

Internal Electronic Information as a competitiveness enhancing resource in German automotive industry suppliers

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Article Running Head

Electronic Information as Competitive Resource

Main Point:

The research indicates that Internal Electronic Information (IEI) satisfies the requirements to be a competitiveness enhancing resource in German automotive industry suppliers.

Key Points:

The results support the proposition, that whilst information itself is not scarce, it is rarely organised in ways that creates knowledge or can be used for analytics for the firm.

In terms of the role and level of IEI for specific business functions of relevance to building competitive advantage there may be gaps in knowledge use for certain important functions.

In order to avoid a significant information gap developing, small and medium-sized automotive industry suppliers (SMAS) in South East Germany (SEG) need to build on their current practices and level of information sophistication.

JEL Codes

L26, O33

Introduction

The purpose of this paper is to explore and analyse the potential for Internal Electronic Information (IEI) to be a competitiveness enhancing resource within the Resource Based View of the firm (RBV) (Oliveira and Martins, 2011). More specifically, it investigates whether and how IEI is able to meet the RBV criteria of being Valuable/value-creating, Rare/scarce, Inimitable/costly-to-copy/non-substitutable, and exploited by the Organisation (Barney and Clark, 2007: 70 drawn from Barney 1991, 1997), the so-called VRIO framework (Peteraf and Barney, 2003: 316; Cardeal and Antonio, 2012).

Issues surrounding the use of electronic information as a competitiveness enhancing resource have long been debated (see, for example, Lederer and Salmela, 1996; Doherty et al., 1999; Levy and Powell, 2000; Peppard and Ward, 2004; and Gable, 2010). Often, however, the debate has focused around interorganisational use of such information (Holland, 1995; Jarvenpaa and Staples, 2000). This paper explores and analyses the potential for IEI to be a competitiveness enhancing resource within the resource based view (RBV) framework (Hinterhuber, 2013) by investigating small and medium-sized automotive industry suppliers (SMAS) in South East Germany (SEG).

Recent statistics emphasise the importance of SMEs in both national and European economies. The Department for Business Enterprise & Regulatory Reform reports that 99.8% of businesses in the UK are SMEs (BERR, 2006). The economic situation in Germany is similar at 99.69% (DESTATIS - Portal, 2007). European statistics concur that small and medium-sized enterprises (SMEs) account for about 99% of all businesses in Europe (EC, 2003). The contribution of small and medium businesses (SMBs) to national economies can also be seen in terms of their impact on employment and turnover. In the UK, SMEs account for 58.9% of employment and for 51.9% turnover (BERR, 2006). The data on Germany reveals that SMEs provide 70.7% (IfM, 2006) of overall employment and a share of 38.3% in national turnover (IfM, 2006).

The differences between small and large firms are not, however, limited to their size but also due to certain related characteristics. Levy and Powell (2005) argue that, for example, although small businesses are confronted with similar economic dynamics as larger firms, there are major differences in the companies' objectives. The main interest in shareholder value by larger

enterprises is in contrast to the intention for flexibility within smaller firms; the fundamental purpose of small companies varying from life-style to growth orientations (Levy and Powell, 2005; Burns, 2006). Gray (2002), identifies however, that resistance to change amongst SME owner/managers may hinder a business's development, indicating the strong link between the owner/manager and the business. Penrose (1995) also proposes that the intention of owner/managers (to grow) is the decisive factor in SMEs' development. Therefore, the owner/managers' lack of growth motivation is a key constraint amongst small businesses (Penrose, 1995).

Levy and Powell (2005) also identify five key characteristics important for small businesses in determining their growth, which are market context, independence, personal influences, innovation and flexibility. Beneficial features associated with SMEs in the research literature generally overlap with this and include agility and responsiveness (Koh and Simpson, 2005), innovation (Levy and Powell, 2005) and flexibility (Jones and Tilley, 2003). Jones and Tilley (2003: 29) point out, that the "major advantage over their large rivals is their ability to respond more rapidly to changing signals from the marketplace". Sharma and Bhagwat (2006) support this, emphasising responsiveness, vis-à-vis the fulfilment of customer demands. Koh and Simpson (2005), highlight these characteristics as being the main aspects of competitive advantage for small manufacturing enterprises. Research, however, also reports a number of resource-related limitations which disproportionately affect SMEs. Specifically, the literature suggests the lack of capital, and particularly financial, skill, and staff resources.

The significance of financial resources in order to prosper is reported, (see for example Bullock et al. 2004). The monetary constraints, however, need to be discussed in three ways. First, the inability of small business to acquire a sufficient amount of external capital inhibits further growth. Consequently, the action plans and initiatives of both German and UK governments assign themselves to the improvement of access to finances for SMEs (BMW, 2006; BERR, 2008). Second, the deficit of internal capital and cash flow amongst SMEs limits the organisational performance as it prohibits the procurement of necessary equipment (Gélinas and Bigras, 2004). The Small Business Service (SBS) annual survey 2005, furthermore, notes the significance of internal finances because this is the "most popular way to fund growth" (BERR, 2005: 62). Third, insufficient utilization of funds or under-investment in organisational functions diminishes the development of the business.

Spending on technology and education or skills improvement is also seen as particularly important in order to maintain SME growth (BERR, 2008). Scarcity of skilled labour and knowledgeable workers is seen as a twofold problem. On the one hand, Pavic et al. (2007) amongst others point to the lack of internal skills and knowledge as leading to individual shortcomings in coping with new models and initiatives. On the other hand, contemporary national surveys report the lack of external or market supply of trained personnel for small business development (Bullock et al., 2004; DIHK, 2007). The “DIHK-Innovations report 2007” in Germany for instance states that the shortage of skills and talent is the major concern amongst SME owners for future growth EU wide (DIHK, 2007; Jones et al., 2011).

The Centre of Urban & Regional Development Studies (CURDS, 2002) further defines such shortcomings as inhibitors for innovation. This is important because, as previously stated, innovation is often a focal competitive advantage for growth-focused SMEs. Considering the importance of resource shortages amongst small businesses, this study focuses on the internally available assets of the firm (Pickernell et al., 2013).

