

Measuring Competitive Factors: A perspective of Spanish manufacturing firms

Adebayo Adiamo, A; De Castro Vila, R.¹; Gimenez Leal, G.

Abstract Most empirical studies have examined the relative importance of competitive priorities on manufacturing strategy. However, the present study identifies competitiveness factors and the relative importance to the manufacturing firms. The quest for this research work was based on the sample collected in 2006 and 2009 by European manufacturing survey (EMS) in Spain. Our simple statistical analysis reveals that, quality and price are the most influencing domains on competitive priorities in the two periods of survey. Nevertheless, the other factors show a pattern which invites to further research.

Keywords: Competitiveness, Spanish Survey, EMS, manufacturing strategy

Introduction

The importance of competitive factors cannot be overemphasis for any economy that wants to achieve world class manufacturing levels. Over the years, there has been a divergence view about what factors constitute competitiveness priorities and the discrepancy about which of the factors we have to consider. Competitive factors are the skills and capabilities that differentiate a firm from its competitors. As a prerequisite to any strategic planning, these competitive factors must first be identified and evaluated as to their relative importance to achieving a firm's strategic goals. Historically, Skinner (1966) identifies manufacturing top priorities and suggested that it would be difficult to focus on more than one competitive factor at a time in any particular firm or manufacturing facility. The notion

¹ Rudi de Castro Vila (✉)

Department d'Organització, Gestió Empresarial i Disseny de producte, Escola Politècnica Superior - UdG, Campus Montilivi 17071 Girona, Spain
e-mail: rudi.castro@udg.edu

about the concepts of competitive priorities can be traced to its evolutionary period, during 1960s and 70s the name competitive priorities has been perceived differently by different areas of competitive performance for improvement of U.S manufacturing sectors, the performance criteria identified by Skinner (1966) includes, introduction of new product, low production cost, quality improvement, price advantage, style, shorter lead time, trouble free product life, and customized products.

Similarly, In the 70s the criteria for measuring manufacturing performance was established, Skinner (1974) identified these criteria as short delivery cycles, dependable delivery promises, ability to produce new products, product flexibility, superior product quality, low investment with expectation of high return, and low cost. In a similar vein, and in the interest of better historical perspective, Wheelwright (1978), classify these criteria as efficiency, dependability, quality and flexibility.

We want to evaluate the competitive factor priorities in Spanish Manufacturing firms. For this purpose of analysis, we use the EMS survey in Spain of 2006 and 2009 editions. We focused on six competitive factors relating to manufacturing sectors: i.e. Product quality, Product price, Product delivery, Product customization, Product innovation and Product related service. This study is based on exploratory analysis and invite to further research. We compare the mean rank of every edition and we evaluate the changes that occur between the two periods of survey. We discard the relationship with performance indicators.

In order to discuss this issue, the article was structured as follows; firstly, we present the theoretical framework, secondly, the research methodology was discussed and finally, results and conclusions were presented.

Theoretical Framework

Understanding competitive factors priorities or manufacturing strategy depends on our perception about the concepts of these competitive factors and different authors have given different names to these concepts but there is a considerable common ground among these authors. Manufacturing competitive priorities may be defined as a consistent set of goals for manufacturing. The review of various works enables us to state the existence of four key manufacturing competitive priorities (or capabilities): cost or efficiency, flexibility, quality and delivery (Avella et al, 2001)

Some of the articles consulted stipulate that different production systems exhibited different operating characteristics; they further explained that some were good at low cost, some at high quality, some at faster response times, in designing a production system. There are different classifications though cost, quality and flexibility are in many of the found proposals.

There are many similar studies that have focused on evaluating the ranking of competitive priorities among manufacturing sectors. After an extensive literature review, we condensed many of them in the Table 1 and we did the ranking of these priorities we found in scientific journals.

Koste and Malhotra (2000) found that there is a great disparity between America and Japanese producers with respect to product flexibility; In addition, they illustrate the notion that flexibility is a dynamic capability. That is, while American companies were seeking to improve performance on the elements of new product flexibility, and thereby reduce the gaps, Japanese companies were seeking to achieve greater differentiation.

In our contribution, we discard comparisons between countries and we centred our study in Spanish firms and we fixed the competitive factors we want categorised in order to determine the priorities.

