability affects these decisions.

Our research does not address the general influence of the external environment from a static cross-sectional perspective. Instead, it is concerned with the dynamism of this influence, attempting to explore how the influence changes and how it helps to lead managerial perception from causal ambiguity to eventual causal understanding, as the process of capability accumulation unfolds.

Methodology

Our research adopts a theory-building agenda (Glaser and Strauss, 1967). The selected methodology and the research agenda are determined by the nature of the phenomenon under consideration. The process we look at is complex, path-dependent and ill-structured, and therefore requires in-depth qualitative work within a small number of organisations.

Evolutionary perspective

There has been a growing call for the adoption of an evolutionary perspective (Barnett and Burgelman, 1996), since some of the most interesting organisational phenomena are the least understandable through static theories and cross-sectional designs. The same holds for the capability accumulation process.

Van de Ven's (1992) suggestion of clarifying the theory of process in order to ground its conceptual basis, and to design and conduct the empirical research, was considered. Within the four basic families of process theory (life cycle, teleology, dialectic and evolution), the model consists of two levels. On the first level, the process is described as a life cycle. The adoption of life cycle theory is beneficial since it enables us to grasp the path-dependency of the studied phenomenon and to break it down into successive phases. This is useful partly since these phases constitute comparative units for the extension of theoretical ideas, and partly since they represent units of analysis that facilitate explanation. The second level of the model is developed in order to explain the properties of each phase of the life cycle. An explanation is possible by adopting an evolution process theory. In the evolution theory, a process is described as a cumulative process of variation, selection and retention. Evolution process theory enables the integration of available knowledge about different influences on the capability accumulation process. Management influences the process by affecting variation. External environment selects whether capability is valuable or not. Retention of capability assures the maintenance of capabilities which were selected as valuable by the market.

Case study field research

Consistent with the phenomenon of interest, the case study methodology was followed (Godfrey and Hill, 1995; Eisenhardt, 1989). A distinguishing feature of this research is its dual methodology, as suggested by Leonard-Barton (1990).

This research combines a real-time longitudinal case study with three additional retrospective case studies. The five-year longitudinal case study provided a close-up view of the dynamic process as it evolved over time, promoting a fuller understanding of the phenomena and context. This first case also demanded retrospective research, since the particular process of capability accumulation extended over a period of 10 years. In this way, the case involved construction of a detailed and contextual narrative using a range of data, enhancing the accuracy and internal validity of the research. The adopted longitudinal case study avoided bias caused by prior knowledge of the outcome of the observed process (Van de Ven, 1992). The additional retrospective case studies were added for theoretical extension and replication. They increase generality and provide more explicit theoretical knowledge. They were carried out over 12 months, and analysed periods of time ranging from ten to 16 years.

Data collection

To carry out the field research, the researchers had to identify a capability; track the capability accumulation process; understand the business context in which the identified capability is valuable; explore interviewees' personal experience of relevant events and decisions; and, if possible, determine quantitative data that directly or indirectly illustrate the capability accumulation process.

Collecting data for the first case study, with its ethnographic nature, differed from collecting data for the retrospective case studies. A lengthy relationship (based on research and consultancy) between the company and research institution allowed long-standing and wide-ranging observation. The researcher was engaged in two new product development processes, spending three working days per week at the company. In the first part of this field research, data were obtained from multiple levels and perspectives. Numerous informal conversations were conducted with top and middle managers, as well as with other employees. We were able to develop an understanding of the business context and to identify a capability that supported a competitive advantage of the company through informal and semi-structured interviews, participation at key meetings, and free access to all company documents (such as annual reports, news clippings, documents describing company history, project reports and strategic plans).

Once this data was collected the retrospective aspects of the research then began. Key events, actions and decisions were mapped chronologically using company documents. Interviews with key individuals from top and middle management were conducted to identify the influence of the business environment, the effect of this influence on managers' perception of capability, and in turn the influence of this perception on decisions relating to the process under study. In general, interviews became more structured as the field research approached its end.

In the additional retrospective cases, data were collected from interviews and company documents. The initial interviews allowed us to identify a capability in the company and to understand its value in the company's specific business context. It should be emphasised that our research was not concerned with identifying the origin of competitive advantage. In initial interviews, it was important to reach a consensus on a characteristic capability of the company. The later interviews focused on people's memories of events, decisions and context, which were important for this research. In preparing for these interviews, and challenging interviewees' memories, we made extensive use of company documents. The interviews normally lasted two to three hours and were taped and transcribed. To ensure that the data were internally valid and reliable, all case studies were written and reviewed by managers who participated in the study (Table I).

Data analysis and conceptualisation

As the very first stage of our research we developed a framework that identified three constructs: business environment, strategic decision-making, and the capability accumulation process. This framework was built on pre-understanding (Gummesson, 2000) in order to focus the research effort (Eisenhardt, 1989). All three constructs proved to be relevant for the research, but the final model is a result of an inductive research process unconstrained by verification of the initial framework.

A strategy for data analysis was determined by the differences between the first (real-time) case study and the additional retrospective ones. The initial case study was used to generate the first level of the model in an inductive theory-building mode. In this case, a predominantly descriptive understanding was achieved of the phenomenon under examination. The developed construct contributed to understanding how capabilities evolve during time. Different life cycle phases were identified.

The retrospective cases were added to the sample as theoretical replications and extensions. Data collection and analysis were guided by the understanding already developed through the initial case study. In retrospective cases, the replication strategy (Yin, 1989) was implemented to test whether the dynamics of the processes studied in the retrospective studies shared certain characteristics with that explored initially. In these cases, the life cycle phases identified represented comparative units of analysis for inter-case testing. Additional intra-case analysis of data enabled further inter-case analysis, representing the final step of conceptualisation.

