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Competitive priorities and knowledge management

An empirical investigation of manufacturing companies in UAE

Received 14 March 2014
Revised 29 August 2014
Accepted 12 April 2015

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Abstract

Purpose – The purpose of this paper is to identify attributes of knowledge management (KM) for large and small manufacturing companies in United Arab Emirates (UAE) and to propose a process to evaluate the competitive priorities of these companies.

Design/methodology/approach – This research is designed by composing multi criteria decision making of KM attributes in order to identify competitive priorities of large and small manufacturing companies to achieve better customer focus. To deal with this complexity of multi criteria decision-making process, Analytical Hierarchical Process (AHP) method has been used in this research.

Findings – Results show that large manufacturing companies are putting more emphasis on "Know-Why" knowledge attribute in all four competitive priorities for achieving customer focus. While, small size manufacturing companies put higher weight on "Know-What" knowledge attribute by focussing on two competitive priorities (flexibility and quality).

Research limitations/implications – Results are derived from a limited number of empirical data only in one country, therefore these cannot be generalized. Future research with larger samples of small and large manufacturing firms from other countries is needed.

Practical implications – To be competitive, manufacturing companies must reshuffle their production strategies to allow them to play a role in global knowledge-intensive market. Therefore, they must incorporate knowledge attributes as a way to achieve higher levels of performance.

Originality/value – This study is among the first and most exhaustive ones carried out in the small and large size firms operating in the manufacturing sector of UAE. It provides a systematic approach to identify the operational competencies and knowledge attributes being followed by large and small manufacturing companies.

Keywords Knowledge management, Customer focus, Knowledge-intensive environments, Manufacturing capabilities

Paper type Research paper

1. Introduction

Knowledge management (KM) is recognized as an important tool for sustaining competitive advantage and improving performance. The evaluation of KM performance has become increasingly important since it provides directions for organizations to enhance their competitiveness. The twenty-first century is the era of knowledge economy, in which most organizations possess knowledge that enables them to improve their performance (Zaied *et al.*, 2012). Organizations that build up and leverage knowledge resources attain greater success than firms that are more reliant on tangible resources (Autio *et al.*, 2000). KM is ever becoming a primary business function for many firms as well as for individual projects as they realize that organizational competitiveness pivots on the effective management and creation of knowledge (Ajmal *et al.*, 2010).

Journal of Manufacturing Technology Management
Vol. 26 No. 6, 2015
pp. 791-806

1741-038X
DOI 10.1108/JMTM-03-2014-0020

On the other hand, globalization and highly demanding customers have tremendously increased the competition among manufacturing companies. Manufacturing companies are increasingly influenced by intense foreign competition, rapid technological change, shorter product life-cycles and customers who are seeking for customized products and services at a greater speed (Zhang *et al.*, 2001). Organizations today, compete not only with their external capabilities but also on their abilities to leverage manufacturing capabilities. Increased customer requirements coupled with competitive pressure from globalization have forced managers to ensure that their organization's resources are well aligned not only across all functional areas but also throughout the entire supply chain. This alignment is the key in developing and maintaining manufacturing capabilities required in meeting evolving customer demands in knowledge-intensive environments.

Many studies have focussed on knowledge at the technological level (Prencipe, 2003). Also, a lot of research has been carried out on competitive priorities of manufacturing companies. However, there is no study in the literature that addresses the relationship between a firm's competitive priorities and its KM, particularly in manufacturing companies of United Arab Emirates (UAE). This paper takes the first step in considering knowledge attributes more specifically in relation to competitive priorities in small and large manufacturing companies. This paper takes into consideration four dimensions of competitive priorities (quality, cost, delivery and flexibility) and examines their impact on three alternative attributes of KM (know-how, Know-why and Know-what). The overall purpose of the research is to refine current theory on the attributes of knowledge and to propose a process for identifying competitive manufacturing priorities in large and small manufacturing companies in UAE. Thus, this research is designed by composing multi criteria decision making of KM attributes to find their contributions for designing a customer focus strategy through manufacturing competitive priorities. To deal with this complexity of multi criteria decision-making process, Analytical Hierarchical Process (AHP) is utilized.

The remainder of this paper is organized as follows. The next section provides a survey of the related literature. In Section 3, the research setting and analysis has been introduced. Section 4 presents discussion and conclusion.