The Resource-Based View (RBV) of the firm (Hinterhuber, 2013) was considered to be the most appropriate as a means for this analysis. The framework provides the substantiation for strategic significance and planning based on a firm’s assets. Taking into account this internal perspective, the RBV of the firm lends support to the creation of competitive advantages based on a firm’s resources, which in turn may sustain the superior performance of the individual firm (Barney, 1991; Barney and Clark, 2007). Considering the origins of the RBV, the framework postulates both historical and causal features and the heterogeneous distribution of a specific firm resource (Rumelt, 1984; Wernerfelt, 1984; Barney, 1986; Barney and Arian, 2005). Thus, the RBV is considered to be an analytical framework which uses “the firm’s resource as the unit of analysis” (Barney and Arian, 2005: p.134).

The respective resource characteristics of the RBV suggest a strategic value perspective for information, and the RBV framework supports the need for conceptualisation of analysis of IEI. As early as 1985 Porter and Millar (1985: 149), for example, state that “the information revolution is sweeping through our economy. No company can escape its effects”. The authors investigate the role and significance of information in the value chain of various industries. This identifies three dimensions of a firm’s finished merchandise, namely the physical good

itself, service, and information. Also of importance is their insight that each organisational transaction not only uses but also creates information.

The importance of information, is also acknowledged in both Decision-Making Processes and Information and Communication Technology (ICT) (De Saulles, 2007). Moreover, Davenport (2006), argues that ICT should “not only avidly consume data but also seize every opportunity to generate information”, arguing that the main task of technology is generating “structured” or “transaction data” (Davenport, 2006: 107). In order to avoid terminological overlaps and misinterpretations, henceforth the investigation uses the terminology “analytics” to represent explicit, critically analysed, information (Melkas and Harmaakorpi, 2008: p.108/109).

The data processing activities undertaken with IT can therefore both contextualise and creates information, the highest level of information produced via IT-analysis classified as analytics (Davenport, 2006). Further,, Davenport (2006) gives a number of examples where firms have gained competitive advantage in their industry based on superior analytical capability, (Davenport, 2006: 99).

Analytics augmenting the value of information transformation, can therefore be seen as a “strategic weapon”. Consequently, planning analytical processes is of relevance, and has given rise to studies such as that by Newkirk et al (2003) and Jones et al. (2012).

The next section explores the literature surrounding the RBV framework (Hinterhuber, 2013), information generally and then IEI specifically, focusing on how IEI fits within the VRIO framework (Lin et al., 2012). The methodology section discusses the specific research issues and the approach taken to the study, followed by results and analysis. Finally, the conclusions section discusses the results and potential future research.

The RBV, IEI, and the VRIO framework

Conner (1991) highlights that, in addition to the RBV, there are other schools, such as Neoclassical perfect competition, Bain Type Input-Output, Schumpeterian, Chicago, and Transaction costs, with which the RBV has differences as well as similarities. Conversely, a historical review also suggests that the Resource Based View (RBV) has been influential in the

development of broader ideas of firm strategy and growth (Conner, 1991), through work such as Barnard (1938), Selznick (1957), Chandler (1962), and Rumelt (1974).

More recently, Eisenhardt and Martin (2000) also acknowledge the relationship between dynamic capabilities and the RBV, whilst Sveiby (2001) discussed the Knowledge Based view, seeing the starting point as the intangible resource of people competence within the firm, from which internal and external value can be created.

Acknowledging this influence, the study therefore takes the RBV as a starting point. Another significant early work which developed RBV is the 'Theory of the Growth of the Firm' first published in 1959 by Edith Penrose (1995). She acknowledges the significance of internal resources and managerial capabilities for the development and determinant of firm success. Succeeding Penrose's firm perspective for strategic planning and development, research by Wernerfelt (1984) and Dierickx and Cool (1989) build the foundation of much of today's RBV discussion. Based on these previous studies, the RBV framework for example was articulated in the early work of Barney (1991).

Barney (1991: 101) establishes the RBV as a "framework for evaluating whether or not particular firm resources can be sources for sustained competitive advantage". The work starts by distinguishing and defining firm resources and capabilities. Although Barney (1991) offers a definition for both terms, this study adheres to the determinations by Amit and Schoemaker (1993). They characterise a firm's resources as "stocks of available factors that are owned and controlled by the firm" (Amit and Schoemaker, 1993: 35). Rather more important is the fact that Amit and Schoemaker (1993) consider resources as convertible assets for value-delivery.

In addition, however, this investigation argues that resource can be created by a business (refers to "experience" Wernerfelt, 1984: 176). The research chooses this definition as it fits the objective of this study on assets being available or already owned by the company. Thereby, the lack of finance in SMEs for acquiring additional resources is recognized. Capabilities conversely are defined as value-adding activities for deploying resources (Amit and Schoemaker, 1993). More specifically, this study determines capability as firm-specific value-adding activities within the organisational context for deploying resources.

The distinction between resources and capability, and their definitions are, however, by no means unquestioned by the literature. In fact, their usage amongst researchers is rather

ambiguous (for example see Teece and Pisano 1994; Barney 1997; Newbert 2007). Consequently, in order to avoid terminological misinterpretation, this research refers to the firm's resources and capabilities by using the all-encompassing term of strategic assets as defined by Amit and Schoemaker (1993).

The latter authors characterise “strategic assets as the set of difficult to trade and imitate, scarce, appropriable and specialized Resources and Capabilities that bestow the firm's competitive advantage” (Amit and Schoemaker, 1993: 36). In order to analyse the competitive potential of a strategic asset, the last definition indicates certain conditions that need be met. The RBV framework, therefore, requires that these are Valuable/value-creating, Rare/scarce, Inimitable/costly-to-copy/non-substitutable, and exploited by the Organisation (Barney and Clark, 2007: 70 drawn from Barney 1991, 1997). The “well-known VRIO framework” (Peteraf and Barney, 2003: 316) has been developed as illustrated below (Table-1).

