Operational Competitiveness Development and Its Risk Evaluation

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Abstract This paper connects previous research in global competitiveness analysis, taking the impact of global financial crisis into account, to evaluate how manufacturing companies are able to manage crisis by adjusting their manufacturing strategy and transformational leadership together with technology level, and develop their operational competitiveness through Sense & Respond (S&R) for dynamic decisions to optimize resource allocations and adjust strategies. It develops a theoretical approach of integrating the core factors which influence operational performance into conceptual analytical models to evaluate overall competitiveness and the risks arisen from adjustments. The empirical studies are focused to compare manufacturing companies in Finland with benchmarking to China, Slovakia, Iceland, and Spain to conclude the development of operational competitiveness.
Key words Operational competitiveness; Manufacturing strategy; Transformational leadership; Risk management

1 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)[1]. Takala et al. (2002)[2] have presented justification of multi-focused manufacturing strategies. Miles and Snow (1978) [3] have defined four company groups which include prospector, analyzer, defender and reactor. According to Miles and Snow (1978)[3], 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)[4] 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)[4] .In China, the most dynamic market, Liu et al. (2008)[5] 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)[6] 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)[7]. Bass and Avolio (1994)[8] 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[9]). Takala et al. (2008a)[10] 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.

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)[2] and transformational leadership by Takala et al. (2005)[11], 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.

2 Research Methodologies

2.1 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.

$$Q\% = \frac{Q}{Q+C+T}(1); C\% = \frac{C}{Q+C+T}(2); T\% = \frac{T}{Q+C+T}(3);$$

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

The analytical model for prospector group:

$$\phi \sim 1-\left(1-Q\%^{1/3}\right)\left(1-0.9*T\%\right)(1-0.9*C\%)*F\%^{1/3} \tag{5}$$

The analytical model for analyzer group:

$$\lambda \sim 1-\left(1-F\%\right)\left(ABS\left(\begin{matrix}\left(0.95*Q\%-0.285\right)*\left(0.95*T\%-0.285\right)* \\ \left(0.95*C\%-0.285\right)\end{matrix}\right)\right)^{1/3} \tag{6}$$

The analytical model for defender group:

$$\varphi \sim 1-\left(1-C\%^{1/3}\right)\left(1-0.9*T\%\right)(1-0.9*Q\%)*F\%^{1/3} \tag{7}$$

2.2 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.

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

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

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

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

Outcome index (OI):

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

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

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

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

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

3 Empirical Analysis

3.1 Operational competitiveness development

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.

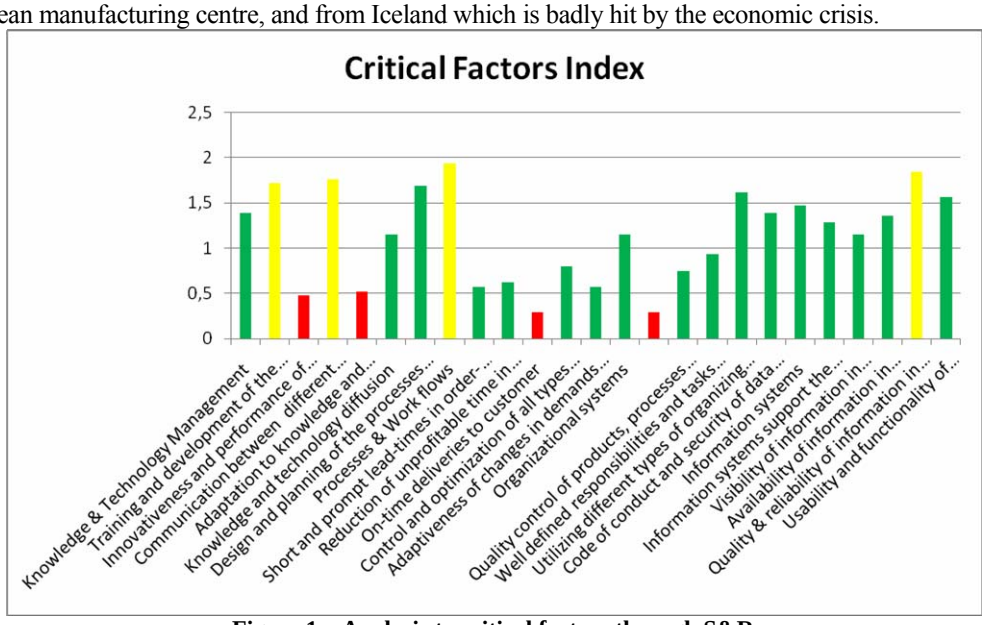

Figure 1 Analysis to critical factors through S&R

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.

