

Identifying core competences for diversification in a small
UK manufacturing firm

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Abstract

This paper addresses a significant gap within the present body of work on the resource based perspective on the firm. That is the lack of empirical research on the resource based perspective within the SME sector (Mills and Platts, 2001). This study applies the resource based perspective and core competence analysis in particular in a very practical situation: a small manufacturing firm in the UK. The study is the result of a two year research project where the researcher was embedded within the firm as part of a DTI Knowledge Transfer Partnership (KTP) programme. The manufacturing firm supplies hydraulic tube assemblies to the yellow construction industry and has experienced rapid growth over the past ten years. Using a causal mapping methodology the findings reveal distinctive capabilities that the firm is able to use as a basis for diversification. The findings contribute to the body of literature on the resource based view of the firm by contributing to the debate on distinguishing between resources capabilities and core competencies and provide a methodological approach which helps to uncover core competencies in practice.

1. Introduction

Diversifying away from your main business and revenue stream that has provided a stable and profitable business for over thirty years is full of risks and uncertainty. This paper illustrates how a manufacturing company in the UK supplying one of the UK's fastest growing private businesses: JCB set about this difficult task of diversifying.

Founded in 1972 and now located in Dorset, Steel-Tubes Limited¹ has extensive experience in the tube manipulation industry and in particular the fabrication of rigid hydraulic tube assemblies for the construction machinery market. Steel-Tubes is a leading supplier to the yellow goods industry, with an established customer base which includes JCB, Caterpillar and Hitachi. With a turnover of £12m, the company is one of the largest tube manipulators in the UK. While Steel-Tubes has been successful, with constant growth in turnover and employees, it has grown into a position where 80% of the business is from one customer. This is, however, a strategy that Steel-Tubes purposely undertook approximately seven years ago. Having seen the potential growth of JCB, over the past five years it focused on growing the business from 50% to 80% from JCB. Having captured this growth the longer term strategy is now on reducing the dependency on the single customer and the yellow goods industry.

The yellow goods industry continues to grow with JCB competing with Caterpillar and CNH of the US, Komatsu of Japan and Volvo of Sweden. Competition is fierce and while there is growth JCB continue to put further pressure on its suppliers to lower costs and demand more for less. The dependency on one customer however is also growing and will continue to grow as long as sales from JCB outweigh total sales from other customers. This causes problems for Steel-Tubes as JCB are able to dictate terms that are disadvantageous, such as demanding short lead times and instant response to new or adjusted orders which causes disruption in production. Dependency on one customer in a focused industry means that Steel-Tubes is vulnerable to changes in JCB's strategy, as well as changes in the construction machinery industry. JCB is also realising the potential threat that being dependant on a sole supplier poses to their business and are currently looking at secondary suppliers for hydraulic tube assemblies. Having recently expanded into China and India, it is

¹ The name of the firm has been changed to ensure anonymity.

reasonable to conclude that JCB may also be planning to outsource parts from these countries in the future.

Given this situation the key challenge for Steel-Tubes was how to identify a strategy to diversify and enable it to build a business to generate a revenue stream beyond the yellow goods industry. In 2006 Steel-Tubes secured a two year DTI KTP Associate for two years to help it develop opportunities for diversification. Given that the Associate was to be embedded within the company working alongside the senior management team, the research lends itself to an in-depth study of the firm's resources and core-competencies. The next section explores the strategic management literature in general and the resource based view of the firm in particular with respect to diversification.

2. The development of the resource based perspective within strategic management

The impact and influence of the development over the past twenty years of the resource based perspective within strategic management has been considerable. This is not just in terms of philosophical management debate but also within the board rooms of firms. For example such questions as: 'What are our key resources?' and 'How can we diversify using our core competences?' are now not uncommon. This is a significant shift away from questions such as 'What is our corporate mission?' and 'What business are we in?' There has been a reorientation in the way firms consider strategic decision-making from, to put it crudely, an external analysis of the environment and aligning the firm to it, to an internal analysis and aligning the firm's resources to the external environment. This later approach is referred to as a resource based perspective (RBP). The perspective is dependent on two basic principles:

- There are differences between firms based upon the way they manage resources and how they exploit them (Nelson, 1991);
- These differences are relatively stable.

