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Evaluation and development of operational competitiveness potentials in global context

Introduction

From an economic perspective, the future has never seemed clear, but high performance businesses have the ability to navigate through uncertainty and emerge ever stronger. How do they do it? The experience and research with the world's most successful companies show that winners follow certain common principles. Companies that come through the strongest actually use economic disruption to improve their competitiveness. To find out how to make it possible, this study develop a series of unique analytical models to evaluate the case companies in Finland and compare them with case companies in other countries e.g. China, Slovakia, Spain and Iceland to evaluate the operational competitiveness in global context and conclude the experience of developing competitiveness potentials. We promote a novel concept of overall competitiveness to evaluate performance of companies in global context by integrating the evaluation of manufacturing strategy and transformational leadership with technology level using analytical models created in this paper, and then use Sense & Respond methodology to improve and develop the competitiveness through optimizing resource allocations.

The theoretical reference framework of this study starts from resource-based view of a firm for case study [Wernerfelt 1984]. Takala et al. [2002] have presented justification of multi-focused manufacturing strategies. Miles and Snow [1978] have defined four company groups which include prospector, analyzer, defender and reactor. According to Miles and Snow [1978], on the contrary to the three groups which are prospector, analyzer and defender, reactor does not lead to a consistent and stable organisation and therefore it is advised to change over to one of the other three groups. Based on this theory, Takala et al. [2007] have introduced unique analytical model to evaluate global competitiveness rankings for manufacturing strategies in prospector, analyzer and defender groups according to the company's multi-criteria priority weights of Q (Quality), C (Cost), T (Time) and F (Flexibility). Such analytical models are used to gain insight into the influences and sensitivities of various parameters and processes on the alteration

of manufacturing strategies by Takala et al. [2007]. In China, the most dynamic market, Liu et al. [2008] has first time applied such analytical models to analyze and improve operational competitiveness of one private middle-size Chinese manufacturing company by adjusting competitive priorities in manufacturing strategy. Liu, Si and Takala [2009] has compared the operational competitiveness strategies in China and other countries in a global context by utilizing same analytical models, in order to analyze different characteristics of manufacturing strategies in different markets and suggest how the companies can improve their operational competitiveness. But the adjustment of manufacturing strategy alone is not just enough to improve the overall competitiveness to develop the business. This is one important factor and there is another important and necessary factor to improve the overall competitiveness no matter in adversity or in prosperity, which can be even more decisive and that is leadership [Bass 1985]. Bass and Avolio [1994] provided evidence on the benefits and effectiveness of transformational leadership on leadership and training of leaders. Transformational leaders help their subordinates to learn and develop as individuals, by encouraging and motivating them with versatile repertoire of behavioural and decision making capability [Bass and Avolio 1994; Bass 1997]. Takala et al. [2008a] introduced another unique analytical model to evaluate the level of outcome direction, leadership behaviour and resource allocation of transformational leadership. In this paper transformational leadership is further extended by adding technology level as part of resource allocation. The final idea in this paper is to create a new analytical model to integrate manufacturing strategy and transformational leadership including technology level together for more comprehensive evaluation of overall competitiveness to develop the business operations further. The empirical studies are done in China, Finland, Slovakia, Iceland, and Spain with deeper insight analysis of overall competitiveness of case companies and suggest how to improve the overall competitiveness. The benchmarking and development of overall competitiveness of case companies in global context emphasize more on the adjustment of manufacturing strategy and transformational leadership through S&R to improve overall competitiveness in regional and global market.

Research methodologies

Analytic Hierarchy Process (AHP) method

Analytic Hierarchy Process (AHP) method [Saaty 1980] is a multi-attribute decision instrument that allows considering quantitative, qualitative measures and making trade-offs. The AHP is used in this study to deal with the empirical part,

which includes analyzing questionnaires and calculating weights of main criteria and sub-criteria. AHP is aimed at integrating different measures into single overall score for ranking decision alternatives with pair wise comparison of chosen attributes [Rangone 1996]. This utilizes pair wise comparison by interviewing the experts within the whole organization. The AHP based instruments (forms and questionnaires) have been used in our case studies for more than 20 years in successful analysis of case companies and proved to be reliable. Further more, some open questions are used in addition to the pair wise comparisons in the AHP questionnaires to add internal validity to the answers. The inconsistency ratio (icr) has been calculated to assure the reliability of pair wise comparison results. Only matrixes with inconsistency value of 0.10 or less, and 0.30 or less in smaller groups with competent informants, can be used for reliable decision-making. Otherwise the answers are considered as invalid and will not be used in the case study.

