CIRRELT

Centre interuniversitaire de recherche sur les réseaux d'entreprise, la logistique et le transport

Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation

Designing and Implementing a Performance Management System in a Textile Company for Competitive Advantage

Muhittin Oral
Fehim Peker

December 2009

CIRRELT-2009-54

Bureaux de Montréal :
Université de Montréal
C.P. 6128, succ. Centre-ville
Montréal (Québec)
Canada H3C 3J7
Téléphone : 514 343-7575
Télécopie : 514 343-7121

Bureaux de Québec :
Université Laval
2325, de la Terrasse, bureau 2642
Québec (Québec)
Canada G1V 0A6
Téléphone : 418 656-2073
Télécopie : 418 656-2624

www.cirrelt.ca

Université Laval · UQÀM · HEC Montréal · École Polytechnique Montréal · Université de Montréal

Designing and Implementing a Performance Management System in a Textile Company for Competitive Advantage

Muhittin Oral[1,*], Fehim Peker[2]

[1] Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation (CIRRELT) and Faculty of Management, Sabanci University, Orhanli 34956, Istanbul, Turkey
[2] Tüp Merserize A.S., Peker Group Companies, Istanbul 34169, Turkey

Abstract. Globalization forces companies to work efficiently, effectively, and intelligently to create and sustain competitive advantage to maintain their existence favorably in the markets of interest. Global competition seems to be very much shaped by shorter delivery period, higher quality, better price, and effective marketing. This is more so in the case of textile industry worldwide. The present paper discusses a framework for designing and implementing a performance management system (PMS) in a textile company that integrates "competitive marketing" and "right-the-first-time" production strategies. The PMS model developed also serves as an instrument for organizational learning to help the company improve its global competitive advantage.

Keywords. Competitive advantage, integrating marketing and production, performance management, organizational and team learning, knitted fabrics, textile industry.

---

* Corresponding author: Muhittin.Oral@cirrelt.ca

Dépôt légal – Bibliothèque et Archives nationales du Québec,
Bibliothèque et Archives Canada, 2009

1. INTRODUCTION

Innovative management of organizational performance has been a major factor for success in international markets for sometime now. It is even more so as we are currently going through an economic and financial crisis. Innovations in production processes, products, marketing effectiveness, and management infrastructure are all needed for creating competitive advantage more than ever. Customer satisfaction needs to be achieved at the highest levels possible while maintaining a high level of production superiority in terms of quality, delivery period, quantity, and costs.

The relationship between manufacturing strategy and competitive strategy and their influence on firm performance has been the subject of many studies since late 1960s. Skinner (1969) argued that manufacturing strategy plays an important role on a firm's competitive potentiality and actuality and hence on the firms' eventual performance. As Amoako-Gyampah and Acquaah (2008) summarized, some of the initial studies sought to develop a linkage between competitive advantage and manufacturing strategy. Among those studies one can cite the works of Dutta and King (1980), Abernathy, Clark, Kantron (1981), Hayes and Wheelwright (1984), Prahalad and Hamel (1990), Ward and Duray (2000). Kaplan and Norton (1992, 1993) suggested a framework for evaluating organizational performance from the perspectives of financial success, customer satisfaction, internal process effectiveness, and learning and growth achievement. Porter (1980, 1985) also provided frameworks for competitor and industry analysis and for gaining competitive advantage. Competitiveness level as an overall measure of organizational performance has been also treated, using mostly model-based approach, by Oral (1986, 1993).

In this paper, the level of firm performance is conceptualize and modeled from a particular competitive strategy perspective that takes into consideration quality, price, delivery time, and marketing effectiveness. For this purpose, it especially integrates two major functions of a firm: marketing and production. Marketing function is based on customer-focused strategy to provide high levels of customer satisfaction in terms of quality, delivery, flexibility, and price. Production function, on the other hand, is founded on the right-the-first time strategy so that due delivery dates are met, production costs are reduced, and superior quality levels are constantly maintained through innovations in the areas of process improvement, product development, and management.

The organization of the present paper is as follows. Section 2 sets the context in which “performance management “is to be perceived; basically relating competitive advantage to marketing effectiveness and production superiority. Section 3 is devoted to the presentation of the methodology developed and implemented for performance evaluation. Section 4 discusses the organizational implications of the new performance management system. And, Section 5 concludes the paper.