The first of these is in contrast to the dominant economic perspective such as neoclassical price theory, in which firms in an industry are seen as essentially alike. This is now giving

way to a richer understanding of the firm with an acknowledgement that they possess firm-specific resources (Williamson, 1985). While this may seem obvious or trivial it is necessary to remind ourselves how far we have travelled from the dominant perspective in the 1980s, which incorporated a level of analysis at the industry level and argued that firms needed to examine the level of attractiveness of an industry; for example, Michael Porter's extremely influential 'five forces' framework. This was externally focused and did not consider the firm's capabilities. Indeed, it is the shift from an external orientation within strategy development to an internal orientation that best captures the appeal of the resource-based perspective. It is this approach that enables us to identify the strengths of individual firms.

The key task facing firms as they analyse and decide on what strategy to pursue remains the same: that of aligning the firm with the environment or industry. This is captured effectively and simply in the SWOT framework. While this framework has been criticised for being overly simplistic, static and creates opportunities for developing unrealistic opportunities; it is not a model (and should not be viewed as one) for developing objective knowledge about the external environment it is merely a framework that provides a useful vantage point from which to help the management team of a firm consider its strategic options. Furthermore, these options or possibilities should be related to the firm's capabilities.

For the academic discipline of strategic management the landscape has changed considerably in little more than ten years. The RBP emerged as the contemporary and dominant approach to strategy development. Virtually all the strategy journals and most of the business and management journals featured articles written from a resource based perspective. Moreover, the language of the RBP such as resources, capabilities and competences now fill the mainstream business press. So what are the key concepts of the RBP?

The concepts of the RBP and Core competence analysis

If the RBP is dependent on the two key principles of: firms are different and these differences are relatively stable, then a key question arises, which is: how does one identify these differences that determine the success of a firm? It is the detail that is significant here.

Here, by differences we mean strengths and it is around this concept of strengths that so much of the debate has taken place.

Strengths have been interpreted as resources, capabilities and competences (Wernerfelt, 1984; Barney, 1991). Hamel and Prahalad (1990) developed the idea of core competence for a very specific type of resource. Indeed, they developed three tests that they argue can be used to identify core competencies, namely “customer value”, “competitor differentiation” and “extendibility” (Hamel and Prahalad, 1994). Yet, despite the widespread acknowledgement of the salience of core competencies for acquiring and sustaining a competitive position, the notion of core competencies has remained largely amorphous (Onyeiwu, 2003). Indeed, there is a tendency in the literature to characterize core competencies as any asset that enhances firm performance. According to Hamel and Prahalad (Op. Cit.) a firm’s ability to generate profits from its technology assets depends on the level of protection it has over these assets and the extent to which firms are able to imitate these competencies. For example, are competencies at the periphery or the centre of a firm’s long-term success? If they are at the centre and difficult for firms to imitate then long-term profits are assured; for example, over the past fifty years few firms have been able to imitate ‘Honda’s’ success in developing performance engines.

Increasingly economists are using the notion that firms possess discrete sets of capabilities or competencies as a way of explaining why firms are different and how firms change over time. To summarise they are: that competitive advantage resides not in a firm’s products but in their competencies. These are defined as knowledge, skills, management processes and routines acquired over time that are difficult to replicate- this is most likely because they are constantly changing them and updating them. However, knowledge or technology in itself does not mean success, firms must be able to convert intellect, knowledge and technology into offerings that customers want. This ability is referred to as a firm’s competencies: *the ability to use its assets to perform value-creating activities*. This frequently means integrating several assets such as: product technology and distribution; product technology and marketing effort; distribution and marketing. Indeed, it is the investment in intangible assets that seem to be determinants of core competencies (Onyeiwu, 2003).

Development of RBP and dynamic capabilities

It is Jay Barney (1991) that is considered by many to have made a significant contribution to the debate on the RBP when he argued that there can be heterogeneity of firm level differences among firms that allow some of them to sustain competitive advantage. He therefore emphasised strategic choice, where responsibility lies with the firm's management to identify, develop and deploy resources to maximise returns. He further proposed that above industry average rents can be earned from resources when they are: Valuable, Rare, Imperfectly Imitable and Non-Substitutable (so called VRIN attributes).