The procedures of utilizing the AHP are as follows in this paper. The first step is to establish the model of hierarchy structure for the goal. In this study, the hierarchy models are constructed for the evaluation of manufacturing strategy by Takala et al. [2002] and transformational leadership by Takala et al. [2005], which servers as theoretical framework of this study. The second step is the comparison of the alternatives and the criteria. They are pair wise compared with respect to each element of the next higher level. The last step is connecting the comparisons so that to get the priorities of the alternatives with respect to each criteria and the weights of each criteria with respect to the goal. The local priorities are then multiplied by the weights of the respective criterion. The results are summed up to get the overall priority of each alternative.

Data collection and analysis

The data of case companies in different countries has been collected in the same manner, by asking senior managers or directors to answer the questionnaires from different organizations and departments. The interviewees are normally decision makers and middle management groups in the case companies, who have good knowledge about the operations of the case companies, and the number of informants is depended on the size of case company. From same case company the inconsistent results are left out. Firstly, the senior managers or directors were trained to understand every criteria of the questionnaire by email, telephone or interview. Secondly, after they finished the questionnaires, the answers were analyzed by AHP software. Thirdly, the discussion with managers or directors revealed the results and verified the reliabilities of the data further.

For studying the manufacturing strategy, competitiveness priorities are listed in the AHP questionnaires as main criteria consisting of quality, cost, delivery,

and flexibility. The main criteria are typical items used in evaluating the competitiveness priorities in multi-focused manufacturing strategies [Takala et al. 2002]. They are formed based on typical case studies and instruments used in interviews. The sub-criteria involve 19 criterions, such as low defect rate, low cost, fast delivery, broad product line, etc. The weights are statistically measured for further analysis with analytical model [Takala et al. 2007].

For studying the transformational leadership, leadership profiles are empirically measured with the theoretical frame of reference by AHP questionnaires [Takala et al. 2005]. Statistical tests are made to find out the logic in the leadership profiles to increase the accuracy in the profiles, and in parallel by induction analytical model is built and tested statistically to measure leadership skills by leadership indexes from resource utilizations to leadership behaviours and finally to outcome directions and outcomes. Analytical model is further used to measure the effectiveness of leadership actions within different areas of outcomes and try to find out the correlation between these outcomes and leadership indexes in a forecasting way [Takala et al. 2008b].

Case studies

The research is based on doing numerous case studies of companies from different countries to analyze with existing analytical models and to create new analytical models for further evaluation, therefore the selection of case companies must be mostly representative, well performed and highly experienced in managing dynamic business situations based on wide variation of industries and good performance in exercising of strategy and leadership. We have chosen case companies from China, the most dynamic market, for benchmarking, and for side by side comparisons in performance of competitiveness development, we have chosen several large and median-sized manufacturing case companies in similar industries from Finland which is known for its highly competitive technologies, from Slovakia which is manufacturing base for many European and multinational companies, from Spain which is another major European manufacturing centre, and from Iceland which is badly hit by the economic crisis.

Evaluation and development of competitiveness

Evaluation of manufacturing strategy

The analytical models for manufacturing strategy are used to calculate the operational competitiveness indexes of companies in the different groups, which

are prospector, analyzer and defender. According to Takala [2002], the responsiveness, agility and leanness (RAL) holistic model supports the theory of the analytical models using four main criteria, i.e. quality, cost, time and flexibility. The analytical models are developed from our research group based on over 100 case company studies in over 10 countries worldwide, whose industrial branch varies from one to another and company size varies from big to small but they share one thing in common which is that they all compete in a highly dynamic business environment and therefore such analytical model has good transferability.

