A Supply Chain Strategy Management Model for Small and Medium Sized Enterprises

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Abstract: This paper proposes a model that will assist companies, particularly the small and medium-sized enterprises, assess their performance by prioritizing performance measures and selecting an adequate operations strategy under various market scenarios. The outlined model utilizes and integrates the Supply Chain Operations Reference framework and the Analytical Hierarchy Process approach to construct, link, and assess a four level hierarchal structure. The model also helps small and medium-sized enterprises put more emphasis on supply chain operations and management. The use and benefits of the proposed model are illustrated on a case of a family owned, medium-sized manufacturing company.

1 INTRODUCTION

Manufacturers today are faced with complex global challenges such as low cost competitors, fluctuating commodity prices, increasing customer expectations, and volatile economic conditions. The uncertainty associated with these factors has contributed on one hand to significant changes in the business environment resulting in tremendous growth and opportunities for new markets, and on the other hand in increased frequency and complexity of challenges that threaten the operations and survival of firms. These competitive pressures are driving manufacturing firms to continuously re-evaluate and adjust their competitive strategies, supply chains, and manufacturing technologies in order to improve performance, compete, and survive long- term.

Small and medium-sized enterprises (SMEs) are much more vulnerable to these external pressures than larger companies, thus their responses often fall short, due to limited resources and capabilities (e.g., financial resources, managerial talent, and access to markets)

Numerous studies have revealed that Small businesses are extremely susceptible to failures; about 50% of small businesses in Canada and 53% in the United States fail to survive for more than five years (Branch, 2012) Several research studies have linked the success of businesses to the type of performance measurement system (PMS) used by the firms and to the successful design and implementation. Other researchers have considered strategic performance measurement system as a means to attain competitive advantage, continuous improvement and ability to successfully manage changes (Holban, 2009; Cocca and Alberti, 2009). Despite these results, several investigators found that many small enterprises predominantly emphasize financial index only (Hudson et al., 2001; Hvolby and Thorstenson, 2001; Gosselin, 2005), neglecting the others.

This paper proposes an approach methodology and a model that will assist SMEs in building a strategic and dynamic performance measurement system that considers two types of supply chain strategies, and the supply chain performance attributes based on Supply Chain Operations Reference (SCOR) framework. The model relies on Analytical Hierarchy Process (AHP) approach to integrate various market scenarios, performance attributes and supply chain strategies into one comprehensive model. Unlike other previous works where the use of AHP and performance measures were mainly addressing the selection of best supplier, vendors, markets or manufacturing departments, this work discusses the improvement of one enterprise performance under different market circumstances and the importance of different performance measures.

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2 PERFORMANCE MEASURMENT SYSTEMS IN SMES

Performance measurement is at the core of a control and management system of an enterprise. It plays a key role in developing strategic plans and assessing organizational objectives. It is also important in assessing business ability to gain and sustain competitive advantage and directing corrective adjustments and actions as well (Holban, 2009).

Various researchers have linked the success of businesses to the type of performance measurement system used by them and to the successful design and implementation of the measurement system. Other researchers have considered strategic performance measurement system as means to attain competitive advantage, continuous improvement and ability to respond to internal and external changes (Cocca and Alberti, 2009).

In this sense, the performance measurement system is the instrument to support the decision-making either for launching, selecting actions or redefining objectives (Bititci, 1995; Globerson, 1985; Neely, 1999). From a global perspective, performance measurement system as a multi-criteria instrument consists of a set of performance expressions or metrics (Melnyk et al, 2004).

The early generations of performance measurement models focused extensively on financial and accounting areas and completely ignored the operational and other non-financial issues. Currently, the new generation of performance measurement models makes a strong effort to be strategically oriented and to address other performance dimensions including combination of financial and non-financial areas (Taticchi, Tonelli, &Cagnazzo, 2010).

Nevertheless, according to Tangen: “these new approaches have a good academic groundwork and are theoretically sound but they rarely help with the practical understanding of specific measures at an operational level”. This is considered a major obstacle in implementing multi-dimensional performance measurement system in small enterprises (Tangen, 2004).