A key issue for debate within the literature has been over what form resources take. It is now widely accepted that resources include tangible ones such as patents, properties, proprietary technologies and intangible resources such as relationships and trust built up over time (Galbraith and Galvin, 2004). It is this wider interpretation of the concept of resources and in particular the recognition that resources include information, knowledge and skills that has further developed the concept of RBP.

Significantly, the idea that firms develop firm specific routines as they conduct their business differentiated the concept of RBP from the more static 'SWOT' framework. Teece, Pisano and Shuen, (1990) put forward the idea that firms develop dynamic capabilities that are difficult to replicate and it is this that makes firms different. This seems to chime well with Edith Penrose's (1959) ideas that it is resources that enable firms to create services or flows. But the technology capability of the firm frequently dictates what is possible and what can or cannot be achieved in a given time frame, hence a firm's opportunities are constrained by its current position and current knowledge base, i.e. it is path dependent. This introduces the notion of technological trajectories (Nelson and Winter, 1982; Dosi, 1982). Acquiring knowledge about technology takes time involves people, experiments and requires learning. To exploit technological opportunities a firm needs to be on the 'technology escalator', that is, firms cannot move easily from one path of knowledge and learning to another. According to Teece et al., (1997) the choices available to the firm in terms of future direction are dependent on its own capabilities; that is the firm's level of technology, skills developed, intellectual property, managerial processes and its routines. Furthermore, they argue the choices made by any firm must take place in a changing environment; characterized by changing levels of technology, changing market conditions and changing societal demands.

Teece et al. (op. cit.) refer to this concept as the dynamic capabilities of firms. This is significant within the debate on the RBP as it implies a shift in focus from protecting rare, inimitable, and non substitutable resources (so called VRIN framework) to continuously creating resources and capabilities in order to compete (Kogut and Zander, 1992; Teece et al., 1997; Winter, 2003).

In a review of the empirical research on RBV of the firm Newbert (2007: 137) examines the issue of distinguishing between resources, capabilities and core competencies and finds: *“it is perhaps no surprise that capabilities and core competencies have been found to be far more significant in explaining competitive advantage and performance than resources.”* Newbert further argues that resources have received a great deal of empirical attention because relative to capabilities and core competencies they are easy to measure. For example, the construct human capital is the most widely studied resource as it can be operationalised along dimensions such as demographics in certain roles/positions; whereas capabilities and core competencies are difficult to access and to identify. Indeed, he presents the identification of capabilities and core competencies as a major methodological challenge which necessitates a greater need for primary data collection techniques and will by its nature introduce a greater potential for respondent bias.

Sustaining success and Diversification

The RBP emphasises the theme of sustained success within the research, diversification can be viewed as the other side of the same coin. It is growing the firm through utilising the firm's resources, capabilities and competences, which is at the heart of this approach to strategy development. The commonly accepted theory of diversification is simply put: it is the resource based perspective. But, this raises one of the key concerns about the RBP (Conner, 1991; Rouse and Daellenbach, 2002). Firm specific resources are at the heart of the RBP. It is the ingredient that makes firms different. A key test of empirical research findings, however, is the extent to which they are generalisable (the other two key tests are internal validity, such as a causal relationship and construct validity, that is whether a study investigates what it claims to investigate). Herein, then lies the apparent paradox in the theory of the resource based view: sustainable competitive advantage is based on firm idiosyncratic resources yet they, by definition, cannot be generalisable. For a theory to be

valid it is the accepted belief that it must be shown to account for phenomena not only in one setting, but are also externally valid in another setting. This is essentially the logic that is applied in pharmaceutical research as testing moves from animals to humans. This raises further questions about whether a firm can use its identified core competences as a valid basis for diversification, if according to one of the three accepted tests of theory, the RBV cannot be generalisable, and therefore is not valid. Gibbert (2006) addresses this paradox and argues that the two other forms of validity are more fundamental as external validity is dependent on internal validity and construct validity. Moreover, he argues, the study of firm specific resources demands a comparative approach, which compares different levels of analysis: at the firm level, industry level and across industries.