2. Literature review

2.1 Manufacturing capabilities

The major theme of manufacturing capabilities is the manufacturers' choice of emphasis among key tasks. These capabilities or competitive priorities include cost efficiency, high quality, fast and reliable delivery and product/process flexibility (Hayes and Wheelwright, 1984).

Previous studies suggested that manufacturing capabilities are built sequentially over time: first, a solid foundation of quality; second, delivery; and third, low cost and flexibility capabilities. Four dimensions that are commonly accepted in literature for competition in market place (Hayes and Wheelwright, 1984) are cost, quality, flexibility and delivery. These four elements were also used as inputs in (Ferdows and De Meyer, 1990) Sand cone model. Sand cone model proposes a sequence in the performance improvement process, starting from quality to delivery, flexibility and ultimately cost. Details of these four elements are presented below:

i. Cost. Competing in the market place on the basis of cost efficiency requires striving for low-cost production. In order to keep manufacturing costs competitive, managers must address materials, labor, overhead and other costs. Inventories have long been the focus of cost reduction in factories and are one of the justifications of the JIT system.

Therefore, inventory and inventory-related items, such as improving vendor's quality, reducing waste of purchased materials, are considered as the indicators of cost capability. Realizing low inventory level, decreasing labor cost and reducing machine time are all positive factors of the cost efficiency construct.

ii. Quality. Quality has been identified as a manufacturer's capability to compete in global market (Hill and Hill, 2009). Quality is measured on the basis of the importance of durability, reliability and innovation of the component. Quality is associated with conformance to specifications and meeting the expectations of the customers (Slack and Lewis, 2002) and durability and reliability in particular, must also conform to the buying firm's specifications (Chan and Chan, 2004). The strength of quality control/assurance function in a plant is the indicator of quality emphasis (Evans and Lindsay, 1999).

Marriott *et al.* (2013) used Process Activity Mapping and Failure Mode and Effect Analysis to prioritize improvement projects based on cost and quality. They tested this approach in a manufacturing setup and found that it could be applicable in a low-volume firm that produces complex products having high risk implications. Theißen and Spinler (2014) used ANP-based decision methodology to assess suppliers for a collaborative CO_2 reduction program. They developed an ANP model for a fast-moving consumer goods (FMCGs) industry that ranks among the ten largest CO_2 emitting industries worldwide.

iii. Flexibility. Manufacturing flexibility was known as the ability of a manufacturing firm to respond to environmental changes (Li, 2000). Upton (1995) defined manufacturing flexibility as the capability to react to market changes within a shorter time and at a lesser cost. Other researchers have suggested that manufacturing flexibility is a multi-dimensional construct that could be measured in many different ways (Duclos *et al.*, 2003). Recent studies have categorized manufacturing flexibility into internal and external flexibility (Upton, 1995). The internal manufacturing flexibility is relative to the need to meet customer requirements efficiently and is not directly related to market demand and environmental uncertainties. Examples of internal manufacturing flexibility are machine-, component-, material- and routing-flexibilities.

Swamidass and Newell (1987) distinguish machine-level flexibility from plant-level flexibility. The former being "predominantly technology based" and the latter being derived from a combination of technology, infrastructure, design and engineering capabilities, and the competitive goals and objectives of a firm.

iv. Delivery. Delivery capability is a time issue. Delivery is usually defined in a number of aspects of an organization's operations. One is how quickly a product or service is delivered to a customer. Another is how reliably the products or services are developed and brought to the market. The third is the rate at which improvements in products and processes are made (Krajewski and Ritzman, 1999).

2.2 Customer focus

Customer focus can be defined as the degree to which an organization always fulfils customer requirements and expectations (Quality, 1995). A winning organization must be proverbial with the need to consign the customer as the first priority in every decision taken. The key purpose of an organization is to keep up an invariable association with the customer. That is, counting customers' proposals in knowledge creation activities, storing knowledge that is valuable to customers, reviewing customer complaints and applying that knowledge to fulfill customer needs and enhance customer satisfaction

(Ju *et al.*, 2006). Bassi and Van Buren (1999) emphasize that the intellectual assets of an organization are not only employees' know-how, but also business process and customers' knowledge as well. Liao (2006) explicates that sharing the information and knowledge about customer needs among co-workers or leaders could proceed as a competitive advantage to a business. Fast learning and knowledge transfer from one individual to another is what an organization must do extremely well in order to retain the products and services against the needs and anticipation of customers (Pfister, 2002).