At this final stage, the inductive cross-case analysis was used to achieve interactive synthesis of the insights provided by all four case studies. All four cases were studied jointly in order to explain why the capability development process evolves in accordance with identified dynamics. In doing this, the life-cycle phases were used as units, not for comparison but for extension and

Interviewees	Number of interviews	Capability accumulation process
<i>Case A^a</i>		
Key managers (as a group)	5	<hr/> 829 <hr/>
Chairman of management board	2	
Member of management board responsible for R&D and operations	4	
Member of management board responsible for marketing	2	
Head of R&D department	4	
Head of marketing department	1	
Head of operations	3	
Head of department for quality	2	
Head of human resource and corporate planning	1	
Manager at a small company owned by company A	1	
<i>Case B</i>		
Board of management advice	1	
Director for strategic marketing	2	
Director of cooking appliances	3	
Senior product manager	3	
Head of finance and controlling	1	
Head of technology department	1	
<i>Case C</i>		
Member of management board responsible for R&D and operations	1	
Head of company's research institute	2	
Director of SBU	4	
Marketing manager at the SBU	2	
Employee at the SBU – research assistant	1	
<i>Case D</i>		
Chairman of management board	1	
Director for R&D	3	
Director of marketing	1	
Director for strategic development	4	
Director for quality	1	
Employee of R&D department	1	

Note: ^a Numerous untaped interviews are not mentioned

Table I.
List of all taped interviews

synthesis. During the process of analysis, data were displayed along a time-line, and were divided into business context, market-driven decisions, capability-driven decisions, strategic behaviour and the capability accumulation process.

To avoid bias, two researchers who had not participated in the field research were involved in analysis and conceptualisation.

Research setting

All four research cases were Slovenian engineering and manufacturing organisations, from different industries. At the beginning of the 1990s, the

changing national economy, which was extremely small, meant that companies had to re-orientate themselves towards an international market. This specific set of circumstances led to the capability accumulation process being particularly intensive, coherent, and so highly observable.

All four selected companies coped successfully with these changes, achieving growth in the last decade. The following paragraphs present brief descriptions of these companies.

Case A. Company A is a medium-sized producer of mechanical security equipment, metal furniture and storage systems. Its core business is security equipment, from which it earns over 60 per cent of its sales revenue. This has been a growth area for the company since the early 1990s, while revenue from metal furniture and storage systems (legacies of the company's history) have either stayed stationary or decreased. Over the last ten years, company A has succeeded in converting itself from being oriented mainly to the domestic market to being export-oriented. With 300 employees, it earns 62 per cent of its sales revenue from foreign markets. More than 30 per cent of sales revenue comes from supplying safes to producers of automatic telling machines (ATM). It can be estimated that company A holds around 8 per cent of the European market in ATM safes.

Case B. Company B has 6,600 employees and is Slovenia's largest manufacturer and exporter. It manufactures and sells household appliances, tools, machines and kitchen furniture, and also provides a number of services. Its core business is in manufacturing and selling household appliances; in 2000 this generated 88 per cent of its sales revenue. Company B produces over 2,000,000 domestic appliances each year, of which 93 per cent are exported. It has a 4 per cent market share of the European market, which is covered by a sales network of 23 companies. Today, company B's products are traded in almost 60 countries, in all continents.

Case C. Company C is a strategic business unit (SBU) of a holding company covering rubber manufacturing, chemicals, trade, tourism and real estate. Since 1920, the company has been developing its rubber manufacturing sector. In 1984, its central research and development (R&D) department developed an innovative method of manufacturing rubber sheets for offset printing (a high-quality product, sold in a niche market), which was patented. On the basis of this patent, the SBU studied as company C was established. Since then, it has undergone a very intensive period of learning to transform the patented innovative method into a globally acknowledged product. The company's rubber manufacturing sector now comprises 11 independent SBUs, of which company C is the fastest growing. Today, company C has 50 employees and exports its products to 60 countries.

Case D. Company D was founded in 1950 as a producer of technical ceramics, and today employs 1,000 employees. In 1957, it began to manufacture fuses, and is now the world leader in the production of fuses designed to

European technical standards. It holds a 30 per cent share of the European market and derives 79 per cent of its sales revenue from foreign markets. Fuses, together with distribution systems and modular protection devices such as circuit breakers and switching devices, form a production programme of electrical products that generates 74 per cent of net sales revenue. The remaining 26 per cent is derived from the original business of producing a range of technical ceramic products.

Findings

This section presents and describes the capabilities identified in all four case studies, providing examples to help clarify the capabilities debate. We then move on to a chronological narrative for case A. Although we cannot provide chronological narratives for cases B to D, we draw on evidence from these retrospective case studies in the discussion section, to underpin our arguments.

Capability in case A

In case A a capability for quick and customised new product development was identified. The value of this is, however, significant in different ways in different business contexts. Company A is competing in the highly fragmented European security market. The global market is sharply divided into North American, European and Asian markets, owing to differences in technical standards. In contrast to some other branches of industry, where products must simply meet a minimum technical standard, in the security industry technical standards determine the relative market positions of different manufacturers. In Europe, there are 13 security levels. Products are tested in independent testing laboratories in accordance with a system based on objective and reproducible procedures. These procedures are continually updated in line with new burglary approaches. In this way, the testing laboratories have a significant role in driving the development of engineering expertise in the mechanical security industry.

Engineering expertise represents a significant building block of identified capability, and is particularly valuable in a business context that requires shifts between design-to-order, engineer-to-order, make-to-order and make-to-stock. Supplying ATM producers is such a business context. To win a contract, it is first necessary to develop a customer-designed safe and to get it certified to the required security level at a testing laboratory. The lead-time between ordering and successful testing is crucial for winning an order. Quick development requires engineering expertise in the field of mechanical security, tight linkage between engineering and manufacturing, and fast prototyping. After winning a contract, make-to-order or make-to-stock is required, and here quality and the dependability of delivery play a leading role. Company A has mastered operations in the make-to-order and make-to-stock contexts. Yet what distinguishes the company from its competitors lies in the area of design- and

engineer-to-order. Although it is tempting to ascribe the speedy development of customised products to engineering expertise, in-depth research in fact shows the importance of top managers' familiarity with R&D and manufacturing, and of their influence on organisational culture.

Capability in case B

The household appliances industry sector has been in the mature phase for quite some time, and is showing no notable growth. Price, cost and productivity are the most commonly mentioned success factors. However, an in-depth understanding of the industry sector reveals that companies cannot compete merely on cost through production efficiency. It is therefore not surprising that, as stated in its mission statement, company B aims to be a very flexible company in all aspects of its activities.

A generic differentiation strategy based on flexibility can only partly explain the existing situation. Since price is an important criterion, flexibility and cost cannot be viewed as static, mutually exclusive criteria. An idiosyncratic flexibility identified in company B can be explained as a capability to implement its strategic vision as well as a capability to cope with any resulting complexity. One of the company's documents states that flexibility could not be considered if the company was not able to manage the complexity of its business operations.