The previous discussions illustrate that there has been a considerable discussion amongst academics on the pages of many of the highly regarded strategic management journals. Indeed, despite the confusion that exists regarding terminology much of the debate has focussed on the validity or not of RBV as a theory and furthermore all the practical applications have been within multinational firms and from a corporate level perspective. Empirical research in this field is almost entirely focussed upon large and multi-business organisations, with the result that the vast SME sector has been largely ignored. Indeed Petts (1997) and Mills and Platts (2001) state that there has been little application of the concepts to SMEs manufacturing or otherwise. While this may be a function of the “growing pains” of the school of thought, this represents a significant gap within the present body of RBV/competence literature. This study attempts to apply the resource based perspective and core competence analysis in particular in a very practical situation: a small manufacturing firm in the UK. The research questions therefore are:

- i) What are the core competences of Steel-Tubes Ltd?
- ii) How can core competences be identified within a small manufacturing firm?
- iii) How can core-competences be used as a basis for diversification?

3. Methodology

Identifying resources and competencies in particular is a key issue within the RBP approach. This is particularly so when there are strong relations of complementarity and co-specialisation among individual resources, so that it is not necessarily the individual resources, but rather the way resources are clustered and how they interact with one another; that is, important to a firm's competitive advantage. Causal maps provide a method of analysis for researchers and managers within firms to uncover complex systems in the areas of quality, strategy, and information systems (Fiol and Huff, 1992). These causal maps are known by many names, including Ishikawa (fishbone) diagrams, cause-and-effect diagrams, impact wheels, issue trees, strategy maps, and risk-assessment mapping tools. Causal maps can be used by managers to focus attention on the root causes of a problem, find critical control points, guide risk management and risk mitigation efforts, formulate and communicate strategy, and teach the fundamental causal relationships in a complex system (Scavarda et al., 2006). In the social sciences, a causal map is generally considered to be a particular type of cognitive map, which is an individual's mental model of the relationships (causal or otherwise) among the elements of a system. Typically, causal maps are drawn with nodes representing concepts, ideas, or areas. The nodes are linked with unidirectional arcs that represent beliefs about the causal relationships among these nodes. The arcs may indicate only the presence or absence of a relationship, or may indicate the strength of the relationship between two nodes. Synthesizing causal maps from a number of respondents results in a "collective causal map."

Eden and Ackerman's modelling of competences using a causal mapping methodology is ideally suited to identifying relationships between assets, distinctive competencies and outcomes. The mapping process using diagrams facilitates managers within the firm to identify and recognise relationships between capabilities where previously they were unrecognised. In particular the approach models competencies as patterns and identifies the way in which patterns often express the distinctiveness of competencies. The relationship between patterns of competencies and the goals of an organisation are used as the basis for establishing core distinctive competencies and for developing and exploring the business model which informs strategic direction (Eden and Ackerman, 2000).

The analysis in this paper relies on content analysis and cognitive maps. Cognitive maps have been defined as:

'graphic representations that locate people in relation to their information environment. Maps provide a frame of reference for what is known and believed'. (Fiol and Huff, 1992: 267).

There are many different types of cognitive maps for example causal maps (e.g. Bougon et al., 1977) have been extensively discussed and used in the management literature (see the special issue of the Journal of management Studies, 1992, 29(3) for a review). In our study presented here, the cognitive maps are derived using Eden and Ackerman's framework (Eden C and Ackerman F (2000)). The cognitive maps produced in the study can be interpreted by drawing on the insights offered by personal constructs.

Cause maps are coded following many different conventions. It is therefore arguable that there can be no general approach to their analysis. Indeed the interpretation and meaning of the analysis can only be undertaken in relation to both the purpose of the research and the theoretical basis of the form of representation to be analysed, be it a cause map, network, or any other graphical picture (Homer and Oliva, 2001; Pavlov and Saeed, 2004; Howick et al., 2006).

Cognitive mapping is a soft systems approach that enables the researcher to establish people's views and why they hold these views. The technique is fairly simple to use and hence does not require extensive training; typically the interviews last about an hour (Eden, 1983). Furthermore, it is a modelling technique that elicits a person's understanding of a process in their own words. The constructed cognitive map (model) uses the participants own language and thus facilitates ease of understanding of the model. This is particularly important for receiving feedback on the developed model. Immediate problems are presented if the model cannot be easily understood by the participant.