Other researchers have tied the failure of implementing existing performance measurement systems in small and medium-sized enterprises to the following issues:

- Use of models or frameworks originally introduced for large enterprises, the one size fits all, leads to implementation failure. (Taticchi et al., 2010).
- Improper use of well-known performance measurement models and frameworks (Tenhunen, et al., 2001).
- Informal approach to performance measurement models and frameworks (no rigorous plan or execution) (Chennell et al., 2005).

Numbers of studies have revealed that many of the small and medium-sized enterprises did not achieve the requirements of a strategic performance measurement system. For example: (Hudson et al., 2001) found that all companies under the study had a surplus of financial measures, but their performance measurement systems were not derived from strategy, often unclear with complex or obsolete data, and historically focused on some outdated measures.

Another empirical survey conducted on 83 Danish enterprises (Hvolby and Thorstenson, 2001) found that 50% of these enterprises have either only one-performance indicator such as cost or no performance indicators in place at all. An additional empirical study (Gosselin, 2005) revealed that majority of small and medium sized Canadian manufacturing firms continue using financial measures.

Despite the recommendations from industrial and academic experts, the proportion of firms that implement well-known performance measurement systems remains low (Gosselin, 2005). The results indicated that the types of performance measures used by the SMEs were rarely connected to strategy. The study also revealed that about 70% of the companies failed to implement well-known strategic performance measurement models (Gosselin, 2005). The majority of SMEs according to the previous studies use traditional management accounting systems.

Nevertheless, the traditional management accounting systems and financial measures simply do not provide the richness of information that allows a company to remain competitive in today's market place (Dixon et al., 1990) see also table 1. It is necessary to understand that the metrics and the measures that are used in performance measurement system should have the power to capture the depth of organizational performance, the measures should reflect their clear relations with a range of levels of decision-making such as strategic, tactical, and operational, the metrics should reflect an acceptable balance between financial and non-financial measures, and the measurement system should ensure proper assignment of measures to the areas where they would be most suitable.

Table 1: Traditional versus no-traditional PMS.

Traditional performance measures	Non-traditional performance measures
Based on outdated traditional accounting system	Based on company strategy
Mainly financial measures	Mainly non-financial measures
Intended for middle and higher managers	Intended for all employees
Lagging metrics	On-time metrics
Do not vary between locations	Vary between locations
Do not change over time	Change overtime as the needs change
Intended mainly for monitoring performance	Intended to improve performance
Not applicable for new advanced technology and methods, JIT,TQM,FMS	Applicable for new advances technology and methods: JIT,TQM,FMS
Ignoring continuous improvement	Help in achieving continuous improvement

3 SMES AND THE CHALLENGES

Studies show that small and medium-sized enterprises are distinguished from larger firms by a number of key characteristics (Hudson, Lean, and Smart, 2001) such as personalized management with little delegation of authority, severe resource limitations in terms of skilled manpower, management and finance, and flexible structure, reactive or fire-fighting mentality, informal and dynamic strategies, dependency on small number of customers, limited markets, and high potential to innovativeness.

These characteristics are also viewed as challenges that influence the implementation of well-known performance measurement systems that are designed for larger firms in small and medium-sized enterprises (Garengo et al., 2005).

For example, the dynamic strategy of small business means that these businesses are more frequently revising their decisions than the larger firms. This greatly influences internal operations, and the relations with customers and suppliers. Such behaviour requires a better system of control with higher capability to control effectively and rapidly reflect these changes and their consequences on the internal operations as well as the external ones. These limitations of small manufacturing enterprises emphasize need for a performance measurement and control system that effectively reflects key business operations with fewer but critical measures that are written in form of an understandable structure, and flexible enough to fit specific needs of each individual enterprise and the changeable market conditions as well.

4 ANALYTICAL HIERARCHY PROCESS (AHP)

The Analytic Hierarchy Process (AHP), introduced in 1970 (Saaty, 2008), has become one of the most broadly used methods for multiple criteria decision-making (MCDM). It is a decision approach designed to assist in the solution of complex multiple criteria problems in a number of application areas. AHP is a problem-solving framework, flexible, organized method employed to represent the elements of a compound problem, hierarchically (Chen et al., 2006). It has been considered to be an essential tool for both practitioners and academic researchers in organizing and analysing complex decisions (Cheng et al., 2002).