(Table 1 here)

Competitive advantage in the RBV literature (Hinterhuber, 2013) is generally defined as superior performance relative to any current or potential rival. In revising their own theories Peteraf and Barney (2003: 314) provide a comprehensive definition of competitive advantage. “An enterprise has a competitive advantage if it is able to create more economic value than the marginal (breakeven) competitor in its product market.” As Table 1 above illustrates, however, different levels of competitive advantage exist ranging from disadvantage, through parity and temporary, to sustainable. It is thus the case that strategic assets can be measured using the VRIO framework (Barney and Clark, 2007; Lin et al., 2012) against a scale that will determine the degree to which they meet the criteria for sustainable competitive advantage.

Notwithstanding the fact that the RBV attracts great interest amongst strategic management scholars, as illustrated above, its specific application within the field of SME research has been rather scarce (Armstrong and Shimizu, 2007; Newbert, 2007). Barney et al. (2001) suggest that in the ten years after 1991 (refers to Barney, 1991) very few studies considered the RBV in the context of SMEs and since then the phenomenon of the SME is seldom the focal context and key concern of the RBV-oriented empirical investigations (Barney and Arıkan, 2005; Armstrong and Shimizu, 2007; Newbert, 2007). Due to this notable lack of specialised SME research from an RBV point-of view, this paper argues that the initial call by Barney et al.

(2001) for further empirical research in the area of SMEs and entrepreneurship is still in need of answering.

Within any RBV analysis Internal Electronic Information (IEI) can be seen as a resource capable of being analysed within the VRIO framework (Lin et al., 2012). In order to investigate this asset, however, various levels of information need to be considered. Specifically, Levy and Powell (2005) distinguish between data, information, and knowledge. First, “*data* is a way of codifying basic facts about a situation [...] person, or product” (Levy and Powell, 2005: 36). Hence, the definition refers to the number of aspects that need to be considered by the business manager and captured by the firm. *Information*, as characterised by Levy and Powell (2005), is the contextualisation of this raw data, the business context (structure, processes, culture) incorporating meaning into the overwhelming flood of data material. Hence, qualitative information for SME management is a prerequisite in order to make sound decisions. Levy and Powell’s (2005) third level of *knowledge* considers the combination of information and experience/expertise, figure-1 below illustrating the linkages.

(Figure 1 here)

Sharma and Bhagwat (2006) who quote Schein (1992) outline the three key functions of Information Systems (ISs) in the organisation as being to automate, transform, and inform. Using the hierarchy established in figure 1, figure-2 below consolidates two previous hierarchies of data, information, and knowledge / analytics and proposes an all-encompassing hierarchy.

(Figure 2 here)

In terms of identifying how and where ICT-generated knowledge and analytics fits within the VRIO framework, this is best examined by considering and evaluating the management activities and strategic planning actions within the business as a source of information rather than external or market information, employing the generic value chain developed by Porter (1985) to outline common management activities as illustration for their diversity. Concerning the strategic planning approach, the study refers to the definition by Stonehouse and Pemberton (2002) who suggest “the devising and formulation of organisational level plans which set the broad and flexible objectives, strategies and policies of a business, driving the organisation

towards its vision of the future” (Stonehouse and Pemberton, 2002: 854). The combination of both Porter’s (1985) value chain and Stonehouse and Pemberton’s (2002) examination found the basis for the internal, procedural sources of information in SMEs considered and added to the management activities (in Figure-3 below).

(Figure 3 here)

Drawing the discussion together within the RBV framework uses the definitions by Amit and Schoemaker (1993) of resource, capability, and strategic asset. The most basic form, data, meets the definition of a resource. The contextualisation of data (equal to information) incorporates the activity-based description of capability. According to Amit and Schoemaker (1993: 36) “the set of [...] *Resources* and *Capabilities* that bestow the firm's competitive advantage” is termed strategic asset. The synthesis of the existing research therefore leads back to the proposition that “information is a sustainable strategic asset”. Information therefore needs to be considered as being a resource and capability at the same time, and can be considered to be a dual asset. Building on this, however, also requires application of the VRIO framework (Barney, 1997) in order to test the sustainability of the value potential of information. This, as can be seen below, however, requires some adjustments to the VRIO framework, as follows.

Rare/Scarce and Organised

Previous studies indicate different levels of ICT endowments amongst small business (Cragg and King, 1993). This leads to the potential that different levels of analytics can exist between small firms. Consequently, these relative differences exist between small firms which might lead to competitive superiority. This paper merges the attributes of “rare” and “organised” from the VRIO framework because of the strong interdependence of the two in the specific context of information. Whilst information itself is not rare, it is rarely organised in ways that create knowledge or analytics for the firm.

This potential rarity or scarcity is itself based on two conditions. First, the likelihood of there being stock existence and organisation of Data, Information, and Analytics (DIA). In order to benefit from generated DIA they need to be recorded, stored, maintained, and used.

As demonstrated by a number of studies, a low level of sophistication in ICT systems often exists (Cragg and King, 1993) and refined management processes in SMEs (Stonehouse and Pemberton, 2002). The latter inhibits or at least limits the ability of these companies to generate higher levels of information.

Consequently, the availability of strategically relevant analytics might be rare. In consequence, the exploitation of information resources through creation of knowledge / analytics offers a sustainable competitive potential. Recent successful examples for this effect are Amazon, Dell, and Marriott (Davenport, 2006).

Second, rarity might exist because of a lack of awareness of the value of information or because of an inability of the organisation to exploit the information. The lack of appreciation of internal sources and the consideration of information as an asset might, for example, be a cause of the scarcity of information as well. Conversely, the lack of thought placed on information processes and processing may also lead to excessive expense (storage and search-time) and risk (loss/lack of data) (Tallon and Scannell, 2007).

Valuable

The potential for information to be valuable is acknowledged in a number of contexts. For instance, its importance in Decision-Making Processes and Information and Communication Technology (ICT) (De Saulles, 2007). More specifically the value of a resource in RBV is determined either according to the external market or relative to any current or potential competitor. Because this investigation considers the firm level, the following determines the relative value of data, information, and analytics.

The diversities of organisational processes are expected to lead to different kinds of data (i.e. amounts, sources). Although data per se is commonly available through for example the internet, transfer into the business transforms it into firm-specific information (Davenport, 2006) by adding context. The information itself therefore enables each firm to utilise data to a different extent and to create various knowledge / analytic outputs.