A number of studies have suggested that an in-depth interview, of the style required for cognitive mapping cannot be started without detailed knowledge and preparation (Marshall and Rossman, 1989). Burgess recommends that it is essential to get to know the people before detailed conversations can occur. In this case this criterion has been met following the immersion within the organisation by the Associate for two years. Table 1 illustrates the

additional information and data to which such a process provides access. The direct interactive modelling technique of cognitive mapping, using elite semi-structured interviews was thus selected as an appropriate method for revealing the core competencies of the organisation.

The research was designed in three phases. Phase 1 was an exploratory approach using Focus Groups to uncover competencies and capabilities within the firm. Phase 2 examined and evaluated the identified variables in more detail. Phase 3 explored links and relationships between the variables using a mapping technique.

Table 1: Information available due to KTP project structure

	Immersion within the organisation provides access to:
1	Internal documentation
2	Attendance at and information from internal meetings
3	Information from informal discussions with colleagues
4	Confidential information
5	Historical and present data

(i) Phase One Focus Groups

In order to gain a perspective from the different management perspectives the Focus Groups were divided into two groups: senior managers (five) and middle managers (seven). By dividing the sessions into these groups the fear of any repercussions from senior colleagues is limited and more honest and complete findings were more likely. The sessions were tape recorded and anonymity was assured. The questions were designed to be explorative and to create discussion within the groups (see Table 2). The questions selected were split into groups with each group aiming to cover a different objective. One group of questions aimed to identify resources and capabilities and the other to discover informal systems within Steel-Tubes.

Table 2: Phase 1 Focus Group Questions

1.	Steel-Tubes does lots of things, but what does it do well?
2.	Which activities do Steel-Tubes struggle to do well, and which ones do they do very well?
3.	What formal and informal systems exist within Steel-Tubes to allow them to deliver benefit to their customers?
4.	How do the formal and informal systems compliment Steel-Tubes's activities and how do they inhibit them?
5.	What activities deliver the most customer benefit in terms of adding value?
6.	What does Steel-Tubes do that competitors can't do? For instance, high quality, flexibility, cutting and plating their own products.
7.	What resources does it have that help it to succeed?
8.	Are these unique in any way?
9.	In terms of unique capabilities are there areas in which Steel-Tubes has adapted and changed over the years which has enabled it to continue to be successful?
10.	How are Steel-Tubes able to be so flexible?
11.	How could Steel-Tubes offer the same level of service to other customers as they do to their major customer?

In order to triangulate the findings from Phase 1 and to avoid inbuilt bias interviews were held with two of the firm's major customers and two potential customers to identify requirements that were seen as necessary in order to compete and be successful in the yellow construction goods industry. These findings were compared to those identified internally in Phase 1.

(ii) Phase Two Focus Groups

In the second session the senior and middle management groups were combined. The objective this time was to establish which of the issues raised during the previous sessions are core to enabling Steel-Tubes to compete and which ones are key to Steel-Tubes's success. This was done in the form of an attribute scoring exercise, where each of the participants scored the success factors identified in the previous sessions in terms of importance. Discussions of why people scored the attributes the way did then took place with the emphasis on the difference between senior and middle management views. Hafeez, Zhang and Malak (2002) designed a scoring exercise as part of the methodology outlined in

their paper and this was used as a template. By scoring the attributes of a company it is easier to identify the importance of each one in relevance to the others. This is important as it is the relationships between the attributes which are considered to underpin a company's competitive advantage and which are likely to lead to core competencies (Wernerfelt, 1984; Barney, 2002; Eden, 2006 and Hamel and Prahalad, 1994).

(iii) Phase Three Focus Groups

For the third sessions, the participants were split into the two groups in Phase 1. This session was designed to build on the findings from the previous sessions and aim to determine the relationships between the identified attributes. Causal mapping was used in the third focus groups as it offers a visible method of showing linkages between the capabilities and resources that were identified in the earlier sessions. The key objective was to establish assets, capabilities and outcomes and explore linkages between them.