AHP has been extensively used for selection process such as comparing the overall performance of manufacturing departments (Rangone, 1996), manufacturing supply chain (Wang et al., 2005), benchmarking logistics performance (Chan et al., 2006), and vendor evaluation and selection (Haq and Kannan, 2006). More researchers are realizing that AHP is an effective technique and are applying it to several manufacturing areas (Wang et al., 2005). AHP has several benefits (Cheng et al., 2002).

- It helps to decompose an unstructured problem into a rational decision hierarchy.
- Second, it can draw out more information from the experts or decision makers by employing the pair-wise comparison of individual groups of elements.
- Third, it sets the computations to assign weights to the elements.
- Fourth, it uses the consistency measure to validate the consistency of the rating from the experts and decision makers

The AHP procedure to solve a complex problem involves four steps:

1- Breaking down the complexity of a problem into multiple levels and synthesizing the relations of the components are the underlying concepts of AHP (Cheng and Li, 2001) see figure 1.

2- Pair-wise comparison aims to determine the relative importance of the elements in each level of the hierarchy. It starts from the second level and ends at the lowest. A set of comparison matrices of all elements in a level of the hierarchy with respect to an element of the immediately higher level are built so as to prioritize and convert individual comparative judgments into ratio scale measurements. The preferences are quantified by using a nine-point scale. The meaning of each scale measurement is explained in table 2. Decision maker needs to express preference between each pair of the elements in terms of how much more one element is important than other element. Table 3 shows a matrix that expresses personal judgment and preferences.

3- Relative weight calculation. After the pair-wise comparison matrix is developed, a vector of priorities (i.e. eigenvector) in the matrix is calculated and is then normalized to sum to 1.0. This is done by dividing the elements of each column of the matrix by the sum of that column (i.e. normalizing the column). Then, obtain the eigenvector by adding the elements in each resulting row to obtain a row sum, and dividing this sum by the number of elements in the row to obtain relative weight.

4- Consistency check. A consistency ratio (CR) is used to measure the consistency in the pair-wise comparison. The purpose is to ensure that the judgments of decision makers are consistent. For example, when using AHP technique, a consistency ratio between factors and criteria can be obtained by the following equation:

$$CR = CI/RI \quad (1)$$

Where:

CI: consistency index

RI: consistency ratio based on the value of *n*

Checking consistency provides more information about the accuracy of the comparison and the decision alternatives selection. The final score of decision alternatives can be obtained by applying the following general equation:

$$S_k = \sum_{i=1}^{m} \sum_{j=1}^{n_i} W_i \, w_{ij} \, r_{ijk} \quad (2)$$

Where:

S_k = overall decision of alternative k score

W_i = relative weight of criteria i

w_{ij} = relative weight of indicator j of criteria i

r_{ijk} = rating of decision alternative k and for indicator j of criteria i

n_i = total number of indicators belong to criteria

Table 2: Comparison scale for the importance using AHP grading system.

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities/factors contribute equally to the objective
3	Somewhat more important	Experience and judgment slightly favour one over the other
5	Strong importance	Experience and judgment strongly favour one over the other
7	Very strong importance	Experience and judgment very strongly favour one over the other. Its importance is demonstrated in practice
9	Absolutely extremely important	The evidence favouring one over the other is of the highest possible validity
2 , 4 , 6 , 8	Intermediate values	When compromise is needed
Reciprocal	Opposite value	When activity I has one of the above numbers assigned to it with activity j, then j has the reciprocal value when compared to I.

Source: Saaty(2008)

Table 3: Pair-wise comparison for *n* number of elements at the same level.

	I1	I2	I3	I*n*
I1	1	2	4	
I2	0.5	1		
I3	0.25		1	
I*n*				1

5 SCOR PERFORMANCE LEVELS AND ATTRIBUTES

Supply Chain Council (SCC) is a global non-profit organization formed in 1996 to make and evolve a standard industry process reference model of the supply chain for the benefits of helping enterprises improve supply chain operations. SCC has established the supply chain framework- the (SCOR) process

reference model- for evaluating and comparing supply chain activities and related performance (supply-chain.org, 2013). The SCOR model consists of standard supply chain processes, standard performance attributes and metrics, standard practices and standard job skills.