The Manufacturing Strategy Index (MSI) is modelled as function $f_{MSI}(Q, C, T, F)$. In the analytical models [Takala et al. 2007], the equations to calculate weights of core factors and the analytical models to calculate the operational competitiveness rankings in each group are given.

$$Q\% = \frac{Q}{Q+C+T} \quad (1)$$

$$C\% = \frac{C}{Q+C+T} \quad (2)$$

$$T\% = \frac{T}{Q+C+T} \quad (3)$$

$$F\% = \frac{F}{Q+C+T+F} \quad (4)$$

The analytical model for prospector group:

$$\phi \sim 1 - (1 - Q\%^{1/3})(1 - 0.9 \cdot T\%)(1 - 0.9 \cdot C\%) \cdot F\%^{1/3} \quad (5)$$

The analytical model for analyzer group:

$$\lambda \sim 1 - (1 - F\%) \left(ABS \left(\frac{(0.95 \cdot Q\% - 0.285) \cdot (0.95 \cdot T\% - 0.285)}{(0.95 \cdot C\% - 0.285)} \right) \right)^{1/3} \quad (6)$$

The analytical model for defender group:

$$\varphi \sim 1 - (1 - C\%^{1/3})(1 - 0.9 \cdot T\%)(1 - 0.9 \cdot Q\%) \cdot F\%^{1/3} \quad (7)$$

Evaluation of transformational leadership

Takala et al. [2008a] have developed analytical models for the evaluations of leadership indexes and its outcomes of different parts of leadership. These models are outcome direction index (*OI*) by balancing the directions, leadership behaviour index (*LI*) by measuring deep leadership, and by measuring maximum of passive and/or controlling leadership and by measuring in different ways the utilization of the cornerstones of deep leadership, and resource allocation index (*RI*) by balancing utilization of human resources. In this paper we propose that technology level index (*TI*) to be considered into transformational leadership as a special part of resources of leadership. Therefore the new proposal is to model Total Leadership Index (*TLI*) as function $f_{TLI}(OI, LI, RI, TI)$.

The theoretical frame of the analytical models is based on theory of Transformational Leadership [Bass 1997]. A holistic but very simple model of a human being from resource allocations to behaviour and finally to outcome directions and outcomes has been built basing on psychic, social, functional, organizational and structural factors and put together according to the sand cone model [Takala et al. 2005] and participation objectives in leadership of an organization. The analytical models for evaluation of leadership are as follow.

$$\text{Outcome Index: } OI = f_{OI}(EF, SA, EE)$$

$$\text{Leadership Index: } LI = f_{LI}(DL, PL, CL, IC, IM, IS, BT)$$

$$\text{Resource Index: } RI = f_{RI}(PT, PC, IT, OR, TI)$$

$$\text{Technology Index: } TI = f_{TI}(SH, CR, BS)$$

Outcome index (*OI*):

$$\text{Without classification: } 1 - \max \left\{ \left| \frac{1}{3} - EF \right|, \left| \frac{1}{3} - SA \right|, \left| \frac{1}{3} - EE \right| \right\} \quad (8)$$

$$\text{Prospector: } 1 - (1 - EE^{1/3}) \cdot (1 - EF) \cdot (1 - SA) \cdot Std\{EE, SA, EF\}^{1/3} \quad (9)$$

$$\text{Analyzer: } 1 - (1 - SA^{1/3}) \cdot (1 - Std\{EE, SA, EF\}^{1/3}) \quad (10)$$

$$\text{Defender: } 1 - (1 - EF^{1/3}) \cdot (1 - EE) \cdot (1 - SA) \cdot Std\{EE, SA, EF\}^{1/3} \quad (11)$$

EF = Effectiveness

SA = Satisfaction

EE = Extra effort

Leadership index (LI):

$$DL \cdot (1 - \max\{PL, CL\}) \cdot \left(1 - \left|\frac{1}{4} - \max\{IC, IM, IS, BT\}\right|\right) \quad (12)$$

DL = deep leadership

PL = passive leadership

CL = controlling leadership

IC = individualized consideration

IM = inspirational motivation

IS = intellectual stimulation

BT = building trust and confidence

Resource index (*RI*) integrating with Technology index (*TI*):

$$(1 - PT \cdot (1 - TI)) \cdot (3 \cdot \min\{PC, IT, OR\} \cdot TI) \quad (13)$$