The identified flexibility resides in a willingness to meet different customer demands and to react to them quickly. This certainly produces complexity. In spite of globalisation, different geographic markets have different demands and a manufacturer must fulfil them with different product concepts. The complexity is caused not simply by a decision to cover different world markets. Company B decided to sell its products through different market channels such as large retailers, small electro-specialists, catalogues and kitchen furniture studios. Different channels require different product concepts – a wide range of product types and variants, increasing the complexity of operations and management of the supply chain. This industry sector is characterised by economies of scale, and company B cannot escape from the basic rules of competition. It is able, however, if necessary, to engineer its product to order, manufacture in smaller batches, assemble a large range of product types, deliver different product families simultaneously, and allow orders to be changed before the start of the production at a later stage than its competitors. Despite the fact that economies of scale are necessary, the company almost over-invests in flexible process technology. When planning investments, its engineers continuously provide more flexibility than is strictly necessary. When the decision is made, it is not clear whether there will be any market demand for the particular type or variant.

However, not all aspects of complexity can be viewed as influenced by the market. Despite its internationalisation, company B has not internationalised

its manufacturing operations. It has 50 years' experience in manufacturing household appliances and most workers spend their entire career at the company. A high level of industry-specific manufacturing skills and deep commitment enables the company to cope with flexibility and the resulting complexity, where no other special managerial approaches exist.

Capability in case C

In this case, it was possible to explore a very intensive process of accumulating a set of different capabilities (as opposed to one single capability) necessary to introduce a patented innovation on the global market. It is an important characteristic of this case that the company was totally unfamiliar with the market, where the product was to be sold at the time when the innovative solution was patented.

The rubber-printing blanket is a high-quality global product sold in a niche market. The competitors are independent medium-sized companies or business units that are part of bigger rubber companies. Long tradition makes this niche market difficult to enter.

Although medium-sized companies are producing the product, they have to master global marketing and distribution channels. Key success factors are quality and the dependability of delivery. Manufacturers sell rubber sheet for offset printing to specialised retailers who supply all products needed by the end-user, the printing industry. Since these retailers sell different brands of offset sheet, it is crucial to establish direct contact and distribution channels, maintaining close relations. This allows the particular features of the product to be promoted, and retailers' suggestions and demands discussed.

In case C, it is clear that the original and patented production method, together with innovative manufacturing, represents a cornerstone of the SBU's competitive advantage. Moreover, this business unit was established on the basis of the patented idea's business potential, and so can be characterised as a scarce resource. However, introducing a new product while also establishing a new brand name required intensive learning, complementing the patented idea with various resources and capabilities that enabled it to be valuable to the market. This learning process was significantly influenced by the personal commitment of the SBU's director, who had also discovered the patented method. Her personal enthusiasm, which rubbed off on other employees, without doubt helped to overcome the obstacles faced during the learning process.

Capability in case D

Company D developed the first facility for automatic fuse assembly in 1974. Ten years later, it invested heavily in tool and assembly line development. While this represented the beginning of its core capability, it needed, however, to be accompanied by other capabilities to enable the effective introduction of a new product. A bundle of capabilities can be identified: expertise in the

development and production of ceramic components; the management of quality; the development of special tools for fuse component production; and the development of assembly lines. These capabilities are valuable for different reasons.

The majority of the products manufactured at the company are commodities, demanding economies of scale. It is, therefore, very important to ensure efficient production through highly automated technology. Even in the early phases of product development, automation of the production process must be considered. In other words, the need for automation significantly drives the development of products.

In addition, close co-ordination between product development and technology development enables the company to move into the production of very high volumes, very quickly. This allows for a fast response to customer demands. The identified capability is also valuable in the context of the small-batch production of special fuses, which rely on specific ceramic components. In this case, co-ordination between experts in ceramics and in fuse development, and the development of specific tools, are required. Also, most of the company's competitors do not have the capability to develop and produce ceramic components. In many cases, therefore, company D is a supplier (sometimes the main supplier) of ceramic components to its competitors.

Capability accumulation process in case A

The capabilities described above have not been accumulated overnight. The process of capability accumulation at company A is described here in five phases, as shown below:

Initial phase (1989-1991). Company A entered the 1990s devastated by restructuring and downsizing. In parallel with dramatic restructuring measures, top management developed a strategic plan. The content of this plan was determined by a painful awareness of the gap between market demands and existing capabilities. Top managers recognised that the company's products were comparable with those of European competitors in neither function nor quality. In the plan, a radical decision was made to focus on security equipment. This left both other areas of business activity without a clear vision for future development.

The decision to commit to the security equipment market did not follow sophisticated analysis; the argument was that metal furniture and storage systems would have demanded for heavy and risky investments in process technology and facilities. It was, meanwhile, perceived that progress in security equipment could be achieved by significantly increasing expert knowledge of the security field.

It was clear that managers perceived the company's capability to lie in its products. However, these were uncompetitive in the market. The tasks defined in the strategic plan focused on making the products more competitive, yet no

special differentiation strategy was considered. Since the European market demands that products be developed in accordance with specific standards, the decisions made in the initial phase clearly set the context for accumulating engineering expertise.

It was, however, under the direct influence of the market that the capability to react quickly emerged. In its first attempts to enter new markets, the company was confronted by retailers' demands for customisation and small orders. This was in total contrast to the large volumes, low variety and long lead times with which it was so familiar. The desire to gain new customers and willingness to respond to their demands helped to break down established routines. Responding to market demands, company A began to accumulate the capability to develop products quickly.

At that time, however, company A did not link engineering expertise with the quick and customised development of new products. Moreover, nobody had realised that this might represent a crucial capability for the ATM market segment.

Learning phase (1991-1995). In this phase, the accumulation of engineering expertise was particularly noticeable. In 1991 and 1992, the company put four new product families through independent testing. This led to an emphasis on engineering expertise, applying established designs to new products. Because the independent testing process requires manufacturing processes to be dependable, the ISO 9002 project was launched at the end of 1993. The accumulation of engineering expertise also demanded the establishment of a network with suppliers of products such as electronic locking mechanisms and mineral fillings.

The company also strove to get closer to bodies, which set trends in the development of security products. In 1993, it helped to establish the Technical Committee for Burglar and Fire Safety at the Slovenian Bureau for Standardisation, which gave it access to the European Standardisation committee. The following year, company A applied for membership of the influential association EUROSAFE. During this period, the organisation co-operated closely with the local university, so fostering the accumulation of engineering expertise.