SCOR model divides the supply chain attributes into two categories: internal and customer related attributes. The SCOR performance attributes such as: Supply Chain Reliability, Responsiveness, and Agility are considered as customer related attributes. Cost and Assets management are internal attributes. The SCOR performance section consists of two types of elements: Performance Attributes and Performance Metrics.

A performance attribute is a combination of characteristics used to express a strategy. However, an attribute itself cannot be measured, it is used to set and identify strategic direction. The metrics that are assigned to each performance attribute measure the ability of the supply chain to achieve these attributes.

Table 4 shows five performance attributes; two of them (the cost and assets management) are considered as internal-focused. Reliability, Responsiveness, and Agility are considered as Customer-focused. Associated with the performance attributes are the level 1 strategic metrics. These level 1 metrics are the calculations by which an organization can measure how successful it is in achieving its desired position within the competitive market.

Table 4: SCOR performance attributes and definitions.

Performance Attribute		Definition
Internal	Costs: **CO**	The cost of operating the supply chain processes.
	Assets management: **AM**	The ability to efficiently utilize assets
Customer	Reliability: **RL**	The ability to perform tasks and activates as planned or expected. It focuses on the outcomes of the processes
	Responsiveness: **RS**	The speed at which tasks and activities are performed
	Agility: **AG**	The ability to respond to external effects, i.e. demand and supply uncertainties.

For example, the performance attribute supply chain cost includes two types of costs: supply chain management cost and cost of goods sold. Reliability on the other hand involves only perfect order fulfilment. Each of level one strategic metric also divided to level 2 and 3 metrics, more information about SCOR performance attributes can be found at Supply Chain Council website (supply-chain.org).

However, the framework does not provide users and practitioners with any guidelines on how to use or where to start the evaluation that requires another tool that simplify such a complex framework.

6 THE APPROACH

Since business conditions became more unpredictable and unstable, manufacturing firms are required to adjust their operations strategies in order to meet these changes. The evaluation of the alternative supply chain strategies; effective or responsive requires that the performance of the strategies on agility, reliability, responsiveness, cost, to be re-evaluated, re-prioritized, quantified and aggregated to capture the new business goals. However, this process is not a straightforward task, since the performance and strategy evaluation process depends on many factors that by nature are interconnected and require a specific level of skill and qualifications that mostly do not exist in many SMEs.

Successful performance measuring systems have to satisfy and completely fulfil the following points:

- The metrics used in performance measurement systems should have the power to capture and represent the organizational performance.
- The measures need to convey clear connections with a range of levels of decision-making such as strategic and operational.
- The metrics should also need to reflect an acceptable balance between non-financial and financial measures,
- A measurement system that ensures a suitable allocation of metrics to the areas where they would be most appropriate.

Therefore, the framework outlined in this paper helps SMEs construct and build a strategic performance measurement system which involves the two types of supply chain strategies: Efficient and Responsive, and supply chain performance attributes based on SCOR model.

The framework utilizes AHP approach to integrate SCOR performance attributes, and the two types of supply chain strategies into one comprehensive model, (figure 1). The supply chain model is use for several reasons. First, SMEs need to think and act relying on a wider range of measures that covers financial and non-financial issues.

Secondly, this effort aims at bridging the gap between supply chain models and SMEs. For example, a study (Arend and Winsner, 2005) revealed that there is a poor fit between supply chain management and the small and medium-sized enterprises. The authors attributed this poor fit to variety of reasons such as

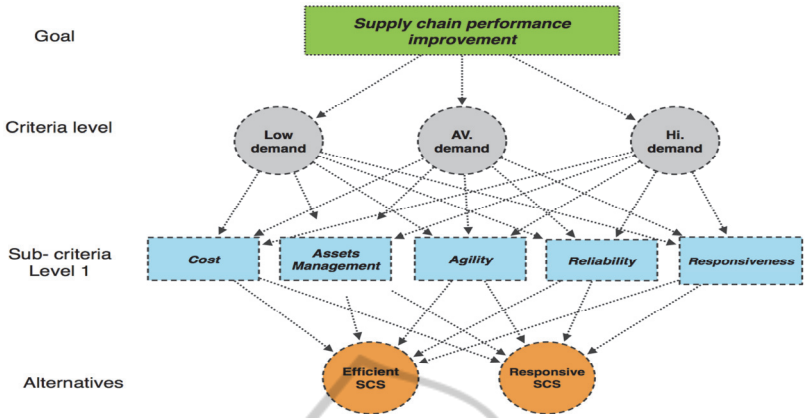

Figure 1: The four levels structure of the model.