2. THE CONTEXT OF PERFORMANCE MANAGEMENT

The company for which this study has been done is active in international markets and makes knitted fabrics for major garment makers of sports and casual wear, mostly for European companies. A content analysis of the daily reporting meetings have indicated that keeping promised delivery dates, maintaining the quality levels required by customers, offering competitive prices and product design flexibility are the major governing factors for running the business successfully. These findings were also supported by the analyses performed using the current and past data on customer relations. All these results have suggested a particular understanding as to which factors that needs to be considered in conceptualizing and designing a performance management system (PMS). The perception of the context within which PMS is to be conceptualized and designed for creating a competitive advantage is given in Figure 1.

As can be seen form Figure 1, the competitive advantage of the firm is perceived to be jointly created and maintained by marketing and production functions. However, there are areas where production function is mainly a dominant activity; such as providing superior quality, meeting the promised delivery dates and quantities, and reducing production costs. Similarly, marketing function is considered to be the foundation of competitive marketing through forming and sustaining right customer portfolio, selling right product mix, and offering competitive yet profitable prices.

Figure 1, in a sense, suggests a framework for conceptualizing a PMS that integrates two major functions of a firm. This feature implies that one needs to design a system by which the performances of marketing and production functions can be evaluated in relation to one another. How this is achieved forms the content of the next section.

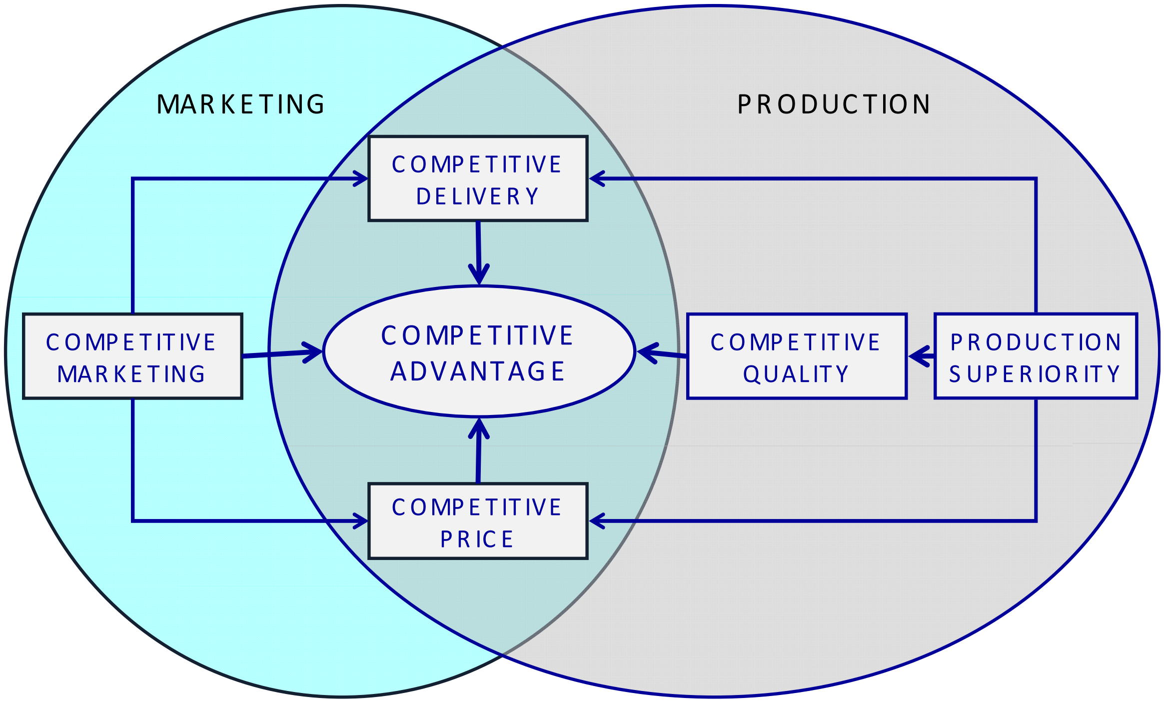

Figure 1: Context for Designing Marketing and Production Factors
Shaping Competitive Advantage