Also during this period, routines had been developed that shaped capability accumulation. The influential chief executive officer (CEO) responsible for R&D and operations, had personally managed every new product development project. Moreover, the CEO and senior engineer developed the design concept jointly. Once the concept had been developed, managers in R&D, operations and quality, then later marketing, were involved. With his authority and engineering expertise, the CEO ensured that each project went smoothly from its inception to certification.

The accumulated engineering expertise (evidenced by successful independent testing) did not, however, at this stage, have a significant

impact on the company's financial fortunes. Indeed, certified products made no significant contribution to sales revenue until 1996. Despite this, the company maintained the development of security products, partly as the capability appeared to be gradually increasing in value during this learning phase, and partly as the company had already committed to the security products in the initial phase.

The CEO is frank in admitting that they simply believed that something positive would happen and that they were already doing the right thing. At that time, certificates from the testing laboratories were the only means by which management could measure the progression of capability building. This was particularly important since the commitment to security products had never been seriously discussed with middle management and other employees. Moreover, all board members had not been equally enthusiastic about the security industry, although they had committed to the decision made in the initial phase. The company was trapped in path-dependency, since it would be extremely difficult to stop the process when the resources were already allocated and a capability accumulating.

Confirmation phase (1995-1996). In 1994, the first contacts with ATM producers were established. Two multinational producers of ATM were establishing a joint venture to cover the European market. They were searching for an ATM safe supplier who could produce safes to European standards. They chose company A, together with some more established manufacturers of mechanical security equipment. To win a contract, the selected companies had to develop a safe to a specified security level, in a set amount of time. This requirement was very similar, though more complex, to previous situations encountered by the company when it was fulfilling customised orders. It was an excellent test of the company's capabilities, and a team comprising members of the R&D and manufacturing departments, led by top management, took a coherent approach, determined to succeed. Within the year, they had developed an ATM safe that took its place among the three leading products of its time. In particular, its superior security design allowed significantly more cash to be stored in it, so reducing how frequently the ATM itself needed refilling (a costly procedure). However, the speed of its development was also crucial, demonstrating the company's ability continuously to produce and supply products to a customer in accordance with specified standards.

Signing the contract in 1995 was a key confirmation that the company had accumulated capability. Its value can be measured through the significant increase in revenue from the sale of certified products in 1996, and the proportion of net sales revenue this represented (see Figure 1).

In the business environment described above, the demands of the external environment and internal company capability are perfect partners. Accumulated engineering expertise allowed the development of a superior

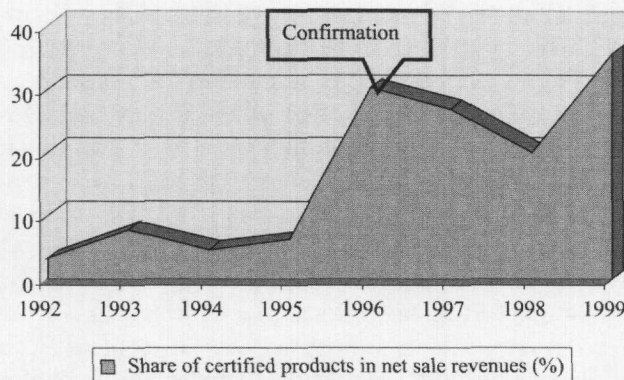


Figure 1.
Quantitative data for
capability accumulation
measure in case A

product. This knowledge was complemented by an organisational culture that could respond to individual customer demand, using a well-orchestrated R&D team led by an authoritative CEO. In these circumstances, expert knowledge and organisational routines accumulated during the evolutionary process came together to form a capability to respond quickly to customer demand in developing a customised security product.

Knowing that they possessed a valuable capability enabled company A's management to make firm plans for future development. If there had been any doubts about the company's orientation towards security products, their success in the marketplace had now dispelled these.

Exploitation phase (1996-1999). In this phase, business decisions became less driven by market demands and by the need to plug the gap between these and the company's existing capabilities. Decisions were more likely to be capability-driven as managers strove to maintain and exploit the capability, which was now known to be valuable. Encouraged by this, managers were prepared to make firmer commitments. During 1995 and 1996 the company invested in advanced manufacturing technology. Then, in the late 1990s, co-operation with the Faculty of Mechanical Engineering led to software being developed that, to some extent, simulated the techniques used by testing laboratories. This increased still further the company's ability to develop certified products quickly.

In this period, company A seized every opportunity to exploit its capability, becoming a valuable supplier to the two multinational ATM producers who had established a joint venture to cover the European market. In addition, in 1998 the firm began developing ATM safes for two companies from Switzerland and Austria. In 1999, following successful testing, both signed contracts. In both cases the company was able to respond much more quickly than its competitors.

Despite all the success achieved as a supplier of ATM safes, company A's management attempted to reduce the risk of only being part of a supply chain.

Following in-depth analysis of competitor products, they launched the STARPRIM project, which introduced a new range of low-security safes, at the beginning of 1997. This is an example of a company attempting to apply a capability valuable to one market, to another where it may be less so. It also illustrates how some ideas may emerge from a capability – in this case from engineering expertise – rather than from the market itself.

The market for low-security safes is characterised by high price sensitivity. Producers therefore strive to decrease costs, leading to low variety and high volumes characterising operations in this market segment. Some competitors transferred their manufacturing operations to low wage areas in order to reduce costs and so improve their competitiveness. In contrast, company A believed that low production costs should be achieved by innovative design and by the introduction of new manufacturing approaches. Because they were keen to meet exact customer demands they needed to introduce a range of product variants.

An expert, previously employed at a testing laboratory, was hired as an external consultant to help with the development. The idea was to optimise the design of the safes in order to achieve low costs, while at the same time meeting the criteria for successful testing. Instead, however, the concepts ended up being upgraded so that they met higher security levels. A range of 29 standard types was introduced, in modular design. This outcome arose from the company engineers' enthusiasm and confidence in their own expertise.

In the exploitation phase, decisions and activities were primarily driven by the desire to maintain and exploit a capability. In a situation where new capabilities might be called for, the company preferred to rely on its existing one, which had already been proved to be valuable.

Although company A still earns almost 40 per cent of sales revenue from other products, its managers clearly see its strength and identity as being in the field of mechanical security products. Other production areas seem prone to problems and weaknesses, and all investment is targeted to security products, helping to increase the organisation's understanding of its existing capability.

Proactive phase (1999 onwards). It was in the late 1990s when company A first began to take a proactive approach, using its capability to create (as opposed to simply react to) opportunities.