2.3 Knowledge and manufacturing

Knowledge is vibrant, relational and is based on human action (Davenport and Prusak, 2000). There are two types of knowledge, i.e. explicit and tacit (Nonaka *et al.*, 1995). Explicit knowledge refers to codified knowledge, which is effortlessly transmitted in a formal, explicit and systematic language. Tacit knowledge refers to knowledge that remains much harder to transfer, formalize or codify, due to its individual superiority. Tacit knowledge, being divergent to explicit, is profoundly rooted in action, commitment and involvement in a specific situation or context (Tsoukas and Vladimirou, 2001), and involves cognitive and procedural components.

The next generation of manufacturing businesses must be in a position to make use of information and extract knowledge from information system and the competitive environment to maximize their return (Davenport and Prusak, 2000) and reuse knowledge for innovation (Hung *et al.*, 2005). This approach converts data to information and transforms information to knowledge (Ajmal and Koskinen, 2008) so that business intelligence can be devised and used in the decision-making process. Explicit knowledge is precisely and formally articulated and codified in documents and databases of corporate procedures and best practices. Tacit knowledge is the practical wisdom possessed by experts that is difficult to capture, yet repeatedly demonstrated in contexts as varied as factory floors, research laboratories, army basis and corporate board rooms (Crowley, 2000).

KM has been applied in manufacturing (Paiva *et al.*, 2002), new product development (Ding and Peters, 2000) and supply chain management (Fan *et al.*, 2000). However, little research can be found on the application of KM dimensions for prioritization of manufacturing capabilities in highly knowledge-intensive environments. Acquiring knowledge is often associated to learning (Argote, 2012).

Table I elaborates different dimensions of knowledge, i.e. know-what, know-how and know-why (Ajmal *et al.*, 2009). More specifically, know-what corresponds to an understanding of the specific system configurations that different customer groups may want and the different uses they may put these systems to (Garud, 1997). Know-how symbolizes an understanding of procedures required to manufacture each component and an understanding of how components should be put together to perform as a system. Know-why stands for an understanding of the principles underlying the structure of each component and their interactions (Garud, 1997).

This paper has considered knowledge more specifically in relation to manufacturing capabilities. Next section sheds light on the methodological approach of this paper.

3. Research setting and analysis

3.1 Overview of AHP

AHP was introduced in 1970s. It is a structured method that involves decomposing complex and unstructured elements into a set of components organized in a multilevel hierarchical form (Saaty, 1983). Decision making involves different alternatives. AHP

Knowledge attributes	Features	Practical examples
"know-what" It specifies what action to take when presented with a set of stimuli. For instance, a salesperson who has been trained to know which product is best suited for various situations	Least sophisticated variety Easy to apply Incorporated in many computer-systems	In the insurance and banking industries customer service representatives who use database systems to address customer questions about products ranging from dishwashers to latest digital TV sets
"know-how" It is, knowing how to decide on an appropriate response based on a diagnostic process, whether in sales, medicine or any other area. It permits a professional to determine which treatment or action is best	Sophisticated variety Not easy to apply	In the above mentioned example when customer service representatives suggest the appropriate available option that is most suitable/appropriate for the customers according to their requirements
"know-why" It involves an understanding of underlying theory and/or a range of experience that includes many instances of interactions and exceptions to the norms and conventional wisdom of a profession	Most sophisticated variety Complicate to apply	Knowing that an unusually high level of sales might be due to an interactive effect – an influence of one factor that only operates at certain levels of another factor would also represent such "know-why" knowledge

Table I.
Knowledge attributes

methods structure the decision process into a hierarchy. Through a set of pair-wise comparisons at each level of the hierarchy, a matrix can be developed, where the entities indicate the strength with which one element dominates another with respect to a given criterion. The main concern of AHP is dealing with inconsistencies arising with the judgment and improving this judgment (Vinodh *et al.*, 2011). AHP judges and selects the elements/concepts which have a greater influence on predetermined objective. AHP has mostly been used to accurately evaluate the influence of the criteria in terms of goals.