improper implementation of supply chain management by the small and medium-sized enterprises, and due to the lack of use of supply chain management to complement strategic focus.

The Expert Choice software was used to assist us in building the hierarchal structure of the company's overall goal, market scenarios, performance attributes and supply chain strategies. Expert Choice is intuitive, graphically based and structured in a user-friendly fashion so as to be valuable for conceptual and analytical thinkers, novices and category. Expert Choice software is intended to help decision-makers and the software users overcome the limits of the human mind to synthesize qualitative and quantitative inputs from multiple stakeholders. The Expert Choice software:

- Conveys structure and measurement to the planning and budgeting process
- Aids you determine strategic priorities and optimally allocates business resources
- Converses priorities and builds consensus
- Documents and justifies strategic decisions
- Enables you to move forward quickly and confidently (Expert Choice, 2013)

The AHP and Expert Choice software engage decision makers in structuring a decision into smaller parts, proceeding from the goal to objectives to sub-objectives down to the alternative courses of action. Decision makers then make simple pairwise comparison judgments throughout the hierarchy to arrive at overall priorities for the alternatives. The decision problem may involve social, political, technical, and economic factors. (Expert Choice, 2013).

The model is illustrated in the next section on a case of a medium-sized manufacturing enterprise.

As shown in figure1, two key supply chain strategies are considered at the last level that represents the available alternatives that the decision maker has to choose from based on market conditions, business environment and company's overall goal. The third level, the attributes level, includes: Cost, Assets management as internal or let us say financial attributes and Agility, Reliability, and Responsiveness as customer or nonfinancial performance and strategy attributes. Notice that the SCOR attributes bring financial and non-financial measures together to achieve an important part of the non-traditional performance system requirements. The second level or the scenario level shows various market conditions: low demand, average demand and high demand. Each and every business encounters one or more of these market conditions, but the question of how, when, and why one supply chain strategy is chosen over the other and on what basis usually remains fairly open. Some of these issues will be highlighted in the next section through the presented case study.

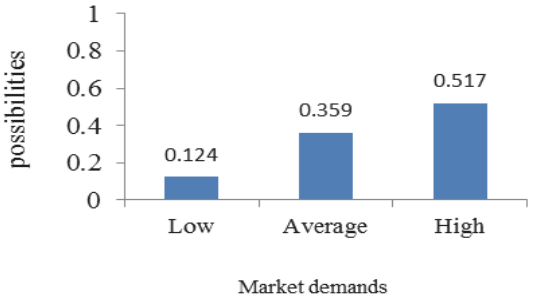

Figure 2: The likelihood of different scenarios.

7 CASE STUDY

A Saudi-based and family-owned medium-size manufacturing firm, call it company X, specialized in

production of plastic pipes and fittings products. The company strategy is to produce and deliver high quality products to its customers at the agreed delivery time and method. Most of its customers are large firms, mega project contractors and government agencies. Although the company operates in a highly competitive market, the plastic pipes and fittings market, its product prices are almost the highest compared to similar products on the market.

Based on the information collected about the company policy and operations, the Expert Choice software was used to translate and build the four level hierarchal structures: the goal, scenarios, criteria, and alternatives levels. The evaluation of these alternative strategies is carried out level-by-level, starting from top down towards the lower levels. The process begins on level two by assessing likelihood of occurrence of scenarios of different market demands during the planning period. The evaluation process of different scenario according to company X is shown in table 5.

Table 5: Pair wise comparison at level 2.

	Low	Av.	High
Low	1	4	3
Av.	1/4	1	2
High	1/3	1/2	1

The results of the second level evaluation process show that the possibility of high demand scenario occurrence is relatively higher than the other ones, figure 2.