4. Findings

All the sessions were approached by all the participants with a willing and positive attitude and this is reflected in the quantity and quality of the data gathered. The focus groups uncovered many resources and capabilities. Many of these areas were raised in both sessions suggesting that these may well be fundamental to Steel-Tubes's sustained competitiveness. It was clear after analysing the results from the focus groups in Phase 1 that the service that Steel-Tubes offer coupled with the high quality products produced were key factors behind Steel-Tubes's success. The attributes that enable Steel-Tubes to be able to offer an exceptional service were identified as follows:

(i) Accommodating production operation

An issue which was raised in both groups was the constant "disruption" to production. Having investigated this further, it seems disruption is caused to the order of the queues for processes. It was explained that although disruption to the order of the queues happens quite regularly, this has little effect on productivity or the actual production processes. This is an important issue to understand as it is the ability to deal with this disruption that enables Steel-Tubes to offer such an exceptional service to its customers. Further evidence of this

ability is that approximately 33% of all parts produced are less than one year old, which suggests new products are introduced to the production line on a regular basis.

(ii) Experience in small batch production

This year, the average order has been approximately 300, with a range of 20 to 1500 but a mean average of 52 per batch. Further research is required however into batch sizes as this will be part of the criterion to investigate market opportunities and therefore it is important to understand what is meant by a small batch size and whether or not this differs between industries.

(iii) Extent and skills of the prototyping service

The benefits and negative effects of prototypes being developed on production machines needs to be explored, particularly the way in which Steel-Tubes is able to cope with this disruption on the production line caused by the prototyping service. This is further evidence of the ability to deal with disruption, the way in which Steel-Tubes are able to control an environment where prototyping and the production line work harmoniously as opposed to working as separate entities in a traditional setup and as the literature would suggest is most effective. This is an important topic to understand as it is this control that allows Steel-Tubes to offer the exceptional service that they do.

(iv) A comprehensive in-house production service

Although this has been identified as a key success factor for Steel-Tubes it is not yet clear if this is a unique resource within the industry. Further investigation will need to be done to establish the full capabilities of the two plants in order to provide a basis for benchmarking against other companies.

(v) In-built capacity

More investigation is needed however, to discover what happens to orders that are at the back of the queues. It is not yet clear if the nightshift production schedule is orders which have been postponed during the day or if nightshift production schedules are postponed to accommodate incomplete orders from the day shift. If this is the case are orders constantly postponed until they are considered urgent or is there an in-built capacity in production which accommodates these postponed orders.

(vi) Planning and logistics

The Planning and Logistics department are responsible for ensuring the right parts are being pushed through the production line and that they get shipped on time. It is important to understand the way in which this is managed in order to benchmark this against other companies.

Good teamwork at the operational level and the knowledge of bending being tacit in individuals are two areas which also enable Steel-Tubes to offer an exceptional customer service. However, they are currently two issues which are relevant to the project but at present will not be investigated. This is because they will be more important when researching market opportunities and will offer bias as to whether or not opportunities are realistic.

Factors and outcomes identified from customers

The interviews were held at the customer's place of business and lasted approximately one hour. Not surprisingly there was considerable similarity with those from within the firm. The key factors that were necessary for success in this industry were:

- i) On-time deliveries;
- ii) Quality;
- iii) Rapid response;
- iv) Competitive price;
- v) Experience of working within the industry;
- vi) Production planning & scheduling

Given the findings from Phase 1 variables i) to iv) were therefore identified as necessary outcomes. These feed into the causal mapping exercise in Phase 3.

Findings from Phase 2

Further analysis of each of the capabilities identified was undertaken using a scoring method base on the work of Hafeez, Zhang and Malak (2002). By scoring the attributes of a company it is easier to identify the importance of each one in relevance to the others. This is important as it is the relationships between the attributes which are considered to underpin a

company's competitive advantage which are likely to lead to core competencies. Barney (2002), Eden (2006) and Hamel and Prahalad (1994) also recognises that some attributes are more important than others and that they have to be ranked in some form in order to be able to distinguish between ones which are crucial to core competencies (this is shown in Table 3).