In recent literature, AHP has been suggested as an emerging solution approach to complex real world and multi criteria decision-making problems (Yang and Shi, 2003; Lee and Drake, 2010; Ishizaka *et al.*, 2012). AHP has been successfully implemented in various fields. For example, Ghodsypour and O'Brien (1998), Korpela *et al.* (2001) and Lee and Hsu (2004) implemented AHP in logistics management; Braglia *et al.* (2001), Çebi and Bayraktar (2003) and Bertolini and Bevilacqua (2006) applied AHP in manufacturing sector; Lee and Kwak (1999) and Kwak and Lee (2002) in health care management; Kurttila *et al.* (2000) and Masozera *et al.* (2006) in environmental management; Radasch and Kwak (1998) and Kwak *et al.* (2005) in marketing discipline; Ngai and Chan (2005), Xiao-qing and Fang-fang (2010) and Grimaldi and Rippa (2011) in KM. AHP has been used in various contexts to select between alternatives (decision making) or ranking/prioritizing (Badurdeen *et al.*, 2011).

The purpose of this research is to refine current theory on the attributes of knowledge and to propose a process for competitive manufacturing priority development. Thus, we have composed a multi criteria decision-making model of KM attributes so as to find their contributions to attain customer focus through competitive priorities in manufacturing. To deal with this complexity of multi criteria decision-making process, AHP has been employed. Details of AHP methods are given in Section 3.2.

3.2 Using AHP to prioritize manufacturing capabilities

The AHP method comprises four phases; i.e. structuring the decision problem, data collection and measurement, determination of normalized weights and synthesis and finding solution to the problem (Tummala and Wan, 1994). Using this four-phase approach, we first formulate an AHP model for manufacturing capabilities and KM that could be easily applied by the manufacturing companies. Figure 1 presents AHP methodology employed in this research.

The objective of the research is to identify attributes of KM for large and small manufacturing companies in UAE and to propose a process for developing competitive manufacturing capability. Therefore, this research is crumbled into hierarchical process and AHP has been applied to investigate this complex hierarchical system. This classifies the goal and all decision criteria and variables into three major levels. The highest level of the hierarchy is the overall goal, i.e. to select the competitive dimensions of the large and small manufacturing companies in UAE. Level 2 represents the criteria and sub criteria used in selecting the KM tools. In this research four types of criteria (cost, quality, delivery and flexibility) have been selected and these are the basic criteria for measuring the competitive dimension of the organization (Hayes and Wheelwright, 1984). For the simplicity of analysis, no sub criteria have been selected. Level 3 contains the decision alternatives that affect the ultimate selection of

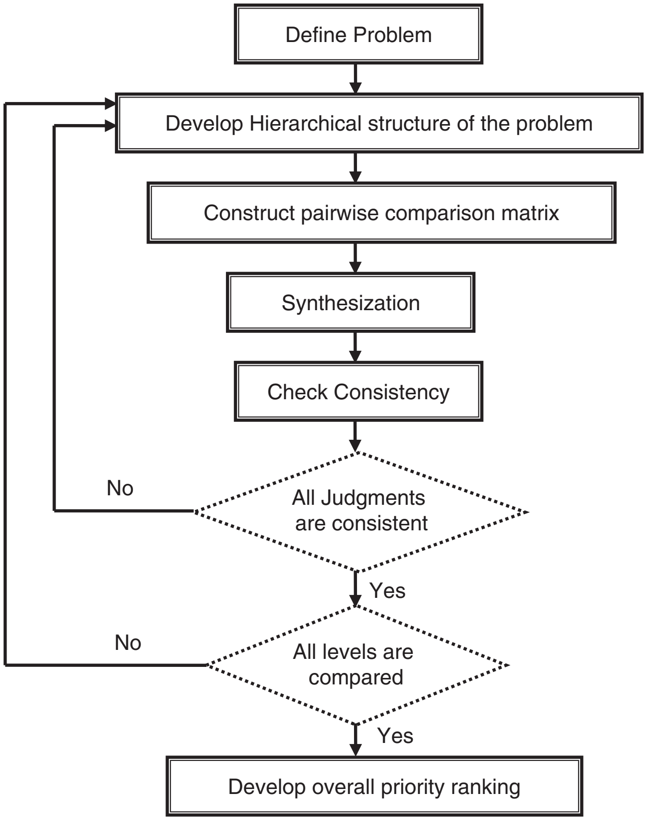

Figure 1.
Outline of AHP method applied

the KM tools. In this research three attributes of KM (know-how, know-why and know-what) have been chosen as a decision criteria. Figure 2 depicts the hierarchy of the AHP model for evaluating the KM tools.