The second step evaluates the relative effects of each criterion "attribute" on performance under a specific scenario. For example, what would be the relative effect of cost (CO), assets management (AM), agility (AG), reliability (RL), and responsiveness (RS) on performance if demand is low?, see table 6. Notices that the relative effects of each performance attribute or criterion may vary depending on market conditions or product types.

Table 6: The pair wise comparison of performance attributes under low market demand.

	CO	AM	AG	RL	RS
CO	1	3	4	3	4
AM	0.33	1	3	2	2
AG	0.25	0.33	1	3	4
RL	0.33	0.50	0.33	1	1
RS	0.25	0.50	0.25	1	1

The results obtained from the evaluation process of performance attributes are shown in figure 3. In order to complete the level calculations one needs two more comparison processes for average and high market demand. The third step addresses the performance of each strategy on each performance criterion.

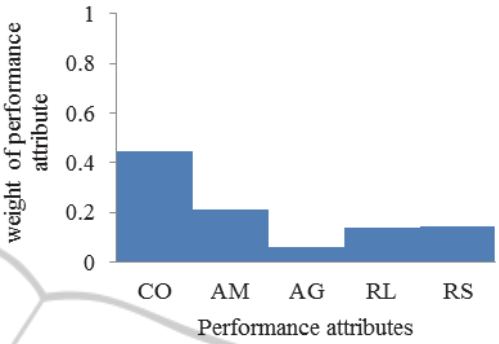

Figure 3: Weights of performance attributes under low market demand.

Finally, the overall performance of each strategy can be calculated through the composition process by using Expert Choice. The performance of the two alternatives: efficient and responsive supply chain strategy is shown in the following figure.

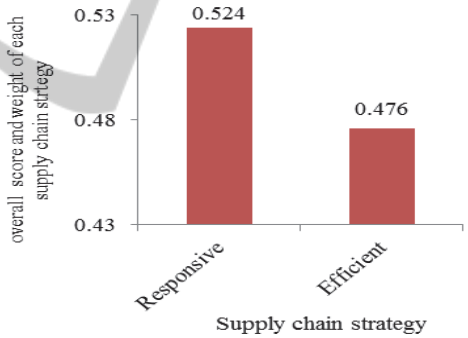

Figure 4: Overall weight of the two alternatives.

8 RESULTS AND DISCUSSION

The proposed framework was used to develop a model for a specific medium-sized manufacturing company. Notice that the company expectations of having high demand for the plastic pipes and fittings products is about 52%, 36% for average demand and 12% for low demand during the planning period. With high market demand, customers usually pay less attention to products prices and manufacturers without difficulty cover fixed and other related costs in mass production environment. This means that the company must place more emphasis on customer-related attributes as a major performance success factors.

Within the planning period, the evaluation process clearly shows that focus on responsiveness is the most appropriate strategy that company X needs to adopt since the possibility of having high demand is relatively higher than the others. However, maintaining forever the same performance measures or supply chain will not help in rapidly changing business environment.

As the external environment changes frequently and rapidly, the group of performance attributes and measures in use by businesses must also change to reflect the changes in internal and/or external environment. Generally speaking, the changes in the performance measurement system can be done by adding, eliminating, replacing, or even reprioritizing performance measures and metrics. For example, a performance measure such as, for example supply chain responsiveness which initially has high priority may move down to low priority in other circumstances or because of changes in the internal and external business environment.

In the case presented, the judgments of the likelihood of having high, average and low demand are based on previously collected information about the market demands of company X in the last few years. However, the demand may change at any time during the planning period which in some cases leads to remarkable increase or decrease of the real market needs. These types of changes usually call for adjustments in businesses strategies, policies, or goals in order to meet the new challenges. For this reason, sensitivity analyses to evaluate changes in scenarios during planning period of company X were used.

The model remains as is with the same scenarios of market demands: low, average, and high in the second level. The third level has five supply chain performance attributes: cost, assets management, agility, reliability, and responsiveness. And finally in fourth level provides a choice between two types of supply chains: efficient or responsive.