A broader economic context is also to be taken into consideration. Performance management strategies can be clustered according to competitiveness and demand levels as shown in Figure 2. When both demand and competition are high we call this economy “competitive normal economy” where “marketing mastery” is the performance management strategy. When demand is high but competition is relatively low, we call this economy “growth economy” (see also, for instance, Rathore *et al,* 2005) and “production mastery” is the strategy to be followed for managing performance. The third type of economy is “tight economy” when both demand and competition are low. In this case, “technical efficiency and effectiveness” is more appropriate a strategy to adopt for performance management. The last type of economy is called “competitive and tight economy” which is characterized by low demand and high competition. Economy during a financial crisis falls in this category, as the one we are currently experiencing since the end of 2008, and it requires a serious revision of all strategies, including performance management. In such economies, “right” activities must be performed “right-the-first-time” and “innovatively”.

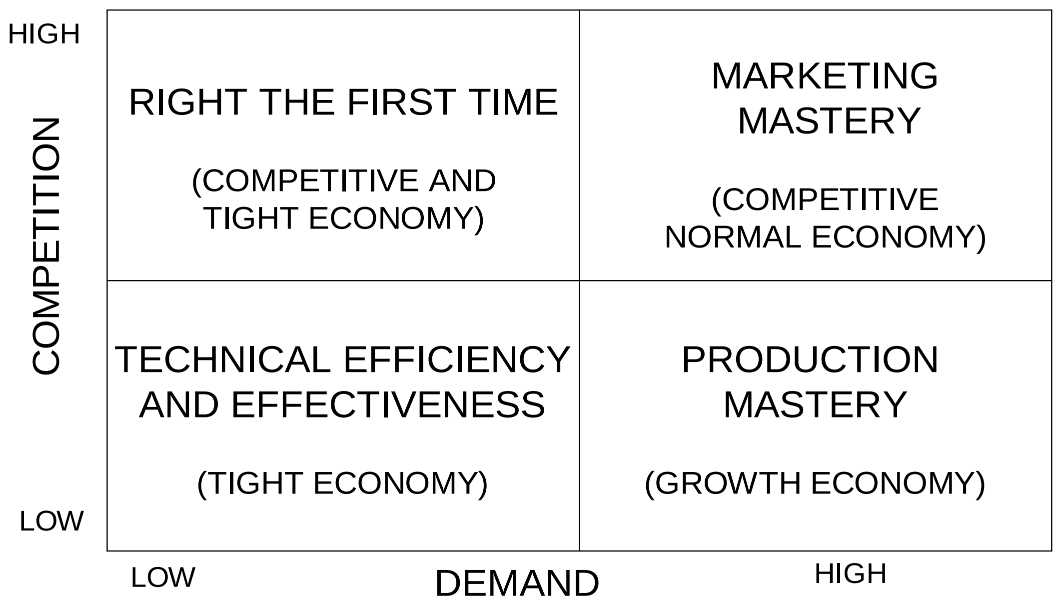

Figure 2: Clustering Performance Management Strategy

The textile company for which this study was done is considered to fall in "the competitive and tight economy" situation due to the current financial and economic crisis. Therefore, identifying the "right" activities to be performed the "right-the-first-time" is the strategy to be pursued and hence forms the foundation of the PMS developed and implemented in this study.

Pursuing a "right activity right-the-first-time" strategy has several advantages and justifications from the perspective of creating competitive advantage. Because it

- reduces production costs – less energy, less dyestuff, fewer amounts of chemicals, and less labor are required because there is no need for repair or reprocessing which requires additional inputs, and hence higher production costs. These savings lead to lower unit production costs and therefore creating opportunity to offer more competitive prices to customers. See "competitive price" in Figure 1.
- facilitates to meet the due delivery dates – because the operations are successfully completed on first trials, thus shortening production times, there is no difficulty in

meeting the promised delivery dates, which helps creating and maintaining good customer relations. See "competitive delivery" in Figure 1.

- contributes to making good quality products – achieving the "right-the-first-time" objective in production means that there is no need for any repairing or reprocessing. Repairing or reprocessing in textile industry is usually major causes of decrease in quality levels, as well as increasing production costs. See "competitive quality" in Figure 1.