Ranking competitive factors is not an easy decision because there are many different criteria for good partner (Liu and Hai, 2005). Furthermore, strategy integration moderates the influences of product-process development, supplier relationship management, workforce development, just-in-time flow, and process quality management practices on certain manufacturing competitive factors priorities. So it is a subject which implies many decisions along the firm. In turn, manufacturing cost efficiency and new product flexibility capabilities mediate the influence of strategy integration on market-based performance. According to Swink et al (2005) in any sense these priorities will lead to better performance in firm results. However, in this contribution, we are not yet focusing on performance. These findings have implications for practice and for future research.

In the work of Bititci et al (2001) explained that, it is possible to change the priorities of some performance measures in order to achieve operational efficiency; we deduce from his findings that, the performance of mass customizer strategy is better than the performance innovator strategy. The changes of performance measures can be in the form of deleting, adding, or replacing some performance measures or just changing the priority of some of them. For example performance measure which was classified as high priority may move to other classes because of changes in the internal or external environments of the business.

The notion that, the relationship between competitive factors and business performance can be established has been the focus of many researchers. Operational measures of key decision variables such as competitive priorities are useful to both decision makers and researchers (Ward et al, 1998).

Lau (2002), in his study of 382 US computer and electronics firms, show that higher product quality and lower production cost are the most important competitive factors. However, the correlations of those two competitive factors on sales growth and profitability performance measures were not statistically significant. It further explained that, achieving high quality or low cost alone is not enough to improve or sustain a firm's competitive position and there is need to explore the emerging role of innovation and advanced manufacturing technology for achieving sustainable competitive advantage. Improve quality can reduce manufacturing

lead time, reduce amount of time spent on rework, the quantity of materials rejected and thus contribute to improvements in flexibility, delivery times, and unit cost efficiencies (Amoako-Gyampah and Acquah, 2008). However, other authors point out that delivery, flexibility and innovation are keys to superior firm performance (Vickery et al, 1997), or that quality management process focus practices and JIT practices was simultaneously related to competitive performance, in terms of cost, quality, dependability and flexibility (Flynn et al, 2004), or Rosenzweig and Roth (2004) identify, as many of consulted sources, four more extended criteria of manufacturing strategy as cost, quality, delivery and flexibility.

Table 1 Competitiveness priorities and manufacturing performance from the literature.

Authors & year	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Performance Focus
Vickery et al. (1997)	Delivery	Value (quality cost)	Flexibility	Innovation	N/A	N/A	Innovation as a key order winner
Butler and Leong (2000)	Quality	Cost	Flexibility	Delivery	N/A	N/A	Financial & operational performance
Bititci et al. (2001)	Cost	Quality	delivery	Flexibility	N/A	N/A	Innovation & mass customization
Najmi and Kehoe (2001)	Quality	Time	Cost	Flexibility	N/A	N/A	Capability & time performance
Gordon and Sohal (2001)	Quality	Cost	Delivery	R&D	N/A	N/A	Distinguish, most successful from least successful plant
Lau (2002)	Quality	Cost	Delivery	Customization	Innovation	N/A	Sales growth & profitability
Dangayach and Deshmukh (2006)	Quality	Delivery	Flexibility	Innovation	Cost	N/A	Profit, export & market share
Phusavat and Kanchana, (2007)	Quality	Customer focus (customization)	Deliver	Flexibility	Innovation	Cost	Internal & external idea of product & process improvement.
Amoako-Gyampah and Acquah (2008)	Delivery	Flexibility	Cost	Quality	N/A	N/A	Sales growth & market share
Yang et al (2010)	Cost	Quality	Delivery		N/A	N/A	

When the limit is extended to performance, a new group of articles we have to work with. Some researchers believed that, it is possible to explore the relationship of competitive priority and manufacturing performance. Others stipulate that a key to success and profitability of a firm depends on its ability to introduce in-

novative and quality products ahead of competitors. However, the consequence of this assertion is that, profitability of any manufacturing firm is a function of the following: sophisticated needs and demand, sale at low price with high quality, availability of advance technology with greater flexibility, and exact delivery with good after sales service. Similarly, recent research reflects the importance attached to the selection of best performance of manufacturing priorities. Cua et al (2001) suggested that, plant management should take into account the possible effects of contextual factors on performance. Therefore, it is important to explore the relationship of competitive priority and manufacturing performance.

The review of much literature indicates that there is a divergence view in the ranking, as shown in table 1 above. Similarly, what is considered excellent performance in one industry may be considered poor or middling performance in another industry, but there is little agreement as to which measure is better (Allen and Helms, 2006).