In 2000, ATM safes were successfully tested at a level to which compliance is extremely hard to achieve. The company had decided to develop these safes not in response to any enquiry made by ATM producers, but based on its own judgement of trends in the industry. Through its membership of institutions that influence technical developments in the field, company A had become able to predict future trends. Managers realised that highly developed European markets would demand high security levels, whereas the developing east European markets, which had great potential, were content with lower levels.

This enabled the company to tailor its products to different market opportunities.

Even more ambitious was the development of a system of 24-hour deposit boxes. This represented a shift from mechanical security to advanced customer-processing technology, in which the customer interacts directly with a system that provides access to services. As such, it can significantly change the way that banks use deposit boxes. In this project, which requires expertise in electrical regulation and computer-based automation, company A co-operates with an Austrian company. Company A's contribution is in its in-depth understanding of security and its development of a very secure vault-room with a modular construction. The mechanical part of the system was successfully tested in 1999, and the entire system introduced the following year.

Although it is too early to estimate the financial impact of these projects, they show how the company is working proactively to create market opportunities. A high level of uncertainty surrounds the projects, but managers have confidence in the value of the capability that has already been confirmed by the market (Table II).

Discussion

The longitudinal perspective of this research allows us to summarise and interpret the field data using the model presented in Figure 2. This reveals a pattern in the capability accumulation process.

The model consists of five life cycle phases that, together, describe the capability accumulation process. The boundaries between phases are sometimes blurred. Within each phase, an evolutionary process unfolds. Categories of evolutionary process – such as variation, selection and retention – come together with categories such as the market, market-driven decisions and capability-driven decisions. Relationships between them can be established for modelling purposes in order to characterise any given phase.

Market-driven decisions are of two types. First, they may represent a response to direct market demands. For example, company A may have been more or less forced by customers to accelerate its response to their demands, reacting with greater customisation of products. The second type of market-driven decisions is more cognitive in nature. They are made under the influence of a perceived gap between required and existing capabilities. Capability-driven decisions, meanwhile, are based on existing capabilities that are already perceived as valuable. These decisions aim to upgrade, maintain and exploit capabilities.

Description of the process

The initial phase in the life cycle sets a strong basis for further development, starting with a small number of important decisions that trigger the

Table II.
Interpretation of
field data in case A

	Initial phase	Learning phase	Confirmation phase	Exploitation phase	Proactive phase
Business context (events)	Orientation towards EU markets. Identified gap between required and possessed capabilities. Customers' demand for quick response and customised design.	No significant financial indicators. Incremental confirmation in form of successful testing. First contact with the ATM producer	The five-year contract with ATM producer for supplying safes presents radical confirmation of the value of the capability	New contracts with ATM producers. Development of new safes for the existing customer. Start of STARPRIM project. Launch of STARPRIM safes on the market.	Development of a new generation of safes. Development of a system of 24-hour deposit boxes.
Market-driven decisions	Formulation of strategic plan, driven by the identified gap	Decisions to fulfil the gap prevail. Development and testing of new products. Establishment of supply chain. Co-operation with university. Membership of trend-setting organisations. Start of ISO 9002	The producer of ATM demands improvements in logistics, delivery dependability and quality of manufacturing processes. Investments in necessary facilities (e.g. warehouse and plant)	More precise product-market positioning with STARPRIM safes	Co-operation with Austrian company on development of a system of 24-hour deposit boxes in order to integrate knowledge that is not possessed
Capability-driven decisions	Commitment to security products is partly explained by considering existing engineering resources			Perceived value of the capability lead decisions. Investments in advanced process technology. New research projects with the Faculty of Mechanical Engineering	Further investments. Building strategic identity around expert knowledge about security in the recent strategic plan.

(continued)

	Initial phase	Learning phase	Confirmation phase	Exploitation phase	Proactive phase
Strategic behaviour	Strategic plan sets tasks in rational-planning mode Emerging reaction to market demand for quick and customised response	Keeping up with development of security program Path-dependency caused by decisions from the initial phase Intensive learning, experimentation and improvisation	Reaction to emerging productive opportunity. This business sets the new context for future development	Reacting to opportunities where accumulated capability is exploited Relying on the capability	Proactively influencing the unarticulated needs of the market with new products
Capability accumulation process	Setting up the context for accumulation of engineering expertise Creating a base for a quick response The two capabilities are not linked The capability structure is not understood and its value is not recognised	Accumulation of engineering expertise Accumulation of organisational routine in new product development process The value of engineering expertise is perceived through product certificates	The linkage between engineering expertise and quick and customised response is recognised The capability is perceived as valuable	Capability accumulation process progresses further, and its structural complexity increases Synergy between different capabilities and resources (new expert knowledge together with new resources, other functional capabilities and network resources)	

Table II.