- increases the effectiveness level of competitive marketing – producing superior quality products in shorter delivery periods at lower costs sets the very ground for competitive marketing. See "competitive marketing" in Figure 1.

A recent study dealing with customer-focused and product-line-based manufacturing performance measurement is due to Chee-Ceng and Wen-Ying (2007). Their study proposes an integrated dynamic performance measurement system where three main areas are integrated; namely, company management, process improvement, and the factory floor shop. As will be seen shortly, the methodology presented in this paper is philosophically similar to that of Chee-Cheng and Wen-Ying, but differs considerably in terms of formulations and performance strategy. Readers are also referred to Oral and Dominique (1989) and Chen *et al* (2006) for competitive strategy formulation that integrates firm-based production plan and market-based performance in mature industries.

3. METHODOLOGY

The textile company, for which this study was done, has three production facilities: fabric making, bleaching, and yarn dying. Although the performance management system discussed in this paper is currently being used in all production lines, we shall concentrate only on fabric production line to explain the methodology developed for the purpose of performance evaluation. We shall start with the marketing function and its performance evaluation.

Marketing Function

The performance evaluation of the marketing function is based on four "right" factors. These are: right customer portfolio, right product portfolio, right pricing, and right production quantity. *Right customer portfolio* means that the company has developed an optimal customer base in terms of right combination of small and big customers, new and old customers, domestic and international customers so that the sustainability of business is successfully maintained.

Right product portfolio refers to selling those products that are strategically important and profitable. *Right pricing* indicates the effectiveness of marketing and sales people in persuading the customers regarding the values of the products offered. *Right economic value* indicates how and at which level of the production capacity is being utilized in terms of exploiting the technological and production superiorities of the company to generate economic value. As a function of these four "rights", the performance level of the marketing function is determined, which is called "competitive marketing"? In a sense, the marketing function is to identify "the rights" that will guide the production activities of the company. See Figure 3 for the details. Now, we shall provide the mathematical formulations of these four "rights", and then how the "earned premium rate" is calculated.

Right Customer Portfolio Index (C): A right combination of customers is important from different perspectives. First, it is risky to work with only few big customers, for there is always a possibility that one or two of them might reduce and even cancel their orders due to their business conditions, thus lowering the negotiating power of the company with its customers (Porter 1980, 1985). Such situations might cause serious interruptions in production activities. Second, it is always beneficial to add new customers to the existing ones for higher capacity utilization. To measure the level of "right customer portfolio" the following metric is formulated:

$$C = \sum_j \gamma_j \frac{N_{jA}}{N_{jT}} \tag{1}$$

where C = the right customer portfolio index,

γ_j = the importance of customer type *j,* with $\sum_j \gamma_j = 1$ and $\gamma_j \geq 0$, $\forall j$ in the context of customer portfolio which is defined and justified by the company management,

N_{jA} = the actual number of customer type *j,* $\forall j$

N_{jT} = the targeted number of customer type *j*, $\forall j$.

To interpret (1) with a simple hypothetical example, let us assume that the number of existing customers is 20 and we were able to do business with 19 of them; and we have targeted to have 5 new customers, but we were able to get only 2 during the performance evaluation period. Then the value of the right customer portfolio index C becomes

$$C = \sum_j \gamma_j \frac{N_{jA}}{N_{jT}} = (0.8)\frac{19}{20} + (0.2)\frac{2}{5} = 0.84$$

when the strategic importance of doing business with the existing customers is (0.8) and gaining new customers is (0.2). It should be noted here that the right customer portfolio index takes on values around 1 by the very definition of C in (1). A value of C greater than 1 indicates that we have done better than the targeted objective, otherwise it is just the opposite.