Methodology

Empirical evidence for the present study came from the Spanish sub-sample of the EMS, which is briefly described here. The EMS, coordinated by the Fraunhofer Institute for Systems and Innovation Research (ISI) in Karlsruhe, Germany collected detailed information on manufacturing firms. The topics covered by the survey can be summarized under seven main headings, namely, competitiveness, production technologies, organizational concepts, product related services, cooperation, off-shoring, and firm and sector characteristics (Llach et al, 2010).

The EMS tries to contribute to the standardization of use of information on organizational and technological topics. In recent years, different surveys have been launched with the aim of measuring the use of new technological and organizational approaches. The great disparity of methodologies used previously resulted in a low degree of comparability among the data collected. EMS is not intended to be a “new” or “better” monitoring system. Rather, it proposes a complex methodology as a first step toward a common method for collecting technological and organizational information. However, these are general features of the EMS “philosophy”.

To accurately identify the various competitive factors in the manufacturing firms, first-hand data were collected from manufacturing managers through EMS survey. In the survey, manufacturing executives were asked to rate the importance of each competitive factor with a six-point scale of 1 (extremely important) to 6 (least important).

The collected data was 151 answers in 2006 (5 missing values) and 117 answers in 2009 (9 missing values). The low rate of responses is a point to consider in conclusions even though the simple methodology we apply (mean value) is enough to take suggested trends.

The main objective is classifying the current competitive factors calculating the mean of the answers looking for the relative importance of competitive factors. The results have sense for every edition in order to rank the competitive factors. But these mean results do not allow concluding comparisons between years, so to compare we use the ranking of competitive factors. This comparison method was used in some available contributions (Lau, 2002).

Results

The results are shown in Table 2. It contains a list of competitive factors that are arranged according to their relative importance ratings as evidenced by their mean values of total sample. The corresponding mean values and ranks for the firms and the two editions (2006 and 2009) are also presented for comparison.

Table 2 Ranking of competitiveness factors depending on answers in EMS survey

Competitive Factor	2006	Ranking	2009	Ranking	Observation
Product quality	2,28	1	3,22	2	These two factors are in the top for the 2 editions
Product Price	3,27	2	2,36	1	
Time Delivery	3,43	3	3,54	3	This factor remains in the same rank
Service	3,76	4	3,92	5	These three factor are in low-est rank, but in different order
Product Innovation	4,06	5	4,33	6	
Customization	4,17	6	3,61	4	

The results are just according to answers of responses. After these results we have to consider the competitive factors edition by edition. The three top factors in both editions are more related to product oriented than customer oriented. This two groups of factors are developed in conclusions although it is difficult to validate because is not statistically support enough.

Conclusions and Further Research

The primary aim of this study was to present empirical results about the relative importance of competitive factors. The EMS data was drawn from two periods of surveys 2006 and 2009. However, 151 respondents were recorded in 2006 as against 117 respondents in 2009 respectively. The competitive factors we have analysed include Product price, Product quality, Product innovation, Customization, Time delivery and Service. All of them are based on literature review we carried out and presented in first section.

To demonstrate the empirical results of this study, two distinct approaches were enacted. Firstly, we categorise the relative importance of each factor by calculating the mean value. We compare the mean of 2006 survey and 2009 survey independently in order to rank the relative importance of each survey. Secondly, based on the combined sample, we could distinguish two types of competitive factors. Three of them (Product price, Product quality and Time delivery) are in top positions, so they are said to be the most important factors Spanish manufacturers chose for improving competitive position. The other three factors (Product innovation, Customization and Service) are in different relative ranking in order to satisfy customers and get ahead of competitors.

The possible conclusions of these results are two folded: 1) there are three competitive factors (price, quality, delivery) which remain on top in the two editions and the only difference is the change in the top position. These factors are the classical we found in literature and many of the models and articles we have been working. 2) Although changes of ranking of the second group of competitive factors needs further research to be justified, there is something to highlight in this second group.

If we consider the two studied periods as (2006 edition) before world crisis and (2009 edition) after world crisis peak, we can speculate in saying that service and innovation goes down and customization arise 2 ranks. One justification could be that before crisis, customization was not so important because the firm were not as customer oriented as we assumed. However, after the evolution (or revolution) due to crisis effect, the customer appears again in manufacturing strategy. We assume this conclusion is weak because is not statistically supported, but it is a conclusion to highlight. More research is required because the limited impact of innovation as a competitive factor is difficult to explain when innovation was one the most used word related to added value or ways to cut down the impact of world crisis.