Some changes were made to the input data and judgments of level 2, the market scenarios level. For example, the likelihood of having high demand was set to 100% in order to capture and observe the changes in the model outputs. The 100% high demand market resulted in selection of responsive supply chain strategy with about 0.66 priority weights as shown in figure 5 below.

However, market conditions and demands always change, thus companies also need to examine the extremes of the markets. Therefore, the model was reset to100% low demand. With this setting, the model chooses efficient supply chain strategy as the best strategy for the low demand market, see figure 6. Similar steps were conducted to reset the model to 100% average demand. With this setting, the model gave the priority to efficient supply chain strategy but with less weight compared to 100% low demand scenario, figure 7.

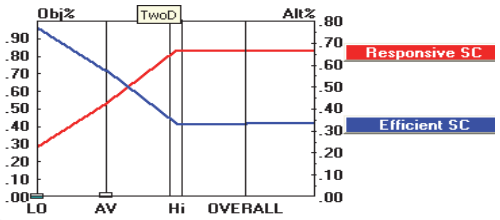

Figure 5: When occurrence of high demand is 100%.

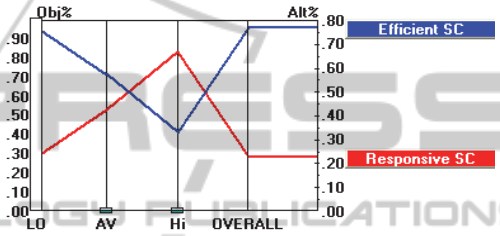

Figure 6: When the event of low demand is 100%.

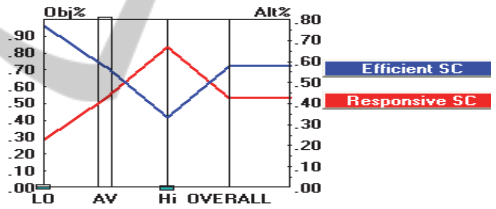

Figure 7: When average demand is 100%.

Table 7 shows the results of different scenarios generated using sensitivity analysis using Expert choice. In general, when the probability of the occurrence of low or average demand is 100%, the performance of efficient supply chain strategy will be better than the performance of responsive supply chain strategy. When the probability of high demand is certain, likelihood of 100%, responsive supply chain strategy should give better performance than efficient supply chain strategy. For company X, the market demand can be divided to three intervals or classes: low, average, and high. In addition, the company sets the limits for each one as shown in table 8 below.

Based on these intervals and the forecasted demand for the planning period, the coming 18 months, the company has to adopt both strategies but in different time periods as shown in figure 8. The company needs to adopt responsive supply chain strategy for the first five months within the planning period and go back to efficient supply chain for the rest of the year.

Table 7: Different scenarios call for differing supply chain strategies.

Prob. Low	Prob. AV.	Prob. Hi	Priority Efficient	Priority Responsiveness	Strategy to Adopt
0.124	0.359	0.517	0.474	0.526	Responsive
1.00	0.00	0.00	0.768	0.232	Efficient
0.00	1.00	0.00	0.573	0.427	Efficient
0.00	0.00	1.00	0.333	0.667	Responsive
0.379	0.00	0.621	0.500	0.500	Either
0.386	0.00	0.614	0.502	0.498	Efficient