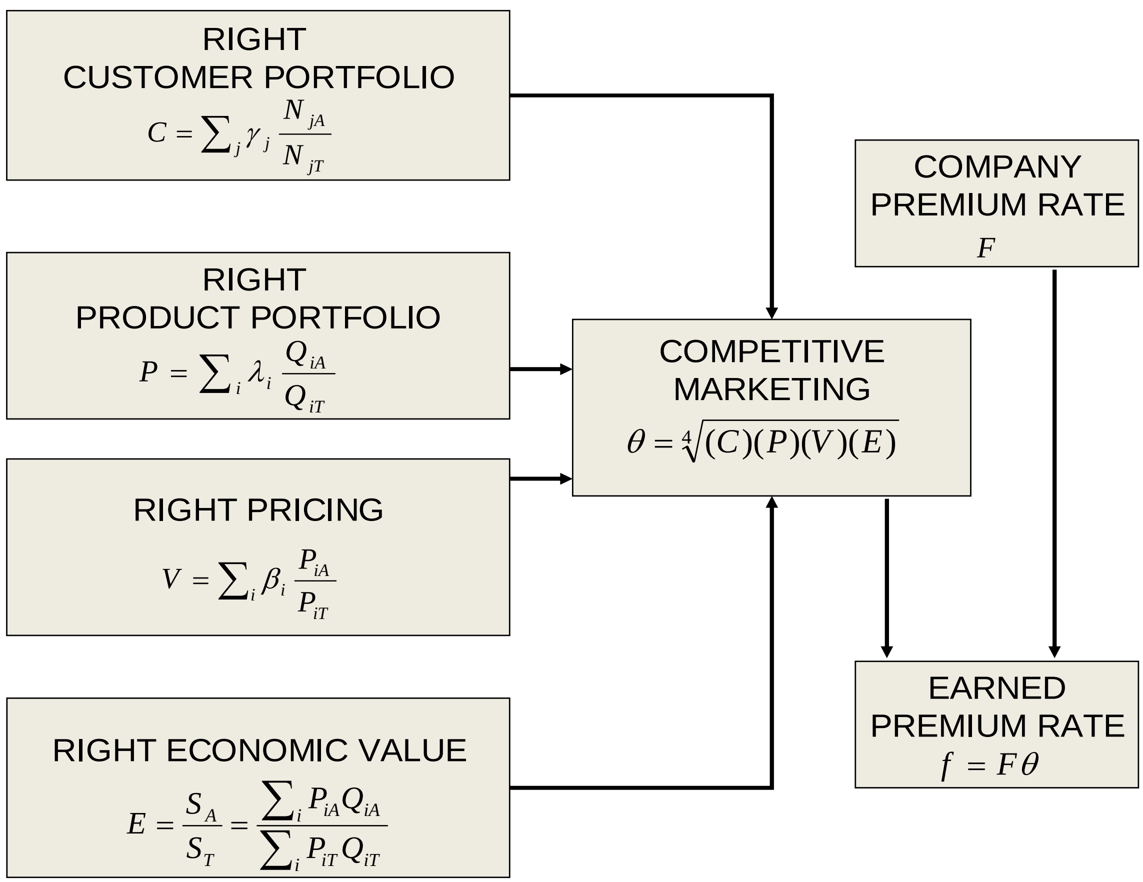

Figure 3: Methodology for Computing Premium - Marketing

Although we have considered only two types of customers in this example, the company is in fact currently working with more than 20 groups of customers.

Right Product Portfolio Index (P): Not only the right customer portfolio but a right product mix is also desirable. Some products might carry higher levels of strategic importance than the others, for one reason or another. To accommodate this feature in the right product portfolio index P, we have the following formulation:

$$P = \sum_i \lambda_i \frac{Q_{iA}}{Q_{iT}} \qquad (2)$$

where P = the right product portfolio index,

λ_i = the strategic importance of product *i* in the context of right product portfolio, which is again defined and justified by the company management, with $\sum_i \lambda_i = 1$ and $\lambda_i \geq 0, \ \forall i$

Q_{iA} = the actual size of the order for product *i*, $\forall i$,

Q_{iT} = the targeted size of the order for product *i*, $\forall i$.

The values of Q_{iT}'s obtained from a model that represents "optimal capacity utilization", which is discussed when explaining the right economic value index E.

Again as a small hypothetical example, let us assume that the products are strategically classified by company management into two groups: the importance of group 1 is 0.4 and that of group 2 is 0.6. The targeted outputs of product group 1 and group 2 are, respectively, 100 and 20 tons of knitted fabrics; where the actual outputs are, again respectively, 105 and 15 tons. Note that the total actual output and total targeted output in this case are the same; that is,120 tons. Putting the values in (2), we obtain

$$P = \sum_i \lambda_i \frac{Q_{iA}}{Q_{iT}} = (0.4)\frac{105}{100} + (0.6)\frac{15}{20} = 0.87 .$$

Although the targeted output is equal to the actual output, we have a value that is less than 1, indicating that we have not attained our objective due to a lower level of achievement with respect to product group 2, although we have actually done better than the targeted value of 100 tons.