After building the AHP hierarchy, the next phase is the measurement and data collection. Particulars of the manufacturing capabilities and knowledge attributes were collected from six metal (aluminum) manufacturing companies in UAE. Three of those were small and three were large manufacturing companies. The size of the companies was determined by the number of employees. As explained in Table II, small manufacturing companies had less than 50 employees and large ones had more than 250 employees. Sample was taken by using same criteria for instance, the similarity of the operations, industrial sectors and corporate cultures of the small and large companies.

As suggested by Saaty (1983), a questionnaire was designed on nine-point scale based on four aspects of manufacturing capabilities (i.e. flexibility, cost, quality and delivery) and subsequent three knowledge attributes (i.e. know-how, know-what and know-why). The questionnaire was pilot-tested using industry experts and academics, and some of the items had to be rephrased to make them more representative of the intended constructs. An evaluation team of five members; two of them were senior managers with more than ten years' experience and remaining three were middle managers/supervisor with more than five years' experience, were selected from each company. All evaluators belonged to manufacturing and operations department and had sufficient experience and knowledge about manufacturing capabilities and KM attributes applied in this research. Since the respondents are the key persons in the case companies so that we are confident about its validity. As suggested by Saaty (1990), the

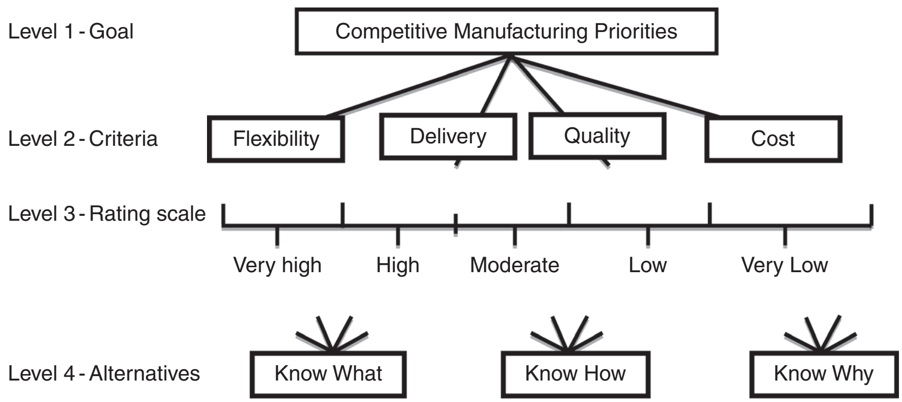

Figure 2. AHP model for manufacturing capabilities

Enterprise category	Annual work unit (AWU)	Annual turnover
Large	$\geqslant 250$	$\geqslant$ €50 million
Medium	< 250	$\leqslant$ €50 million
Small	< 50	$\leqslant$ €10 million

Source: The new SME definition: user guide and model declaration, European Commission

Table II. Company categorization

geometric mean approach, instead of the arithmetic approach, is used to combine the individual pair-wise comparison judgment matrices to obtain the consensus pair-wise comparison judgment matrices for the entire team.

Next step in AHP is to determine pair-wise comparison among the criteria applied. For determining pair-wise comparison criteria, Saaty (1983) has suggested a nine-point scale, as shown in Table III, for defining pair-wise comparison. For example, if a company identifies quality as moderately more important than cost, the former is rated "3" and the latter "1/3" in this comparison and so on.