It can be seen from Table 1 that the results of adjustments are different as company FI_SW being considered to compete in three kinds of group. After S&R adjustments the result of MSI in prospector group is nearly the same as before; the result of MSI in analyzer respect is worse than before; and the result of MSI in defender group is slightly better than before. However, the result of TLI is much better by adjustment than before, which means that the overal competitiveness is improved significantly than before the adjustments. The correlation of MSI vs TLI before and after S&R adjustments are shown in Figure 2 and Figure 3.

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

Coutinued Table 1

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

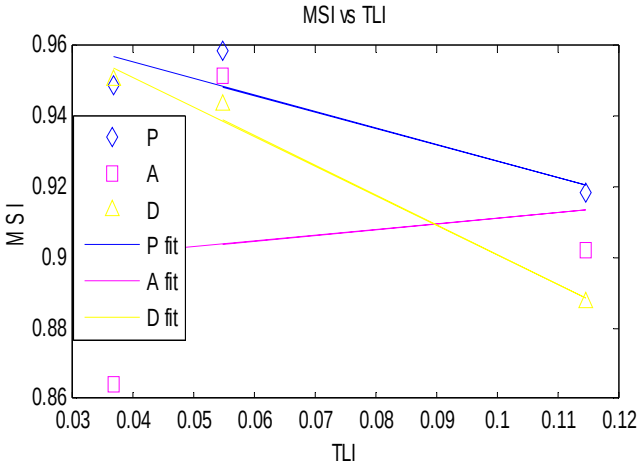

Figure 2 MSI vs TLI before S&R adjustments

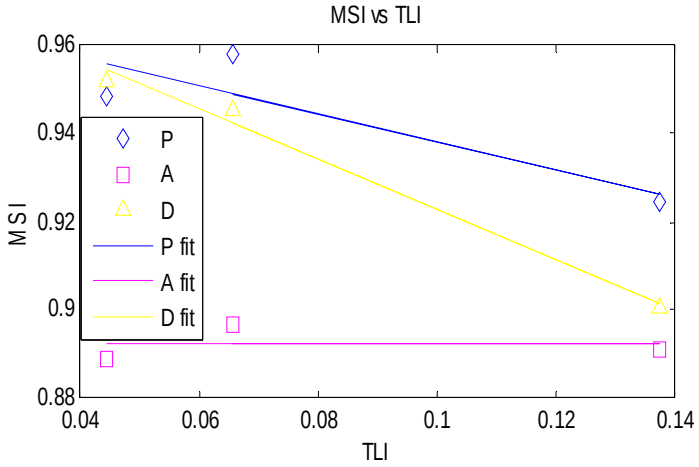

Figure 3 MSI vs TLI after S&R adjustments

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 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 4 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.

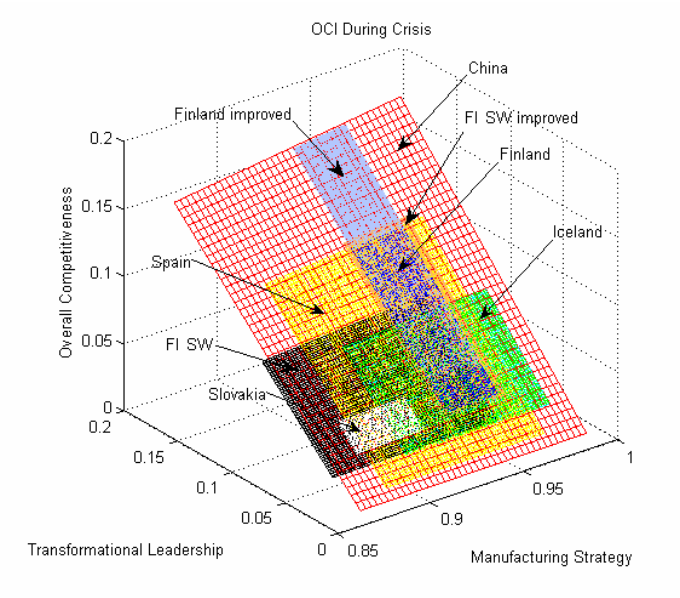

Figure 4 FI_SW improved OCI potential (light brown region) compared to its previous (black region) and other cases improved in global context