PT = people, technology, know how

PC = processes

IT = information systems

OR = organization (groups, teams)

$$TI = 1 - \max\left\{\left|SH_{optimal} - SH\right|, \left|CR_{optimal} - CR\right|, \left|BS_{optimal} - BS\right|\right\} \quad (14)$$

SH = Spearhead, *CR* = Core, *BS* = Basic

Combined total leadership index (*TLI*):

$$TLI = OI \cdot LI \cdot RI \quad (15)$$

Analysis to critical factors through S&R

Figure 1 shows analysis to critical factors through S&R for the case company FI_SW, from which the decision can be made to adjust manufacturing strategy and transformational leadership by optimizing the resource allocations, so that the multi-focus priorities i.e. quality to be slightly decreased by 5%, delivery to be increased a lot by 40%, cost to be slightly increased by 5%, flexibility to be decreased by 10%, and resource index to be much increased by 20%. The effects of such adjustments are compared in Table 1.

Figure 2 shows the MSI vs TLI before S&R adjustments. It can be seen that R^2 in prospector and defender groups are very high, and the competitive group for FI_SW is analyzer.

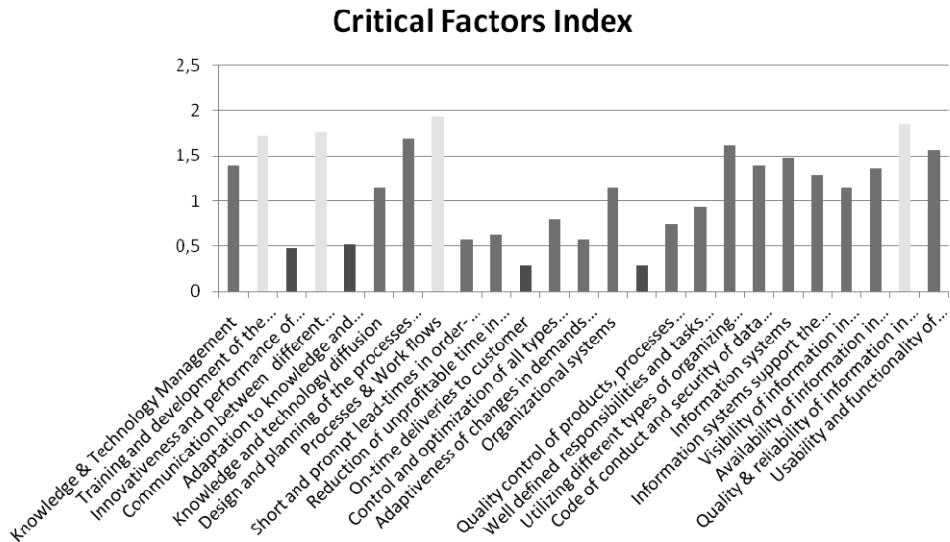


Figure 1
Analysis to critical factors through S&R

Table 1
Competitiveness indexes compared before and after S&R

	Before S&R adjustments			After S&R adjustments			Results of adjustments
MSI (Prospector)	0.9588	0.9185	0.9489	0.9582	0.9244	0.9487	nearly same
MSI (Analyzer)	0.9514	0.9024	0.8641	0.8969	0.8912	0.8890	worse
MSI (Defender)	0.9434	0.8877	0.9503	0.9455	0.9008	0.9519	slightly better
TLI	0.0548	0.1146	0.0370	0.0658	0.1375	0.0444	much better
MSI vs TLI (Prospector)	$y = -0.4635x + 0.9739$ $R^2 = 0.8039$			$y = -0.3143x + 0.9697$ $R^2 = 0.7723$			better
MSI vs TLI (Analyzer)	$y = 0.1609x + 0.8949$ $R^2 = 0.0223$			$y = -0.0026x + 0.8926$ $R^2 = 0.0010$			worse
MSI vs TLI (Defender)	$y = -0.8388x + 0.9848$ $R^2 = 0.9856$			$y = -0.5678x + 0.9796$ $R^2 = 0.9888$			better

Figure 3 shows the MSI vs TLI after S&R adjustments. It can be seen that the new competitive group for FI_SW should be prospector, and analyzer is no longer suitable with dramatic increase in delivery and decrease in flexibility. Under new business situation, prospector is more profitable for FI_SW based on the S&R measurements.