The more sophisticated the information, therefore, the higher the knowledge or analytical level possible, providing the opportunity for businesses to draw better conclusions for optimisations, improvements, and long-term development of organisational activities, using the experience

and expertise of the business. The resulting knowledge can thus be regarded as both valuable and highly firm-specific, linking it to the final part of the framework, namely inimitability.

Inimitable

Inimitability is itself assessed using the three criteria of unique historic conditions, social complexity, and causal ambiguity, as suggested by Barney (1997). Sound strategic decisions, for example, depend on data collection and analysing activities and past performances (Davenport, 2006). Tallon and Scannell (2007) for example, define “information life cycle management” which illustrates the capturing, application, and decline of information in the firm. However, there is a need to direct the perspective of the firm as they are not only consumers of information but also as producers of information. Hence continuous gathering of information enables the firm to develop a competitive advantage. However, as SMEs are often poorly equipped with capital, storing capacity also needs to be at its most efficient.

First mover advantage is also frequently associated with entrepreneurship and insight into opportunities before others (Barney, 1991). In accordance with Wernerfelt’s (1984: 173) “first mover advantage”, the timeliness of the exploitation of information is therefore important, as is the building of barriers to resources in order to protect the company’s competitive market position.

Linked to this, of course, the diversity of enterprises also causes much internal information, particularly that which becomes knowledge / analytics to be firm-specific. This enables each firm to both generate and consume strategically relevant information which might lead to competitive advantage. Imitation would therefore seem to be limited for any competitor due to the loss of value outside the original firm (Barney, 1997).

Having considered the literature in terms of the resource based view of the firm, competitive advantage, internal electronic systems and the VRIO framework, this suggests that IEI does have the potential to be a competitiveness enhancing resource within the RBV framework. More specifically, the following conceptualisation is possible (shown in table 2), summarising the determination of the value, specifically, of IEI by means of the RBV as posited by Bakos *et al.* (2008).

Regarding the criteria of the RBV framework (VRIO), **R**arity is produced by the lack, in many SMEs, of understanding and expectations regarding the potential value that the resource internal information entails (Barney, 1991; Glazier, 1993). The link between **R**arity and **O**rganisation is then evident due to the relative paucity of technological means (Cragg and King, 1993), skilled labour, and expertise in SMEs (Storey, 1994) for analysing this information within the **O**rganisation (where it is turned into (context relevant) information and then (expertise / experience relevant) knowledge / analytics. This then offers the potential for a sustainable competitive advantage because the **V**alue (from the initial data gathered) is ultimately created by its context-dependence (i.e. in the value-creating areas in which it is used). Finally, the degree of this organisational and individual embeddedness further promotes its **I**nimitability (Barney, 1991). Very broadly, therefore, this creates the following proposed ROVI framework, which takes the VRIO framework and adjusts it specifically for the Data-Information-Analytics (DIA) process.

(Table 2 here)

Methodology

The research, therefore, assesses the stock, use, role and level of IEI in SMEs (from Saunders et al., 2007: 135)), and the VRIO framework adjusted from IEI in table 2, as follows:-

- (a) stock of IEI (in order to examine the issues of **R**arity)
- (b) use of IEI in order to analyse its exploitation by the **O**rganisation
- (c) role of IEI to examine its **V**alue, and
- (d) level of IEI in SMEs to evaluate the degree to which it may be **I**nimitable

The purpose of this is to examine whether IEI does indeed fit within the RBV of the firm. The second, overlapping proposition of the paper links the four elements of the ROVI framework together, arguing that, whilst information itself is not **R**are, it is relatively rarely **O**rganised in ways that create knowledge or analytics for the firm, in terms of the most **V**aluable areas of knowledge, and / or in the most **I**nimitable quantities. This then highlights a range of measures against which IEI can be measured in order to determine where the potential knowledge / analytics gaps exist. Taken together, this creates three basic overlapping research Questions:-

- 1) Does IEI fit within the RBV as designated by this ROVI (VRIO adjusted) framework?
- 2) Is it the case that whilst information itself is not Rare, it is relatively rarely Organised in ways that create knowledge or analytics for the firm, in terms of the most Valuable areas of knowledge, and / or in the most Inimitable quantities?
- 3) Where are the potential knowledge gaps / analytics most prevalent?

Given that the important role of information is already acknowledged in the context of large firms (Neilson *et al.*, 2008) as well as a theoretical construct in strategic, resource-oriented scholars (Barney, 1991), this research addresses the questions of information regarding the small business context. Specifically, the population for this research comprises of small and medium-sized automotive industry suppliers in Germany. Considering the gap in the literature and the lack of empirical evidence regarding IEI amongst SMEs in the German automobile supplier industry, however, this study is exploratory in nature.

In order to reduce the variances of regional differences (Storey, 1994), the literature further suggests a focus on a particular region with a successful industry that uses ICT. Accordingly, the region of SEG, Bavaria was selected, having the highest density of automobile manufacturers and suppliers, and the highest contribution of this sector to regional GDP (23%) (Stmwivt Bayern, 2007).

The Worldbank (2007) reports that based on the national Gross Domestic Product (GDP) Germany is the third biggest economy in the World and the largest market in Europe. With a total sum of €434 billion GDP, Bavaria's proportions of the German economy grew from 17.4% in 2000 to about 17.9% in 2007. This placed it second in the national market (DESTATIS - Portal, 2007). The second lowest unemployment rate (5.3%) and the highest, constant growth rate regarding GDP (approx. 17.2% between 2000-2007) are achieved in this region.

“The automobile industry is the most important industry sector in Germany” (BMW, 2008). This contribution is evaluated with regard to both employment and GDP data. Regarding the former, it is stated that almost every seventh job is associated with the automobile industry either directly or indirectly and the contribution to GDP is approximately 12% (BMW, 2008). In addition, the pivotal role of the automobile industry is underpinned in the Bavarian context (23%) (Stmwivt Bayern, 2007).

The industry population comprises of members of the automobile industry. The German automobile industry is determined as a network of vehicle manufacturers, capital equipment, raw material suppliers, electrical and chemical engineering, as well as service provider for planning, logistics, and sales (BMW, 2008).