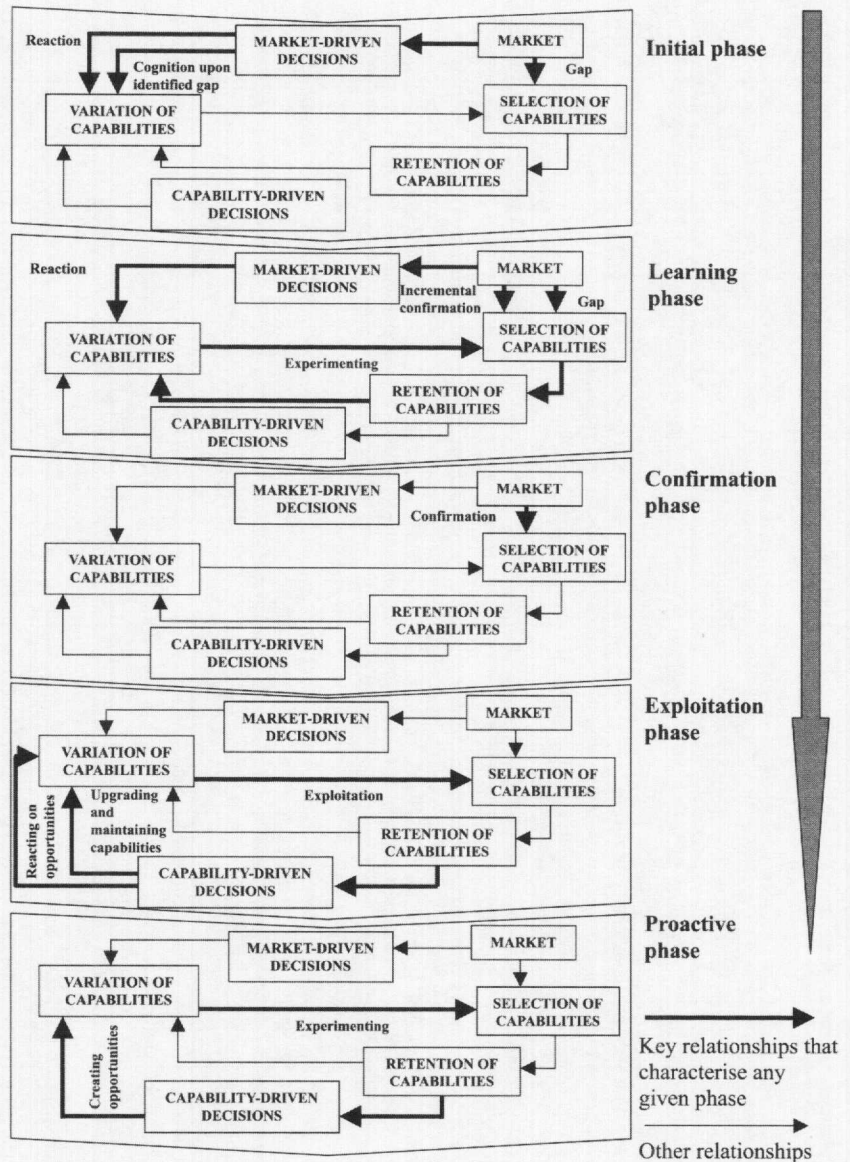


Figure 2. Summary model of the process of accumulating capability

accumulation process. This is followed by a period of intensive learning, which is set in motion by decisions in the initial phase. The capability is intensively accumulated in an effort to fill the identified gap. Decisions are framed by path-dependency. Through a local search, a firm incrementally accumulates a capability and adapts it to market demands. The confirmation phase has some

characteristics in common with the initial phase, both being characterised by content. While in the initial phase there is a gap between the required and existing capability, in the confirmation phase the capability is confirmed as valuable on the market. This in return sets a strong context for further exploitation of the valuable capability.

In the exploitation phase, firms strive to upgrade and maintain the capability, which has now been recognised as valuable by the market. The capability accumulates incrementally to achieve the best results in the established processes. The proactive phase represents a shift from simple capability exploitation to meet opportunities that present themselves, towards active opportunity creation. The proactive phase is characterised by its dual nature. The process of maintaining and upgrading capabilities still takes place but is accompanied by more radical future-oriented decisions that may change the business landscape. In all four case studies it was possible to identify a certain delay between confirmation and the first proactive decisions.

Obsolescence versus imitation

Having discussed this life cycle, it is logical to ask: what will follow the proactive phase? What might cause the companies' valuable capabilities to lose value? Because our research covered a period of growth, we cannot say for sure. Imitation is usually recognised as the main threat, but this seems unlikely to be a problem for the firms included in our research. None has made any extensive effort to replicate its competitors' practice. All identified processes were shaped by the companies' unique history and context, and the processes of collective learning were time-consuming and therefore less vulnerable to the threat of imitation. It is more likely that obsolescence caused by major changes in the market could represent an enduring threat to capability value.

This research suggests that managers are more concerned with creating new organisational knowledge in order to prevent obsolescence, and with observing competitors so as to recognise their capabilities, than with direct copying of industrial practices.

Means and mechanisms for selections and sense-making

This research explicitly observed the process of generating organisational knowledge. In doing this it has shown that this process is accompanied by another, within which knowledge about the particular capability is accumulated. The identification of two highly dependent processes leads to the recognition of the external environment's dual role. The market selects the value of capability through the mechanism of competitiveness between firms and through customer choice. However, competition for customers is not the only mechanism by which the external environment values a certain capability. The mechanism of co-operation is likely to play an important role in assessing the value of a capability. Other components of the external environment may be important as well.

For example, in case A testing laboratories selected the accumulated engineering expertise. It could be argued that this is industry-specific, since it is often claimed that mechanical security manufacturers develop their products for testing laboratories and not for customers. However, customers and competitors are stakeholders with an interest in the existence of testing laboratories, but other stakeholders exist as well. This suggests that it is not only competitors and customers who represent the business environment relevant for selecting capability.

The external environment does not just influence the process of capability accumulation in terms of selection; it also influences the parallel process of generating knowledge about the capability. The external environment helps managers to make sense of the value of capabilities. This sense-making is achieved through different means. In manufacturing, products and their competitiveness clearly represent an important means by which capability is perceived. Capabilities are embedded in operations so that competitive dimensions such as speed, dependability of delivery, lead times, quality and flexibility present static means on which the selection is made and value is perceived. In some business contexts more intangible means are relevant, so that where co-operation is important, expert knowledge is more relevant than simply a product. However, perceiving the value of a capability is a cognitive activity, whereas managers often base their understanding of capability on the behaviour of different members of the business environment.

From causal ambiguity to causal understanding

The initial phase is characterised by a high level of causal ambiguity. This does not mean that the underlying structure of a capability is not recognised, since at that time this structure does not exist. At this point, causal ambiguity refers to a lack of knowledge about exactly what kind of capability is necessary, what exactly should be done and how the consequences of decisions will affect the future value of the capability. In case A at that time, nobody linked engineering expertise with quick and customised response. In case B, flexibility emerged more as a side effect of the desire to cut costs and increase productivity. Yet ten years later, this flexibility is the cornerstone of the company's strategic identity. In case C, the company held a patent perceived as potentially valuable, yet found itself in a completely unknown market. In this phase, the external environment triggers the capability accumulation process. By selecting existing capabilities as non-valuable, it enables managers to identify a gap and to make market-driven decisions to fill it.

In the learning phase, the causal ambiguity is incrementally resolved. All the activities in the learning phase are akin to experimentation. Companies enter the market and consequently test the value of a capability. When the market shows that the capability is not well enough developed, companies react quickly to suppress weaknesses. This process of identifying

weaknesses allows the companies to identify the value of accumulated capability. In case A, successful testing enabled the firm to make sense of the development of capability. Case C, meanwhile, struggled to introduce a new product successfully. The patented design meant that the product was bound to be mechanically superior, yet it still proved to be insufficient in relation to printing requirements. However, some potential customers, despite rejecting the product, expressed enthusiasm for possibilities allowed by the product's mechanical superiority, so accelerating the learning process.