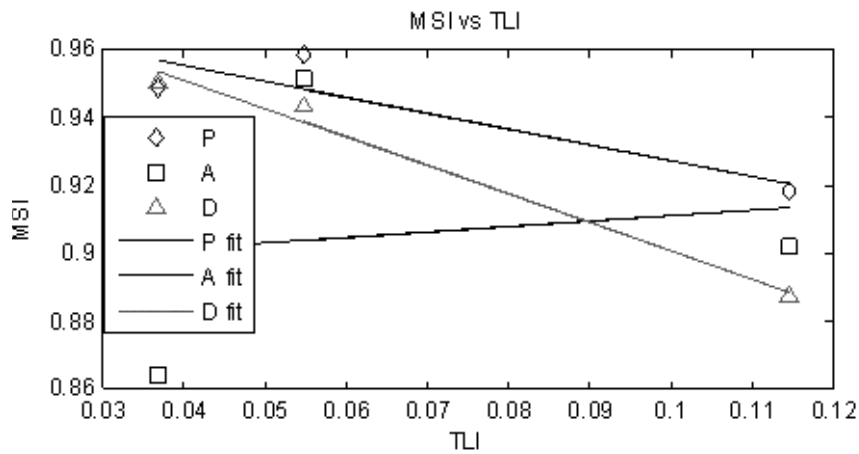


Figure 2
MSI vs TLI before S&R adjustments

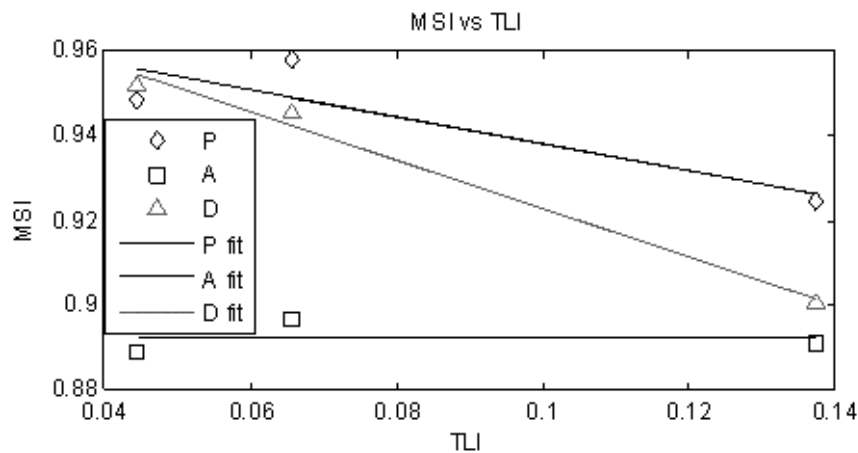


Figure 3
MSI vs TLI after S&R adjustments

Figure 4 shows FI_SW improved OCI potential (light brown region) compared to its previous (black region) and other cases improved in Finland.

Figure 5 shows FI_SW improved OCI potential (light brown region) compared to its previous (black region) and other cases improved in global context with benchmarking to cases in China, Slovakia, Spain and Iceland.

It can be seen that S&R is a very effective way to make optimizations and strategic adjustments for case FI_SW and significantly improves its operational competitiveness potential.

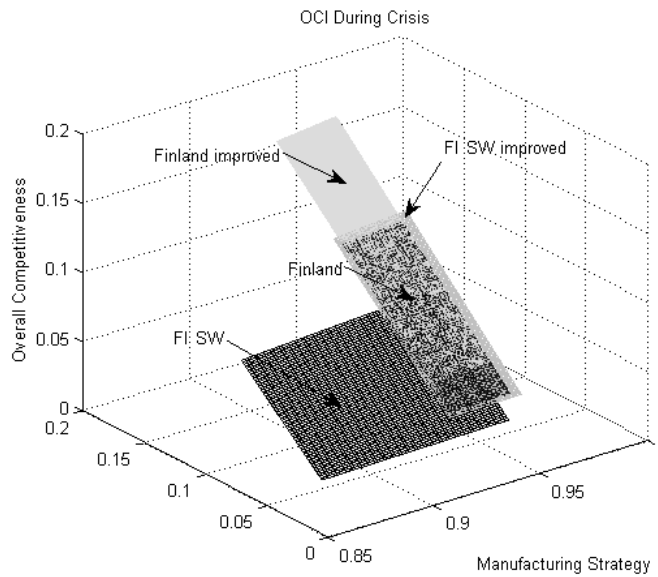


Figure 4
 FI_SW improved OCI potential (light brown region) compared to its previous (black region) and other cases improved in Finland