To check the consistency, the Consistency Index (CI) is applied. Saaty (1983) defined consistency as follows:

$$CI = (\lambda_{\max} - n)/(n-1) \tag{1}$$

where, $\lambda_{\max}$ is the maximum eigenvalue of the matrix of the importance ratios and n is the number of factors. Then, the Consistency Ratio (CR) is used to assess whether a matrix is sufficiently consistent or not. This is the ratio of the CI to the Random Index (RI), which is the CI of a matrix of comparisons generated randomly:

$$CR = CI/RI \tag{2}$$

Random pair-wise comparisons have been simulated to produce average random indices for different sized matrices. The values of RI are given in Table IV. The inconsistency is acceptable if CR is smaller or equal to 0.10 (Saaty, 1983).

As suggested by Saaty (1990), the geometric mean approach, instead of the arithmetic approach, is used to combine the individual pair-wise comparison judgment matrices to obtain the consensus pair-wise comparison judgment matrices for all evaluators. Table V presents the geometric means of pair-wise comparison for large manufacturing companies. The next step is to define the relative priorities of criteria (the final column of Tables V and VI) by computing "Priority Vectors." Saaty (1990) introduced a "Consistency Principle" for calculating priority vectors. Consistency

Table III. 1 to 9 scale for AHP preferences

Intensity of importance	Definition	Explanation
1	Equal importance	Two criteria contribute equally to the objective
3	Moderate importance	Judgment slightly favor one over another
5	Strong importance	Judgment strongly favor one over another
7	Very strong importance	A criterion is strongly favored and its dominance is demonstrated in practice
9	Absolute importance	Importance of one over another affirmed on the highest possible order
2,4,6,8	Intermediate values	Used to represent compromise between the priorities listed above

Table IV. Random index

n	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.48

Note: n is number of factors

	Flexibility	Delivery	Quality	Cost	Priority weight
Competitive priority					
Flexibility	1.0	2.0	5.4	0.5	0.36
Delivery	0.5	1.0	3.0	4.0	0.31
Quality	0.2	0.3	1.0	2.5	0.14
Cost	2.0	0.2	0.4	1.0	0.19
				CR = 0.04 < 0.10 (acceptable)	
	Know-what	Know-how	Know-why	Priority weight	
Flexibility					
Know-what	1.0	5.2	0.5	0.36	
Know-how	0.2	1.0	0.2	0.09	
Know-why	2.0	5.0	1.0	0.45	
			CR = 0.03 < 0.10 (acceptable)		
Delivery					
Know-what	1.0	0.5	0.5	0.19	
Know-how	2.0	1.0	0.2	0.22	
Know-why	2.0	5.0	1.0	0.59	
			CR = 0.03 < 0.10 (acceptable)		
Quality					
Know-what	1.0	7.0	3.2	0.63	
Know-how	0.1	1.0	4.6	0.25	
Know-why	0.3	0.2	1.0	0.12	
			CR = 0.04 < 0.10 (acceptable)		
Cost					
Know-what	1.0	5.4	0.3	0.29	
Know-how	0.2	1.0	0.1	0.07	
Know-why	3.0	7.0	1.0	0.64	
			CR = 0.03 < 0.10 (acceptable)		

Table V. Geometric means of pair-wise comparison of all evaluators for large manufacturing companies with priority weights

principle says that $a_{ik} = a_{ij} \cdot a_{jk}$ and subsequent argument for using the special case of the consistency matrix formed by elements $a_{ik} = w_i/w_j$, where w_i and w_j are the elements of the priority weight vector corresponding to criteria i and j.

It is evident that flexibility has the highest weight (0.36) in large manufacturing companies. Delivery is the next competitive priority (0.31) and least important is the quality (0.14). In case of small manufacturing companies, as shown in Table VI, flexibility (priority weight of 0.39) is three times important to delivery (priority weight of 0.13). Table VI also shows that quality (priority weight of 0.280 is more important than cost (priority weight of 0.20). CR values of Tables V and VI show that results are consistent.