In the confirmation phase, causal ambiguity is replaced by causal understanding, as managers begin to perceive the capability as valuable. At this stage, knowledge appears that will guide future capability-driven decisions. The value of a capability is suddenly or more gradually made clear as the market embraces it. In case A, one key event confirmed the value of the capability, while in company B, a larger number of events, together with improved financial indicators, illustrated its value. Case D offers an interesting illustration of capability being confirmed through co-operation. A multinational company with a diversified range of activities, including fuse production, abandoned this part of its business when it recognised company D's capability in developing complete automation of fuse assembly, in-house. Instead, they established close co-operation, not just in supplying, but also in co-designing, products.

In the exploitation and proactive phases, causal understanding is developed further. In the previous phase, the capability is recognised and perceived as valuable. However, this does not mean that there is a full understanding of the underlying structure, though the existence of capability-driven decisions aiming to upgrade the retained capability might create the impression that there is. For example, in case B, the market confirmed company flexibility as valuable, yet the company had to cope with any increasing complexity. The majority of decisions identified at company B address this complexity. These decisions are clearly capability-driven, since they do not plug any gap signalled by the market. The market values flexibility, yet it is indifferent about complexity. All these decisions are necessary since the underlying structure that enables the capability to be valuable is never completely recognised, owing to its dynamic nature. Capability-driven decisions gradually build this structure, yet there is always less knowledge about it when decisions are made, than when their consequences become clear.

Conclusion

This paper attempts to make two contributions. First, it discusses the incorporation of an RBV perspective into the field of operations strategy research. Capabilities are embedded in operations; the main conclusion from this part of the paper is, therefore, that incorporating RBV is a legitimate

direction for further research. However, researchers should not neglect the study of multi-faceted, dynamic organisational phenomena. Additionally, more conceptual and interpretative knowledge should be generated. Incorporating RBV should not mean incorporating just RBV terminology.

Second, this paper presents a model that describes and explains the dynamics of the capability accumulation process. This is a result of in-depth field research, where researchers have been confronted with the multi-faceted and dynamic nature of this phenomenon. As such, the empirical part represents a logical extension to our plea for research that is rich in description and that explains this dynamic phenomenon. Different points of relevance can be drawn from the research findings. An understanding of the capability accumulation process requires an understanding of different types of knowledge. The knowledge of how to perform certain activities, which exist in the form of capability, is influenced by knowledge about this capability. The latter progresses from causal ambiguity towards causal understanding. The external environment influences the capability accumulation process directly – by selecting capabilities – and indirectly – by helping to resolve causal ambiguity relating to their value.

The research reported here has some limitations. The external environment is explored on the competitive level; the research sample did not allow comparison on the basis of different institutional or cultural contexts. In addition, the extent to which personal perception of capability and the market in the early phases of the process could be studied in retrospective cases was limited by the amount of time that had since elapsed. It is also impossible to deny that using a transitional economy, though this offered a number of advantages, clearly influenced the research findings. The relatively small size of selected companies, together with the transitional economy context, did not allow us to study the possible role of radical technological innovations. More could be done to identify a range of mechanisms and means by which markets influence managers' decisions. However, this would require a different research design using static categories and would focus less on processes themselves.

Clearly, much more empirical work is required to understand the dynamics of the capability accumulation process and to provide solutions for practical implementation. It would be fruitful to explore the technological innovations that create new markets as a starting point for capability accumulation. Further work must place much more weight on the individual's view of capability. Using in-depth, polarised cases, where the accumulation of similar capabilities in a chosen industry can be studied, may prove helpful in shedding more light on the phenomenon. Moreover, polarised cases may enable the building of theories explaining the process of decline, not just that of growth.

References

- Amit, R. and Schoemaker, P.J.H. (1993), "Strategic assets and organizational rent", *Strategic Management Journal*, Vol. 14 No. 1, pp. 33-46.
- Amundson, S.D. (1998), "Relationships between theory-driven empirical research in operations management and other disciplines", *Journal of Operations Management*, Vol. 16 No. 4, pp. 341-59.
- Anderson, J.C., Cleveland, G. and Schroeder, R.G. (1989), "Operations strategy: a literature review", *Journal of Operations Management*, Vol. 8 No. 2, pp. 133-58.
- Barnett, W.P. and Burgelman, R.A. (1996), "Evolutionary perspectives on strategy", *Strategic Management Journal*, Vol. 17, pp. 5-19.
- Barney, J. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99-120.
- Barney, J.B. (1986), "Strategic factor market: expectations, luck, and business strategy", *Management Science*, Vol. 32 No. 10, pp. 1231-41.
- Black, J.A. and Boal, K.B. (1994), "Strategic resources: traits, configurations and paths to sustainable competitive advantage", *Strategic Management Journal*, Vol. 15, pp. 131-48.
- Clark, K.B. (1996), "Competing through operations and the new operations paradigm: is operations strategy passé?", *Production and Operations Management*, Vol. 5 No. 1, pp. 42-58.
- Coates, T.T. and McDermott, C.M. (2002), "An exploratory analysis of new competences: a resource-based view", *Journal of Operations Management*, Vol. 20 No. 5, pp. 435-50.
- Collis, D.J. (1994), "Research note: how valuable are organizational capabilities?", *Strategic Management Journal*, Vol. 15, Winter, pp. 143-52.
- Conner, K.R. (1991), "A historical comparison of resource-based theory and five schools of thought within industrial organization economics: do we have a new theory of the firm?", *Journal of Management*, Vol. 17 No. 1, pp. 121-54.
- Corbett, C. and Van Wassenhove, L. (1994), "Trade-offs? What trade-offs? Competence and competitiveness in manufacturing strategy", *California Management Review*, Vol. 35 No. 4, pp. 107-20.
- Dierickx, I. and Cool, K. (1989), "Asset stock accumulation and sustainability of competitive advantage", *Management Science*, Vol. 17 No. 1, pp. 121-54.
- Dosi, G., Nelson, R.R. and Winter, S.G. (2000), *The Nature and Dynamics of Organizational Capabilities*, Oxford University Press, Oxford.
- Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532-50.
- Eisenhardt, K.M. and Martin, J.A. (2000), "Dynamic capabilities: what are they?", *Strategic Management Journal*, Vol. 21, pp. 1105-21.
- Gagnon, S. (1999), "Resource-based competition and the new operations strategy", *International Journal of Operations & Production Management*, Vol. 19 No. 2, pp. 125-38.
- Glaser, B. and Strauss, A. (1967), *The Discovery of Grounded Theory: Strategies of Qualitative Research*, Wiedenfeld and Nicholson, London.
- Godfrey, P.C. and Hill, C.W.L. (1995), "The problem of unobservables in strategic management research", *Strategic Management Journal*, Vol. 16 No. 7, pp. 519-33.
- Grant, R.M. (1991), "The resource based theory of competitive advantage: implications for strategy formulation", *California Management Review*, Vol. 33 No. 3, pp. 114-35.