Table 3: Findings from Focus Group 2 Scoring

	Commercial Manager	Prototype Manager	Quality Manager	Logistics Manager	Dispatch Manager	Poole General Manager	Production Coordinator	Commercial Estimator	Production Manager	Production Director	Quality Controller	Total
Knowledge and experience of bending	1	4	3	4	5	5	4	5	5	4	5	45
Good teamwork at the operational level	2	2	4	5	4	3	5	5	4	5	4	43
Comprehensive in-house production capability	4	2	1	5	2	3	5	3	5	5	5	40
High perceived quality in the industry	2	5	3	2	5	4	4	4	4	3	4	40
Flexible accommodating production system	3	3	5	3	1	4	3	4	5	4	4	39
Extent and skills of the prototyping service	4	4	2	2	2	4	4	5	3	4	4	38
Planning and logistics systems	3	2	2	4	3	4	3	3	4	4	4	36
In-built production capacity	3	3	4	3	4	2	2	4	3	4	3	35
Experience in small batch production	2	2	4	1	3	4	4	2	3	3	3	31
Total	24	27	28	29	29	33	34	35	36	36	36	

Findings from Phase 3

The findings from Phase 2 feed directly into Phase 3. Figure 1 shows a causal map with three key layers. The outcomes at the top of the map can be distinguished from distinct competencies as they tend to be factors that are demanded by customers. These were identified by correlating findings from Phase 1 and the findings from interviews with customers. Whereas distinct competencies are the effect of processes within the firm (here a process is defined as a series of activities, which are linked together and managed). It is the ability to manage distinct competencies that separates them from assets, which cannot be managed. The map illustrates many links and relationships that have been identified between the resources and capabilities. This illustrates how Steel-Tubes's flexible manufacturing system contributes to its success in terms of provision of service and how it is integral to Steel-Tubes. The three distinctive competencies that were identified through an analysis of Steel-Tubes's business model were:

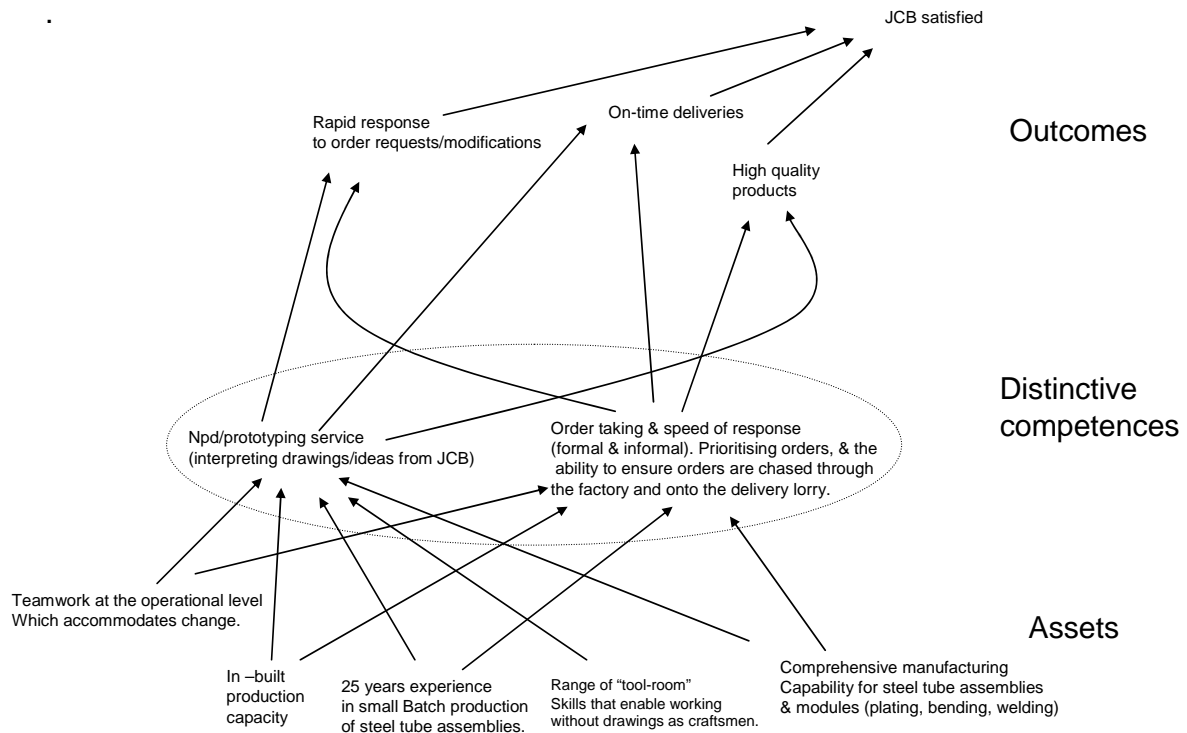
1. Flexible production system allowing rapid response to orders.
2. Personal service to customers utilising specialist prototyping expertise.
3. High quality small bore steel tube manipulation and manufacture of tube assemblies.