The last step is to synthesize the solution by evaluating the alternatives and calculating global weights for each alternative using pair-wise comparison. This time pair-wise comparison is conducted between each alternatives evaluated against each criteria. In this research, we have used four criteria (flexibility, cost, quality and delivery) and three alternatives (know-how, know-what and know-why). Table VII shows the derived priority for different alternatives along with their global weights for both large and small manufacturing companies. The priority weights in Tables V and VI are used to calculate global weights of alternatives. The corresponding criteria weights are multiplied to give global weight for each alternative, so that the weight of alternative is measured by its importance to its criteria weighted by the importance of

	Flexibility	Delivery	Quality	Cost	Priority weight
Competitive priority					
Flexibility	1.0	3.1	7.0	0.4	0.39
Delivery	0.3	1.0	0.5	2.2	0.13
Quality	0.1	2.0	1.0	6.5	0.28
Cost	5.0	0.4	0.1	1.0	0.20
				CR = 0.06 < 0.10 (acceptable)	
	Know-what	Know-how	Know-why	Priority weight	
Flexibility					
Know-what	1.0	0.5	0.1	0.14	
Know-how	2.0	1.0	5.2	0.54	
Know-why	7.0	0.2	1.0	0.32	
			CR = 0.05 < 0.10 (acceptable)		
Delivery					
Know-what	1.0	5.6	2.4	0.63	
Know-how	0.2	1.0	0.5	0.12	
Know-why	0.4	2.0	1.0	0.25	
			CR = 0.03 < 0.10 (acceptable)		
Quality					
Know-what	1.0	4.8	2.2	0.56	
Know-how	0.2	1.0	4.5	0.29	
Know-why	0.4	0.2	1.0	0.15	
			CR = 0.04 < 0.10 (acceptable)		
Cost					
Know-what	1.0	0.1	0.5	0.13	
Know-how	7.0	1.0	0.5	0.42	
Know-why	2.0	2.0	1.0	0.45	
			CR = 0.04 < 0.10 (acceptable)		

Table VI.
Geometric means of pair-wise comparison of all evaluators for small manufacturing companies with priority weights

Company		Competitive priority Flexibility	Delivery	Quality	Cost	Global weight	Rank
Large manufacturing companies	Local weight	0.36	0.31	0.14	0.19		
	Know-what	0.36	0.19	0.63	0.29	0.33	2
	Know-how	0.09	0.22	0.25	0.07	0.15	3
	Know-why	0.55	0.59	0.12	0.64	0.52	1
Small manufacturing companies	Local weight	0.39	0.13	0.28	0.20		
	Know-what	0.14	0.63	0.56	0.13	0.32	2
	Know-how	0.54	0.12	0.29	0.42	0.39	1
	Know-why	0.32	0.25	0.15	0.45	0.29	3

Table VII.
Overall weights of the alternatives for large and small manufacturing companies

parent criteria to the business strategy (Lee and Drake, 2010). The global weight is simply normalization of linear combination of multiplication between weight and priority vector. For example, global weight of criteria "know-what" for large manufacturing companies is 0.33 as shown in Table VII. This is attained by (0.36×0.36)+(0.31×0.19)

$+(0.14\times0.63)+(0.19\times0.29)=0.33$. Results of Table VII reveal that Know-why is most important KM attribute for large manufacturing companies with a global weight of 0.52, more than three times important as compared to know-how (0.15). As discussed earlier in Table I, "know-why" is the most complicated and sophisticated knowledge attribute. Therefore, large manufacturing companies should emphasize on "know-why." While, "know-what" has got moderate importance with global weight of 0.33. In case of small manufacturing companies, it has been found that "know-how" has got highest importance (0.39) and next is "know-what" (0.32). Know-why (0.29) is least important in small manufacturing companies

4. Discussion and conclusion

The contemporary aggressive manager has acknowledged for long, the role of KM in improving customer satisfaction and business growth (Anantatmula, 2007). This vital recognition has helped him identify the key attributes of KM. But, at the same time, there is a lack of research that highlights the role of KM attributes in fostering the competitive priorities of manufacturing firms, especially in growing economies such as UAE.

The paper is designed using an empirical study of large and small manufacturing companies in UAE. AHP has been used to select the competitive dimensions of these companies. Four operational competitive priorities (cost, quality, flexibility and delivery) have been used and these competitive priorities have been generally accepted in literature as an order winning criteria in the literature (e.g. Hayes and Wheelwright, 1984). Three attributes of KM (know-how, know-why and know-what) have been chosen as a decision criteria. A questionnaire was designed on a nine-point scale based on four aspects of manufacturing capabilities (i.e. flexibility, cost, quality and delivery) and subsequent three knowledge attributes (i.e. know-how, know-what and know-why). The questionnaire was pilot-tested using industry experts and academics, and some of the items had to be rephrased to make them more representative of the intended constructs. Primary data has been collected from six aluminum manufacturing, three large and three small, companies in UAE. To observe consistency, a sample was taken by using the same criteria (e.g. the similarity of the operations, industrial sectors and corporate cultures of companies). Also, a consistency test was performed to ensure the consistency of the pair-wise comparison. Secondary data are obtained from an extensive literature review of competitive dimensions of manufacturing and KM.