Moreover, the relation between competitive factors and performance it is a field we can explode with the results of EMS survey in 2006 and 2009 editions and we are working in future research in longitudinal studies related to topic of competitive factors. In this sense there is plenty of literature we just pointed out and we have to work with.

Finally we want to propose this study with the European partners of EMS and there is another branch to develop comparison studies between countries. After preliminary results, the competitive factors behaviour is quite similar, so this would confirm the idea of a manufacturing strategy pattern.

References

- Allen R.S. and Helms M.M., (2006). Linking strategic practices and organizational performance to Porter's generic strategies. *Business Process Management Journal*, 12 (4):433 – 454

- Amoako-Gyampah K. and Acquah M. (2008) Manufacturing strategy, competitive strategy and firm performance: An empirical study in a developing economy environment. *International Journal of Production Economics* 111: 575–592
- Avella L., Fernandez E. and Vazquez C.J. (2001). Analysis of manufacturing strategy as an explanatory factor of competitiveness in the large Spanish industrial firm. *International Journal of Production Economics*, 72 (2): 139-157
- Bititci U.S., Suwignjo P. and Carrie A.S. (2001) Strategy management through quantitative modelling of performance measurement systems. *International Journal of Production Economics*, 69 (1):15-22.
- Butler T.W. and G. Keong Leong G.K. (2000) The impact of operations competitive priorities on hospital performance Health Care. *Management Science*, 3 (3): 227-235
- Cua, K.O., McKone K.E., Schroeder R.G. (2001) Relationships between implementation of TQM, JIT, and TPM and manufacturing performance. *Journal of Operations Management*, 19 (6): 675-694
- Dangayach, G.S. and Deshmukh S.G. (2006) An exploratory study of manufacturing strategy practices of machinery manufacturing companies in India. *International journal of management science*, Omega 34: 254 – 273.
- Flynn B.B. and Flynn E.J. (2004) An exploratory study of the nature of cumulative capabilities. *Journal of Operations Management* 22: 439–457
- Gordon J. and Sohal A.S. (2001) Assessing manufacturing plant Competitiveness: An empirical field study. *International Journal of Operations & Production Management*, Vol. 21 No. 1/2:233-253.
- Koste L.L. and Malhotra M-K. (2000) Trade-offs among the elements of flexibility: a comparison from the automotive industry. *International Journal of Management Science: Omega* 28:693 -710
- Lau R.S.M. (2002) Competitive factors and their relative importance in the US electronics and computer industries. *International Journal of Operations & Production Management*, Vol. 22 (1):125 – 135
- Liu F.H.F. and Hai H.L.(2005) The voting analytic hierarchy process method for Selecting supplier *International Journal Production Economics*, 97: 308-317
- Llach Pagès, J., Bikfalvi, A., De Castro Vila, R. (2010). The use and impact of technology in factory environments: Evidence from a survey of manufacturing industry in Spain *International Journal of Advanced Manufacturing Technology* 47 (1-4):181-190
- Najmi M. and Kehoe D.F. (2001) The role of performance measurement systems in promoting quality development beyond ISO 9000. *International Journal of Operations & Production Management*, Vol. 21 (1/2): 159 - 172
- Phusavat K. and Kanchana R. (2007) Competitive priorities of manufacturing firms in Thailand: *Industrial Management & Data Systems*. Vol. 107 (7):979-996
- Rosenzweig, E. D. and Roth, A. V. (2004). Towards a Theory of Competitive Progression: Evidence from High-Tech Manufacturing. *Production and Operations Management*, 13: 354–368
- Skinner, W., (1966) Production under pressure. *Harvard Business Review*, 139-146.
- Skinner, W., (1974) The focused factory. *Harvard Business Review*, 113-121.
- Swink M., Narasimhan R. and Kim S.W. (2005) Manufacturing Practices and Strategy Integration: Effects on Flexibility and Market-Based Performance, *Decision Sciences* Volume 36 (3)
- Vickery S.K., Droge C. and Markland R.E (1997) Dimensions of manufacturing strength in the furniture industry. *Journal of Operations Management* 15: 317-330
- Ward P.T., McCreery J.K., Ritzman L.P. and Sharma D. (1998) Competitive Priorities in Operations Management. *Decision Sciences*, 29 (4): 456-478
- Wheelwright, S.C., (1978) Reflecting corporate strategy in manufacturing decisions. *Business Horizons*, 57-66.
- Yang Ch.L., Lin S.H., Chan Y.H. and Chwen-Sheu (2010). Mediated effect of environmental management on manufacturing competitiveness: An empirical study: *International Journal of Production Economics* 123: 210–220