In their study on the utilisation of Enterprise Resource Planning (ERP) systems in SMEs, Sharma and Bhagwat (2006) emphasise the responsiveness vis-à-vis the fulfilment of customer demands. Seeing the Original Equipment Manufacturers (OEMs) as a dominant and very demanding customer, SMEs therefore face an increase in client pressures. The accuracy in customer order fulfilment is thus crucial for small manufacturing enterprises given that Koh and Simpson (2005) determine this as their main competitive advantage. Further, they determine that the information gap is the greatest limitation for effective and efficient order fulfilment in SMEs.

In order to develop an appropriate and robust survey instrument, the investigations adhere to the research strategy by Oppenheim (1992) and Gable (1994). Both authors suggest a sequence of stages for the purpose of developing a reliable and robust questionnaire.

The research takes into account related areas such as IM and ICT which put a particular focus on information orientation as proposed by Marchand *et al.* (2000), Davenport (1994), Porter and Millar (1985), and Drucker (1995). An exploratory, qualitative pilot assessment underpinned the issues found in the literature (Bakos *et al.*, 2008). As such, the pilot study supported the determinants of the information-orientation highlighted in the literature in the context of SMAS in SEG, likewise. In addition, this phase aimed to delineate variables regarding the aforementioned issues in order to operationalise and design suitable questions and scales for the quantitative investigation which is conducted subsequently.

The questions and scales designed previously were then tested by way of a small scale pilot investigation. Some 125 SMEs were extracted manually and contacted for participation from a database called the 'Bavarian initiative of innovation and cooperation of suppliers to the automotive industry' (BAIKA) (BAIKA, 2008). The responses and comments received from 17 SMAS on the design of the questionnaire were then used to refine the survey instrument for the primary data collection.

Finally, the robust instrument developed was set up as an online questionnaire. An online method was chosen as a result of the remoteness of the research, the cost of distribution, and the accuracy of the technology. Due to the focus of this investigation being on IEI the online survey was deemed appropriate because the instrument was limited to those SMEs which possessed electronic equipment and capability. Thus, the tool itself functioned as a filter for testing the appropriateness of the respondent enterprises and to further define the population being investigated.

The population of this investigation comprises SMAS in SEG who possess and use electronic communications technology. After the evaluation of various data sources based on the criteria automobile, supply (non sales or leasing), and within the EU SME definition (EC, 2003), the potential population is determined according to the subsequent quantitative information. Consistent with the statistics of the German Chamber of Commerce and Industry - Bavaria (IHK Bavaria) (n = 1,235) (Bavaria, 2009), the Automotive Cluster of the Bavarian Ministry of Economics, Industry, Infrastructure and Technology (n = 1,653) (BAIKA, 2008) and the Hoppenstedt research database (n = 1478) (Hoppenstedt, 2009), an average of 1,455 SMAS in SEG is calculated and assumed (Table 3).

(Table 3 here)

Due to the availability and access to electronic addresses for the online survey, a total of 1,308 companies were contacted. Considering the death of firms, the out-of-datedness of the research database used, the configuration of the companies' respective email servers and firewalls and individuals' out-of-office notifications, the number of bounced or rejected survey emails aggregates to 178. Nevertheless, the investigation at hand managed to obtain usable responses from 151 companies (response rate 13% of valid and received emails) that match the targeted research context (SMAS), equivalent to about 11% of the assumed averaged population size, which includes the bounced and rejected emails.

In comparison with similar studies in the automobile supplier sector (e.g. VDA, 2007; Heupel, 2008; Roth, 2008) both the sample size and the response ratio are appropriate. The size distribution is in accordance with former studies in the German automobile supplier sector (VDA, 2007; Fuß, 2008; Heupel, 2008). In addition, a comparison of early and late respondents with regard to size, sector and role of respondent did not find any results that achieved a .05

level of significance. The research, moreover, adheres to the suggestion by Huber and Power (1985), cited in Bhatt and Grover (2005: 263), “in the case where one respondent per unit is solicited, it should be the most informed respondent”. Considering, the respondents were asked about their role in the business. Taking into account response bias, the results indicate that 89% of the questionnaires were answered by a member of the senior management team (Owner, CEO, or Department Head).

Results

The findings are presented according to the questionnaire’s structure and the four cornerstones of this investigation. First, the IEI stock is assessed to determine the current information supply which has been accumulated by SMAS. Second, analysis of IEI use evaluates both the technological readiness and the basic use of IEI amongst the participants in order to explore the overlapping issues of rarity and organisational exploitability. Third the role of IEI in the firm is examined through the percentage of firms using IEI for a particular function to establish value. Fourth, the level of IEI use, represented by the percentiles IEI use is analysed for the purpose of highlighting competitive opportunities for SMAS in SEG related to the scale of inimitability.

(Table 4 Here)

Regarding the accumulation of resource stocks, the RBV states this as a basic prerequisite for successful, future asset utilization and exploitation (Dierickx and Cool, 1989). Accordingly, the investigation determines the existence of electronic information stocks based on (1) (past) the number of years SMASs have been gathering information electronically, (2a,b,c) (present) the perceived satisfaction with current electronic information supply and usability, and (3) the future trend of electronic information development required within the business. The trend is significant in particular because previous studies claim that the increasing amount of information which needs to be processed systemically also prompts an issue for the future development of the small firm (Gélinas and Bigras, 2004) (Table 4).

The number of years (1) that the small firms report to have collected information electronically, for all intents and purposes, is predetermined by the age of the business. Thus, the average amongst the investigated SMAS allows for a conclusion of both the maturity of the firms and

the information history. The report indicates that the mean score of the (Table 4 - 1) number of years is 14.85 in the context of German SMAS in SEG.