It is evident that flexibility has the highest priority weight (0.36) in large manufacturing companies. Flexibility is associated with how capable the firm is in changing its production volume and/or capacity and its capability in producing a wide range of customized products. Large manufacturing companies have shifted their competitive priority from cost and quality to innovation and offering new products and services. Underpinning this transformation has been the ability of companies to move quickly to respond to changing market circumstances and to seize new opportunities. This is only possible if companies have flexibility in their operations. This flexibility allows companies to adopt different production strategies, quickly rearrange their production lines, multi skilled labor and economies of scope in order to respond quickly to changing customer demands.

Delivery is the next competitive priority (0.31) and least important is the quality (0.14). Delivery performance as a competitive priority generally has two dimensions. The first is speed. Delivering products to customers quickly can offer a number of competitive advantages, and there are many firms for which delivery speed is crucial to success. Overnight delivery and fast food restaurants are two industries that are based on delivery speed. Increasingly, time is becoming important to customers and this verifies time compression paradigm and importance of lead time reduction (Hussain and Drake, 2011; Hussain *et al.*, 2012). The other dimension of delivery performance is delivery reliability, or the capability to deliver the product to the customer on time, when it is promised. On-time delivery is particularly important for firms operating in a just-in-time environment, where early delivery is often just as bad as late delivery.

In case of small manufacturing companies, as shown in Table VI, flexibility (priority weight of 0.39) is three times more important than delivery (priority weight of 0.13). Table VI also shows that quality (priority weight of 0.28) is more important than cost (priority weight of 0.20). CR values of Tables V and VI show that results are consistent. Finally, this research also found that the flexibility and cost are competitive priorities for both large and small manufacturing companies. This suggests that a manufacturing company (either size) would support agile manufacturing strategy by meeting lean (cost) and agility (flexibility) as competitive advantage over competitors (Drake *et al.*, 2013) (Figure 3).

Figure 3 shows that large manufacturing companies put higher weight on know-why in all competitive priorities as compared to small size companies. Know-why reflects the theoretical understanding of why the components of a particular product work together to allow a general purpose of a product, i.e. research carried out to modify a product design. This is in accordance with the above finding that large manufacturing companies in UAE are putting more weight on flexibility. Know-why underlies technological development and product and process advances in most industries. On the other hand, small size manufacturing companies put higher weight on know-how. Clearly, this implies that different organizations manage and apply different attributes of KM. However, to truly manage knowledge as a strategic asset, it is important to manage not just its constituents, but all three components as a system (Sapolsky, 2003). Above findings are based on data collected from Aluminum manufacturing companies in UAE.

Future research should focus on extracting more data from other manufacturing companies as well. Future work may also include sub criteria for measuring the four competitive priorities. Furthermore, extending this research to service industry is also important to find competitive service strategy.

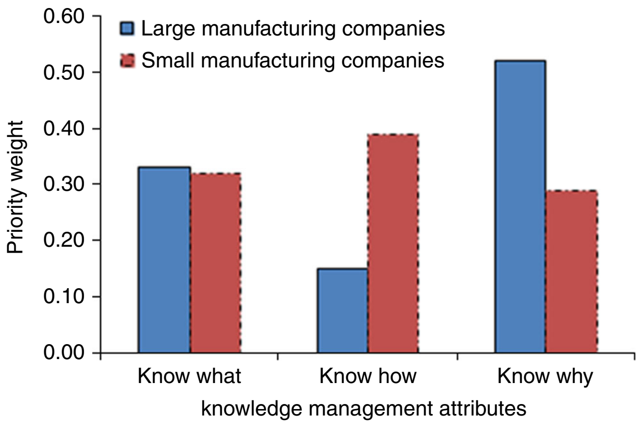

Figure 3.
Comparison of knowledge management attributes for large and small manufacturing companies

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