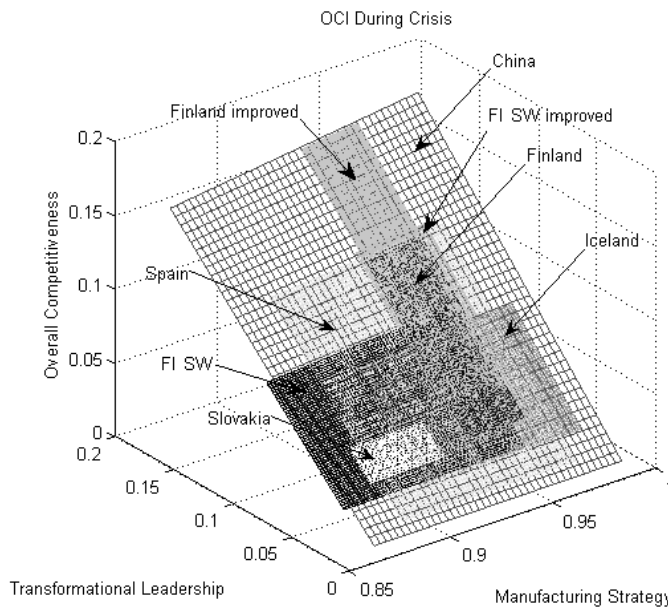


Figure 5
 FI_SW improved OCI potential (light brown region) compared to its previous (black region) and other cases improved in global context

Conclusion

In this paper, a novel concept to evaluate and develop overall competitiveness potentials for dealing with dynamic business situations has been proposed by integrating manufacturing strategy and transformational leadership with technology level together and through S&R for dynamic decision making to optimize resource allocations and adjust strategies in order to develop operational competitiveness potentials in a sustainable manner. The empirical studies are focused to studying manufacturing companies in Finland and benchmarking with cases in China, Slovakia, Spain and Iceland. The case companies are evaluated with the proposed analytical models and their performances are compared in global context to conclude the development of operational competitiveness potentials.

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Ocena i rozwój potencjałów konkurencyjności operacyjnej w kontekście globalnym

Streszczenie

Celem artykułu jest połączenie dotychczasowych badań nad analizą konkurencyjności globalnej, z uwzględnieniem wpływu światowego kryzysu finansowego, oraz ustalenie jak przedsiębiorstwa produkcyjne mogą zarządzać kryzysem modyfikując własne strategii produkcyjne oraz przywództwo transformacyjne wraz z poziomem technologii dla poprawy swojej globalnej konkurencyjności operacyjnej oraz przez zastosowanie metodologii dynamicznego podejmowania decyzji Sense&Respond (S&R) dla optymalizacji rozmieszczenia zasobów oraz modyfikacji strategii na potrzeby rozwoju potencjałów konkurencyjności operacyjnej w sposób trwały. Na podstawie wcześniejszych badań przekształcono teoretyczne podejście do modelowania podstawowych czynników, mających wpływ na kształtowanie konkurencyjności operacyjnej, na przykład strategii produkcyjnych oraz przywództwa transformacyjnego wraz z poziomem technologii, na koncepcyjne modele analityczne dla oceny ogólnej konkurencyjności. Badania empiryczne koncentrują się na porównaniu przedsiębiorstw produkcyjnych w Finlandii ze wzorcami w Chinach, Słowacji, Islandii oraz Hiszpanii. Badane przedsiębiorstwa oceniono przy pomocy zaproponowanych modeli analitycznych, a ich wyniki porównano w kontekście globalnym w celu sformułowania wniosku o rozwoju potencjałów konkurencyjności operacyjnej.