The perceived satisfaction with the stock in terms of information supply (Table 4 - 2a,b) and usability (Table 4 - 2c) of the information is tested considering the User-Information-Satisfaction (UIS) model (amongst others Diamantopoulos and Souchon, 1999). The perception of the stock itself is measured on a 5 point scale ranging from (1) “Too little”, through (2) “Just enough”, (3) Optimum, (4) “Just manageable” and (5) “Too much”. Satisfaction with the amount of information stock, is assessed using attitude statements which are measured on a 5-point-Likert scale ranging from “Very Dissatisfied” (1) to “Very Satisfied” (5) (scale 1 - 5). Usability of the data also uses a 5 point scale ranging from “fail”, “pass” “satisfactory”, “good” and “very good”. The means indicate a positive trend of satisfaction regarding the mean scores for both information supply amount and its quality with 3.11 (Table 4 - 2a) and 3.66 (Table 4 - 2b), respectively. The usability of the data is also shown to be strong with a positive mean (of 3.45) (Table 4 - 2c).

Regarding the perceived amount of information, however, no definitive conclusion could be drawn from the survey due to much of the data having a bimodal distribution (either “just enough” or “just manageable”). The fact that the SMAS in this investigation perceive their own information supply as satisfactory, almost 70% agree, and usability of the electronic information resource is ranked by 90% of respondents as satisfactory or better illustrates a generally high level of satisfaction with the data currently being gathered. This is important, given that there is a trend of increasingly more information for businesses to confront. Indeed, nearly 80% of respondents agreed or strongly agreed with the statement that “There is a trend / development you and your business being confronted with more information?”, the mean being 3.96.

(Table 5 here)

Table 5 shows the relationships between stock, satisfaction and usability. Perhaps unsurprisingly it shows a significant positive relationship between satisfaction with the IEI data collected and the number of years of collection and also between the perceived usability of the IEI and both the number of years during which IEI collection has taken place, and the satisfaction with that data. Conversely, the negative relationship between usability and stock

may highlight a capacity issue for the responding firms. Taken with the result that increasing amounts of data are confronting small firms, this would tend to support the Gélinas and Bigras' (2004) contention concerning lack of capital resource, creating an issue for future development of the small firm.

Investigating the information use issue in more detail, therefore, in most investigations in ICT and IM in SMEs, there is agreement as to the importance of both the IT endowments and the employees' integration in using and analysing the information in order to realise value for the business (Davenport, 1994; Marchand *et al.*, 2000; Ray *et al.*, 2007). The information use, initially, is assessed using attitude statements which are measured on a 5-point-Likert scale ranging from "Strongly Agree" (1) to "Strongly Disagree" (5) (scale 1 – 5). Due to the fact that the underlying construct reflects the overall IT capability of the SMAS (Bhatt and Grover, 2005), a Cronbach-Alpha reliability test is conducted ($\alpha = .775$).

The readiness of IT endowments (1) staff training for collection, (2) analysis of information (3), and knowledge needs of the business (4) are all rated as mainly, "Strongly agree" or "Agree" by the respondents. There is also, an increase in the mean value as one moves from data-rich elements towards the more knowledge rich elements, indicating a lower degree of agreement with the statement. Thus, there is a fall in the number of companies able to move along the DIA continuum as one moves from data towards knowledge / analytics, supporting the VRIO framework adjusted for IEI (ROVI).

(Table 6 here)

Table 7, further illustrates that there are strong and significant positive relationships between the variables. Cragg's (2002) contention, that a perceived high level of technical IT endowment and human IT capability satisfaction is a prerequisite for successful IT exploitation and information use in SMEs, therefore receives some support from the findings in Table 7. In addition, the relationships reduce in strength as we move from data collection to knowledge/analytics-related variables.

(Table 7 here)

Taken with the results from Tables 4, 5 and 6, these results would also tend to support the proposition that whilst information itself is not rare, it is rarely organised in ways that create knowledge or analytics for the firm. The results in table 7 then highlight that a lack of the organisation exploiting information by failing to generate knowledge / analytics from it may be partly linked to gaps in the pre-requisites for information use.

In order to further examine the overlapping issues of value and inimitability of the knowledge / analytics, the role and level of use of the IEI in particular functions was also examined. In terms of the role of IEI within the firms, this is determined from a holistic organisational perspective. As such, this research adopts the Porterian Value-Chain operations as the list of items (Porter, 1985). In regards to the applied research process discussed previously, this study modifies the process of the original value-chain model according to the comment and outcomes of the qualitative pilot investigation (Bakos *et al.*, 2008). Accordingly, SME managers suggested to split the activity of Sales & Marketing, as well as to specify the abstract process description of Inbound and Outbound logistics in Porter's model (Porter, 1985). Table 8 presents the adopted list of process items in consideration of the pilot investigation. Again the Cronbach-Alpha results indicate a very strong reliability ($\alpha = .960$; $N = 151$).

The result shows the relative frequency of the use of electronic information by SMAS. The latter represents the dichotomous answers (Yes/No) regarding the use of the information which was collected electronically.

(Table 8 here)

Table 8 suggests that IEI information is used by the vast majority of SMAS in their business operations with particularly high percentages for customer relationships, finance and production. On the subject of supplier management, HR planning, and warehouse management, however, the results also hint at a relative lack of electronic information usage.

The level of this use of knowledge / analytics (i.e. for those firms that do gather information for that function) is then presented using a five-Point-Likert scale (equally distributed 0%-100% scaled 1 - 5) (Bakos *et al.*, 2008: 7). The following tables (Tables 9 and 10) indicate that the highest level of electronic information use in business operation occurs in the organisational activities of customer relations, warehouse management, and finance.

(Table 9 here)

(Table 10 here)

Table 10 highlights that, for all of the functions mentioned, the average percentage use of information gathered in each function is in the 40-60% band or higher, with most in the 61-80% band, indicating a high level of use of the information, but also with room for this to increase. The degree to which electronic information is used is, on average, above 80% in the areas of customer relationships. The fact that the process “finances” shifts from second position (Table 8) to third place (Table 10) indicates that even here, SMAS managers feel that they do not use the available financial data to its full extent. Again Tables 8 and 10 position HR planning towards the bottom of the ranking, but with marketing also dropping considerably down the rankings.

In relation to the intensity of electronic information stock and use in the process customer relationship and distribution/logistics, the investigation uncovers the competitive potential of SMAS in the region of SEG. This finding is supported by Sharma and Bhagwat’s (2006: 205) investigation on the subject of the use and exploitation of ERP systems in SMEs. They propose that the primary concern in “today’s highly competitive market requires customer orientation products and fast delivery of quality products” (2006: 205). As such, the SMAS in this study generally recognise and react information-wise, and thus, strengthen their competitiveness.