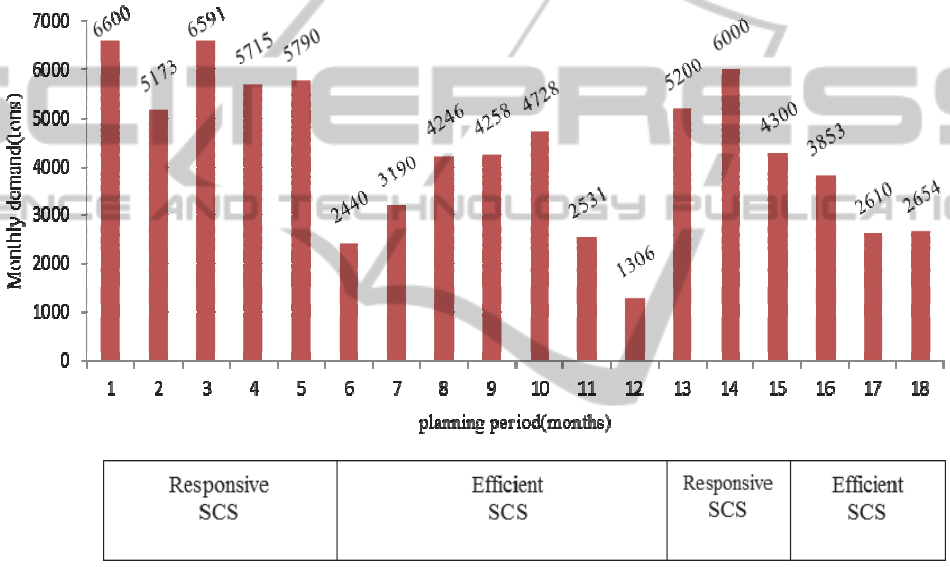

Figure 8: Forecasted market demand of company x and the selection of the supply chain strategy.

Table 8: Demand categories for company x.

Demand	**Low**	**Average**	**High**
Weight (Tons)	0-2499	2500-4999	5000-8000

The Fisher's framework suggests that there are two types of products, functional and innovative products (Fisher, 1997). Based on this classification, he suggested two types of supply chain strategies that fit each product type. For instance, he recommended efficient supply chain strategy for functional products, and a responsive supply chain for innovative types of products.

Although efficient supply chain strategy performs well with functional products, i.e. plastic pipes and fittings, our case shows that there are few months within the planning period that require some degree of responsiveness in order to meet customer orders, particularly orders for government projects.

Nevertheless, implementation of the model requires users to be aware of the difference between the two strategies. For instance, in the presented case the company needs to minimize inventory to lower the cost during low demand time. It also needs to select material suppliers based on cost as a main factor while trying to reduce manufacturing costs and lower the margins. On the other hand (during high demand period), the company has to reduce lead time, put higher price margins, respond quickly to demand and select suppliers based on flexibility, speed and reliability. Table 9 shows the general differences and a comparison between the two strategies.

9 CONCLUSIONS

A quantitative model for performance measurement system with the example used illustrates how practitioners especially in SMEs can implement the model in order to improve business performance. Using SCOR model helped in identifying a set of financial and nonfinancial performance measures that are generally used to evaluate supply chain performance in large firms. The use of AHP approach was useful in structuring the model to four levels: Overall goal, Scenarios, Criteria, and Alternatives.

Table 9: Characteristics of efficient and responsive supply chain strategies.

	Efficient Supply Chain	Responsive Supply Chain
Primary goal	Supply demand at lowest cost	Respond quickly to demand
Product design strategy	Max. Performance at a min. product cost	Create modularity to allow postponement of product differentiation
Pricing strategy	Lower margins because price is a prime custom driver	Higher margins because price is not a prime customer driver
Manufacturing strategy	Lower costs through high utilization	Maintain capacity flexibility to buffer against demand/supply uncertainty
Inventory strategy	Min. inventory to lower cost	Maintain buffer inventory to deal with demand/supply uncertainty
Lead time strategy	Reduce, but not at the expense of costs	Reduce aggressively, even if the cost are significant
Supplier strategy	Select based on cost and quality	Select based on speed, flexibility, reliability, and quality

Source: (Chopra and Meindle, 2004)

The use of Expert Choice software facilitated an excellent environment in structuring the model hierarchically, carrying out evaluation by level, and making final alternatives evaluation and selection. Some sensitivity analyses were performed in order to sense the difference when changes occur in the internal or external environment through our model. We witnessed through the case that the link between product type and supply chain strategy type works very well which proofs previous suggestions. We also observed that adding market demands with three different scenarios into the model provides us with different results for one market scenario, which suggests that there are two key players in strategy selection and that are the product type and the market demand.

The authors of this paper believe that the outlined model achieves important directions of non-traditional performance measurement system such as: flexibility, easy to use, up to date, comprehensive, involves financial and non-financial measures, and based on business strategy as well. Unlike previous implementations of AHP and performance measures model, the proposed model introduced a new approach that SMEs can use to evaluate their internal needs and external requirements by combining the two approaches correctly.

The proposed model also effectively engages users, mainly SMEs, to the world of supply chain management and operations.

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