3.2 Risk evaluation

From the empirical analysis in developing operational competitiveness, it can be seen that S&R can find out the critical factors in resource and optimize them accordingly. However, due to the uncertainty of evaluation and implementation in the adjustment, risks will arise including risk analysis processes, risks arising from the implementation process. Therefore it's important to apply risk management in following two major areas:

(1) The process of risk assessment and management, also known as process control or field control, including targeted risk research object, the risk of data effectiveness, etc.

(2) The implementation of risk assessment and management, also known as ex post facto control, including the feasibility of risk adjustment indicators, indicators of other factors to adjust on endogenous risks, etc.

The detail evaluation will be modelled analytically in future studies.

4 Conclusions

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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Research on the Critical Success Factors of Advanced Manufacturing Services in Hubei Province of China

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Abstract This paper used such variables like critical success factors, competitive advantages, corporate culture, innovative capability, core competence, KM (knowledge management) and customer orientated to probe into the determinants of success for Hubei advanced manufacturing services enterprises. In this study, 114 high-tech manufacturing and advanced manufacturing services enterprises accepted our survey. This research analyzed the statistical data and tested the hypotheses mode. This research found that corporate culture, innovative capability, core competence, knowledge management and customer oriented are strongly related. But due to the advanced manufacturing services focus on the result of R & D and service, only innovative capability, core competence and knowledge management are the critical success factors of corporate competitive advantages.
Key words Advanced manufacturing services; Critical success factor; Competitive advantage

1 Introduction

After reform and opening up, especially since the 90s of last century, the service industry of Hubei province has entered a period of rapid development. The size of service has been expanding, and the proportion of service in the national economy has continued to increase. The service industry made a significant contribution for the development of the national economy and the promotion of people's quality of life. The service industry has played an increasingly important role in the national economy. However, compared with developed provinces or cities in China and developed countries, the development of service industry in Hubei province still lags behind.

Into the 21st century, Chinese manufacturing industry is facing the opportunities and challenges that the global industrial structure adjustment brings to us. While the manufacturing industry been transferred to the developing countries, developed countries have experienced a wave of servitization in manufacturing. Manufacturing enterprises develop to the two ends of industry chain, and enhance the capacity of providing high value-added services. Hubei province is still at an early stage of manufacturing services. Its development speed can't meet the needs of the rapid development of manufacturing industry. So, develop the advanced manufacturing services becomes the emphasis of the development of Hubei service industry in the current stage.

2 Literature Review

2.1 Advanced manufacturing services

The servitization of the manufacturing industry was developed and widely grown up from the 1990s in the world economic system. It not only strengthened the relation between the manufacturing industry and the service industry, but also has facilitated the development of a new industry, that was "manufacturing service industry". The research of manufacturing service industry in the foreign academic circles was started from the late 1990s, and the concept of "manufacturing service industry" has evolved from "service-enhanced manufacturing", "service-embedded manufacturing", "service-oriented manufacturing" to "manufacturing services industry". [1][2] Through the research on the tendency of servitization of the manufacturing industry in developed countries, foreign scholars put forward a series of new concepts for the behaviors and activities of manufacturing servitization, and studied and explored the operation mechanism of manufacturing services enterprises from the enterprise organization level. [3] In the Chinese academic circles, Wang Yingluo (2008), Sun Linyan (2007) etc first stated the meaning of servitization of the manufacturing mode, and explored the macro and micro value and significance for Chinese manufacturing industry to develop manufacturing services mode. [4][5]

Vandermerwe and Rada (1988) first proposed the concept of "Servitization". They considered that the Manufacturing firms needed to transform from just providing goods to providing goods and services, and services must be taken the dominant position in the manufacturing firms' products. Because services

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