This study found that amongst the three primary sources for electronic information use the financial process is key to perceived value. As such this evaluation agrees with a variety of studies which examined the primary areas for IT utilisation in SMEs (Levy and Powell, 2005; Sharma and Bhagwat, 2006). Notwithstanding, Levy and Powell (2005) suggest in their quadrant model that any level of IT sophistication comprises at least word processing and accounting. Accordingly, the fundamental role of close financial management is realised by SMAS in SEG, as well, in order to cope with common issues such as access to finance and shortage of capital in SMEs (Storey, 1994). Similarly, the German SME panel 2008, report that finance is the third highest concern after the shortage of skilled labour and market conditions in Germany (IfM, 2008).

Regarding the context of SMAS, the Automobile Supplier study 2008, by the management consultancy Ernst & Young, is most significant since the study supports the need for close financial management in a changing market environment (Fuß, 2008). The latter states the biggest concerns are raw material prices, innovations, pressures for consolidation, and shortage of skilled labour in the automobile supplier industry which the assessment suggests to be fundamentally grounded in the suppliers' financial management (Fuß, 2008).

Conversely, the relative paucity of information use in the area of production/project planning concurs with Sharma and Bhagwat (2006). Their study in ERP systems in Indian manufacturing SMEs concludes that the lack of forecasting and planning originates from the small scale of the businesses in question. Previous investigations particularly concur with the lack of ERP systems' usage for the purpose of information analysis in the areas of production and supply management in SMEs (Koh and Simpson, 2005). This study supports these issues from an information use point-of-view. The previous data presents that both production and supplier management are located amongst the least frequently and sophisticated mentioned matters (Tables 8, 9 and 10).

Conclusion

The research examined the ROVI conceptual framework (adjusted from VRIO), in order to provide empirical evidence of internal information stocks, use, and exploitation in SMEs in response to the assumption by Hicks (2007: 239) "that the information managed is of some value to the organisation and/or individuals within the [SMEs] and that the IS implemented support the flow of value" (Cardeal and Antonio, 2012; Lin et al., 2012). This research also tested the assumption of individual and organisational awareness and appreciation of information as an asset to the company (Ray *et al.*, 2007).

The majority of the sampled small firms acknowledge the significance of their electronic information resources and realise its intrinsic value by way of utilising their information capacities. In so doing, the findings support IEI as satisfying the requirements to be a competitiveness enhancing resource for German automotive industry suppliers.

The respondent small business managers also indicate that there is a trend towards more electronic information within the firms. Consequently, there is potential to find it difficult to

utilise this data effectively in terms of producing useful knowledge / analytics. Perhaps as a partial consequence, the results support the proposition that whilst information itself is not rare, it is rarely organised in ways that create knowledge or analytics for the firm. This may be partly linked to the pre-requisite of ICT and IM for maximising information use.

The results in terms of the role and level of IEI for specific business functions suggest that whilst businesses focus on the areas of most relevance to building competitive advantage, there may also be gaps in knowledge use for certain important functions. This paper concludes that in order to avoid a more significant information gap developing, SMAS in most areas need to build on their current practices and level of information sophistication.

Further statistical analyses need to be carried out, in terms of the limitations of the sample size, in order to gain a deeper understanding of the underlying constructs within the collected data. This will allow the research to further underpin the proposition of the strategic potential of information. Future research could also assess the needs and gaps of SMEs for the purpose of taking advantage of these information opportunities and establishing an organisational information readiness.

Nevertheless, this investigation has made a contribution to knowledge in a number of areas. Specifically, highlighting the information opportunities within SMEs that supply the Bavarian automotive industry. More broadly it has introduced and tested the ROVI framework and demonstrated that for SMEs (in this case in the automotive industry) that information itself may often not be scarce, but may not be organised in ways that maximise the value for the firm for reasons linked to the lack of ICT and IM resources.

As such the development of guidelines for better information exploitation would encourage policy makers, academics, and practitioners, alike, to realise the benefits which this inexpensive asset entails and bridge the information literacy gap (De Saulles, 2007).

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Information hierarchies

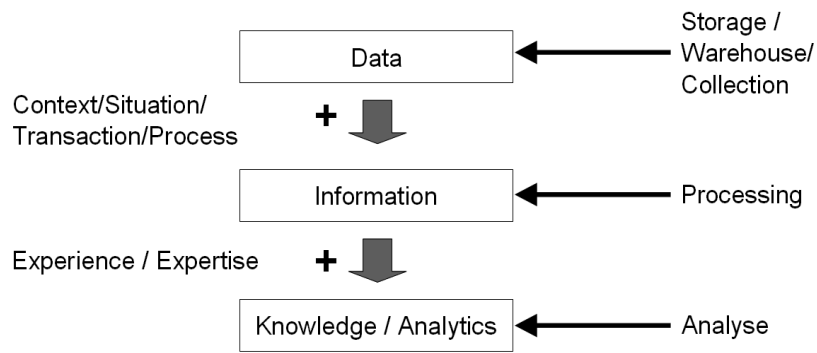


Figure 1 – Data-Information-Analytics (DIA) hierarchy (Bakos et al., 2008)

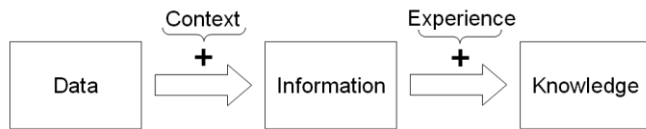


Figure 2 Data-Information-Knowledge, Source: (adopted from Levy and Powell, 2005: 36/37)