As a final test for the validity of these core competencies, they have been compared to three questions devised by Hamel and Prahalad (1994):

1. Does it add customer value?
2. Does it differentiate your company from your competitors?
3. Does it offer a base of expansion for your company?

The distinctive competencies do satisfy all of Hamel and Prahalad's tests and therefore it is fair to conclude that the above are realistic core competencies for Steel-Tubes Limited.

Identification of Core Competences Within Steel-Tubes



Using Barney's VRIO framework it is possible to analyse the capabilities identified and explore whether there is congruence. Table 4 shows the attributes within the VRIO framework. This offers three attributes that have the characteristics of core competencies as identified by Barney.

Table 4: Steel-Tubes's competencies using Barney's (2002) VRIO Framework

Attribute	Valuable	Rare	Costly to Imitate	Exploitable
Experience in small batch production	No			
In-built production capacity	No			
Good teamwork at the operational level	No	No		
Planning and logistics systems	Yes	No		
Comprehensive in-house production	Yes	Yes	No	
Knowledge and experience of bending	Yes	Yes	No	
Flexible accommodating production system	Yes	Yes	Yes	Yes
Extent and skills of the prototyping service	Yes	Yes	Yes	Yes
High perceived quality in the industry	Yes	Yes	Yes	Yes

5. Conclusions

This study has shown how the core competences of an SME can be identified using a causal mapping methodology. The methodology to identify the core competences used here had three phases based on focus groups, a scoring process for competences and the development of causal maps (Hafeez, Zhang and Malak, 2002). The core competences were further evaluated using the tests suggested by Hamel and Prahalad (1994) and Barney (2002) and cross-checked with customers, suppliers and competitors. The core competences identified, now inform the process to develop a diversification strategy for Steel-Tubes, which is the second stage of the KTP.

The casual mapping methodology cited in this paper can be used by other SMEs but it should be noted that the resources and skills required are not insignificant. The mapping process requires extensive discussions between the lead researcher and individuals, both inside and outside the firm (Marshall and Rossman, 1989) and the organisation of the interviews and focus groups and the analysis of the data, all take time. In addition Steel-Tubes went through the KTP approval process with the DTI, recruited a graduate and then introduced that person to all aspects of the firm's operations. It was crucial during this period that the graduate was able to develop the trust and confidence of Steel-Tubes's management. The project also required the company's management to engage fully with the process.

Although technically employed by the Knowledge Transfer Partnership, the graduate spent most of his time at Steel-Tubes and in this respect was 'embedded' in the firm. He developed a highly detailed understanding of the firm, not only because he has been there for more than a year at the time of writing but also because the mapping process demands extensive interaction with the company, suppliers, customers and to an extent competitors. So the experience of carrying out the analysis of Steel-Tubes suggests that it is essential for firms to ensure that a full and detailed understanding of the firm is developed during the process. Steel-Tubes could have asked an external consultant to carry out the brief but the cost would have been prohibitive, and besides the cost, a consultant would not have had the same access to tacit knowledge in the firm that the KTP associate had, who was employed full-time and

was thus 'embedded' in the firm. In this respect, although Steel-Tubes had no choice but to use a cheaper alternative to consultants, the company believes that working with someone who was essentially working full-time in the firm was a better alternative.

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Appendix 1: Attribute Scoring Exercise

Below is the list of attributes that have been identified as key to Steel-Tubes’s success. Using numbers 1-5 please score each of the attributes depending on how important you perceive them to be. 1 being of low importance, 5 being of high importance. However, you are only able to use the number 3 twice.

Key Attribute	Score
Comprehensive in-house production capability	
Experience in small batch production	
Planning and logistics systems	
Flexible accommodating production system	
In-built production capacity	
Extent and skills of the prototyping service	
Good teamwork at the operational level	
Knowledge and experience of bending	
High perceived quality in the industry	