- Gulati, R. (1998), "Alliances and networks", *Strategic Management Journal*, Vol. 19 No. 4, pp. 293-317.
- Gummesson, E. (2000), *Qualitative Methods in Management Research*, Sage, London.
- Hannan, M.T. and Freeman, J. (1988), *Organizational Ecology*, Harvard University Press, Cambridge, MA.
- Hayes, R.H. and Pisano, G.P. (1994), "Beyond world class: the new operations strategy", *Harvard Business Review*, January-February, pp. 77-86.
- Hayes, R.H. and Pisano, G.P. (1996), "Operations strategy: at the intersection of two paradigm shifts", *Production and Operations Management*, Vol. 5 No. 1, pp. 25-41.
- Langley, A. (1999), "Strategies for theorising from process data", *Academy of Management Review*, Vol. 24 No. 4, pp. 691-710.
- Leonard-Barton, D. (1990), "A dual methodology for case studies: synergistic use of a longitudinal single site with replicated multiple sites", *Organization Science*, Vol. 1 No. 3, pp. 248-66.
- Lippman, S.A. and Rumelt, R.P. (1982), "Uncertain imitability: an analysis of interfirm differences in efficiency under competition", *Bell Journal of Economics*, Vol. 13, pp. 418-38.
- Lovas, B. and Ghoshal, S. (2000), "Strategy as guided evolution", *Strategic Management Journal*, Vol. 21 No. 9, pp. 875-96.
- Mahoney, J.T. and Pandian, J.R. (1992), "The resource-based view within the conversation of strategic management", *Strategic Management Journal*, Vol. 13 No. 5, pp. 363-80.
- Makadok, R. (2001), "Toward a synthesis of the resource-based and dynamic-capability views of rent creation", *Strategic Management Journal*, Vol. 23 No. 5, pp. 387-401.
- Miller, J.G. and Roth, A.V. (1994), "A taxonomy of operations strategy", *Management Science*, Vol. 40 No. 3, pp. 285-304.
- Mills, J. and Platts, K. (2002), "A competence and resource-based architecture for operations strategy", in: Christiansen, K.J. and Boer, H. (Eds.), *Operations Management and the New Economy*, EurOMA Conference, Copenhagen, pp. 955-66.
- Mills, J., Platts, K. and Bourne, M. (2003), "Applying resource-based view: methods, outcomes and utility for managers", *International Journal of Operations & Production Management*, Vol. 23 No. 2, pp. 148-66.
- Mills, J., Platts, K. and Gregory, M. (1995), "A framework for the design of operations strategy process, a contingency approach", *International Journal of Operations & Production Management*, Vol. 15 No. 4, pp. 17-49.
- Mintzberg, H. (1978), "Patterns in strategy formation", *Management Science*, Vol. 24 No. 9, pp. 934-48.
- Nelson, R. and Winter, S. (1982), *An Evolutionary Theory of Economic Change*, Belknap Press, Cambridge, MA.
- Penrose, E. (1959), *The Theory of the Growth of the Firm*, Basil Blackwell, London.
- Quinn, J.B. (1980), *Strategies for Change: Logical Incrementalism*, Richard D. Irwin, Homewood, IL.
- Roth, A.V. (1996), "Neo-operations strategies linking capabilities-based competition to technology", in Gaynor, G.H. (Ed.), *The Handbook of Technology Management*, McGraw-Hill, New York, NY.
- Schroeder, R.G., Bates, K.A. and Junttila, M.A. (2002), "A resource-based view of manufacturing strategy and the relationship to manufacturing performance", *Strategic Management Journal*, Vol. 23 No. 2, pp. 105-17.

- Skinner, W. (1969), "Operations – missing link in corporate strategy", *Harvard Business Review*, May-June, pp. 136-45.
- Slack, N. and Lewis, M. (2001), *Operations Strategy*, *Financial Times*, Prentice Hall, Englewood Cliffs, NJ.
- Spring, M. and Boaden, R. (1997), "One more time: how do you win orders?: a critical reappraisal of the Hill manufacturing strategy framework", *International Journal of Operations & Production Management*, Vol. 17 No. 8, pp. 757-79.
- Stalk, G., Evans, P. and Shulman, L.E. (1992), "Competing on capabilities: the new rules of corporate strategy", *Harvard Business Review*, Vol. 70 No. 2, pp. 57-69.
- Swink, M. and Hegarty, W.H. (1998), "Core operations capabilities and their links to product differentiation", *International Journal of Operations & Production Management*, Vol. 18 No. 4, pp. 374-96.
- Teece, D.J., Pisano, G.P. and Shuen, A. (1997), "Dynamic capabilities and strategic management", *Strategic Management Journal*, Vol. 18 No. 7, pp. 509-33.
- Tranfield, D. and Smith, S. (1998), "The strategic regeneration of operations by changing routines", *International Journal of Operations & Production Management*, Vol. 18 No. 2, pp. 114-29.
- Van de Ven, A.H. (1992), "Suggestions for studying strategy process: a research note", *Strategic Management Journal*, Vol. 13, pp. 169-88.
- Ward, P.T. and Duray, R. (2000), "Operations strategy in context: environment, competitive strategy and operations strategy", *Journal of Operations Management*, Vol. 18 No. 2, pp. 123-38.
- Wernerfelt, B. (1984), "A resource-based view of the firm", *Strategic Management Journal*, Vol. 5 No. 2, pp. 171-80.
- Winter, S.G. (2000), "The satisfying principle in capability learning", *Strategic Management Journal*, Vol. 21, pp. 981-96.
- Yin, R.K. (1989), *Case Study Research, Design and Methods*, Sage Publications, London.
- Zollo, M. and Winter, S.G. (2002), "Deliberate learning and the evolution of dynamic capabilities", *Organization Science*, Vol. 13 No. 3, pp. 339-51.