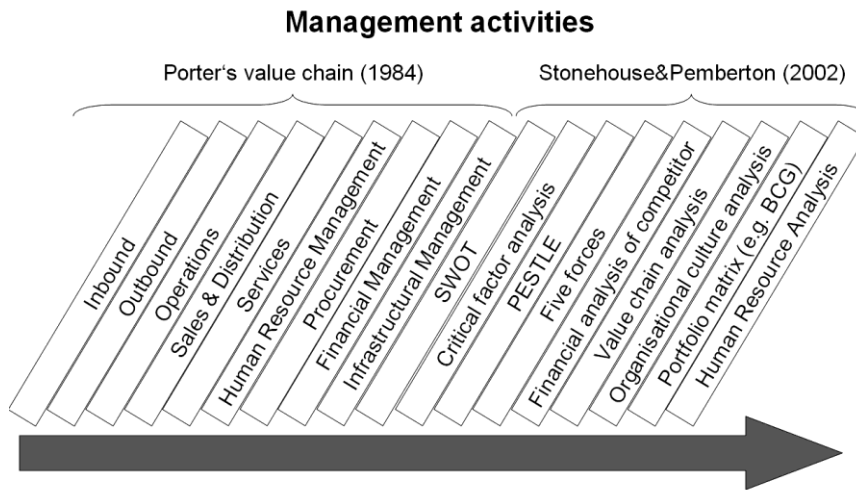



Figure 3 Synergy – Information as a Sustainable Strategic Asset

Table 1: The VRIO Framework

Valuable?	Rare?	Costly To imitate?	Able to be Exploited by Organisation?	Competitive Advantage Implications
No	No	No	No	Competitive disadvantage
Yes	No	No	 To	Competitive parity
Yes	Yes	No		Temporary competitive advantage
Yes	Yes	Yes	Yes	Sustainable competitive advantage

Source:- Adopted from Barney and Clark (2007: 70 drawn from Barney 1991, 1997)

Table 2 ROVI Framework (VRIO Framework Adjusted for DIA)


DIA	Rare?	Able to be Exploited by Organisation?	Valuable?	Costly To Imitate?	Competitive Advantage Implications
No Data	No	No	No	No	Competitive disadvantage
Data	No	To 	Yes	No	Competitive parity
Information	Yes		Yes	No / low cost	Temporary competitive advantage
Knowledge / Analytics	Yes	Yes	Yes	Yes / High cost	Sustainable competitive advantage

Table 3 Population summary

IHK Bavaria (Bavaria, 2009)	1,235
BAIKA (BAIKA, 2008)	1,653
Hoppenstedt (Hoppenstedt, 2009)	1,478
Population Average	1,455

Table 4 IEI Stock Results

	Information Stock	Mean	Std. Deviation	
1	IEI Years	14.85	7.38	
2a	Perception of Stock amount	3.11	1.027	
2b	Perception of Satisfaction with Information Stock itself	3.66	0.824	
2c	Usability of Stock	3.45	0.877	
3	Information Trend	3.96	0.81	

Table 5 – IEI stock (variable relationships Spearman’s Rho (correlation))

		IEI years	IEI Satisfaction	Perceived IEI stock
IEI Satisfaction	Correlation Coefficient	.236**		
	Sig. (1-tailed)	.004		
Perceived IEI stock	Correlation Coefficient	.004	-.062	
	Sig. (1-tailed)	.965	.447	
IEI usability	Correlation Coefficient	.218**	.302**	-.268**
	Sig. (1-tailed)	.007	.000	.001

** . Correlation is significant at the 0.01 level (1-tailed).

Table 7 – Correlations of Information / Analytics Pre-requisites requirements (Spearman's Rho)

		Employee Collect	Employee Analysis	Employee Aware
IT Endowment	Correlation Coefficient	.425**	.404**	.333**
	Sig. (1-tailed)	.000	.000	.000
	N	151	151	151
Employee Collect	Correlation Coefficient		.624**	.405**
	Sig. (1-tailed)		.000	.000
	N		151	151
Employee Analysis	Correlation Coefficient			.446**
	Sig. (1-tailed)			.000
	N			151

Table 8: Role of IEI: Percentage of Firms using information for that Function

Rank	Operations	Information Use
1	Customer Relationship	96% (4,5,6,7,8,9,10,11)
2	Finances	95% (6,7,8,9,10,11)
3	Production/ Project Planning	93% (8,9,10,11)
4	Procurement	90% (1,8,9,10,11)
5	Sales	90% (1,8,9,10,11)
6	Infrastructure / IT	89% (1,2,8,9,10,11)
7	Distribution/ Logistics	88% (1,2,8,9,10,11)
8	Marketing	83%(1,2,3,4,5,6,10,11)
9	Warehouse Management	79% (1,2,3,4,5,6,7)
10	HR Planning	77% (1,2,3,4,5,6,7,8)
11	Supplier management	73% (1,2,3,4,5,6,7,8)

Table 9: Percentage of Information Gathered in each function that is used

	Supplier	HR	Warehouse	Marketing	Distribution	Infra	Purchase	Sales	Production	Finance	Customer Rel.
0-20 %	16	19	9	12	11	15	13	3	20	9	8
21-40 %	7	25	7	13	13	9	20	14	19	10	5
41-60 %	17	30	17	53	19	15	17	29	20	24	12
61-80 %	37	19	29	28	32	33	40	46	34	39	35
81-100 %	33	23	58	19	58	62	46	44	47	61	85
Total	110	116	120	125	133	134	136	136	140	143	145

Table 10: Mean Value of Percentage of Information Gathered in each function that is used
(where 1=0-20%, 5=81-100%)

	HR(1) (2,3,4,5,6,7,8,9,10,11)	Marketing (2) (1,5,6,7,8,9,10,11)	Production (3) (1,6,7,8,9,10,11)	Supplier (4) (1,6,7,8,9,10,11)	Purchase (5) (1,2,7,9,10,11)	Sales (6) (1,2,3,4,11)	Distribution (7) (1,2,3,4,5,11)	Infra (8) (1,2,3,4,11)	Finance (9) (1,2,3,4,5,11)	Warehouse (10) (1,2,3,4,5,11)	Customer Rel.(11)
Mean	3.02	3.23	3.49	3.58	3.63	3.84	3.85	3.88	3.93	4.00	4.27
Std. Dev.	1.358	1.130	1.437	1.364	1.338	1.063	1.306	1.360	1.202	1.243	1.113
Std. Err. of Mean	.125	.101	.121	.131	.115	.091	.113	.117	.100	.113	.092
Valid	116	125	140	110	136	136	133	134	143	120	145