Right Pricing Index (V): This is the index formulated to measure how successful the marketing people are with respect to pricing. For each product there is a targeted price and actual price. The right pricing index indicates to what extent the targeted prices are actually maintained. Its formulation is below:

$$V = \sum_i \beta_i \frac{P_{iA}}{P_{iT}} \tag{3}$$

where V = the right pricing index,

β_i = the strategic importance of product i in the context of pricing, as defined and justified by the company management, with $\sum_i \beta_i = 1$ and $\beta_i \geq 0,\ \forall i$,

P_{iA} = the actual price charged for product i,

P_{iT} = the targeted price for product i.

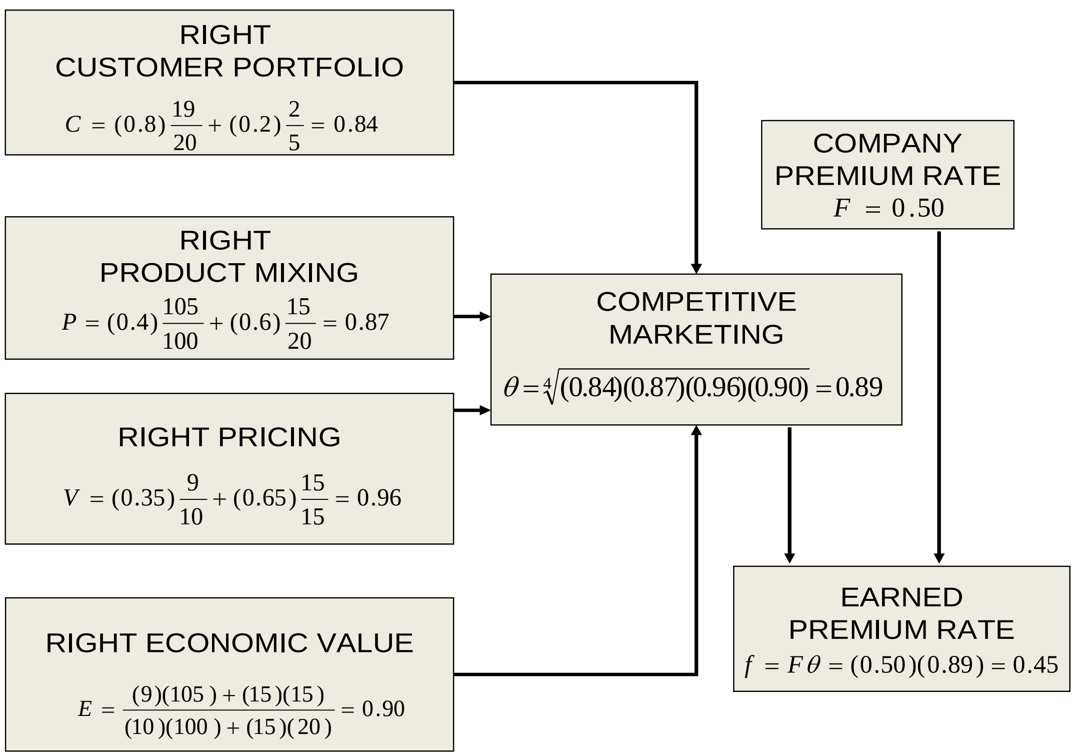

Figure 4: Computing Earned Premium Rate for Marketing – Numerical Example

A small hypothetical example to interpret the equation (3) could be the following. Suppose the strategic importance of product group 1 is 0.35 and that of product group 2 is 0.65 within the context of the right pricing index. Let the actual average prices charged are \$9 and \$ 15 for product group 1 and 2, respectively. The targeted prices, on the other hand, are \$10 and \$15. Then substituting the values in equation (3) we get

$$V = \sum_i \beta_i \frac{P_{iA}}{P_{iT}} = (0.35)\frac{9}{10} + (0.65)\frac{15}{15} = 0.96$$

implying that the company is very close to the target level of 1.

Right Economic Value Index (E): An optimal use of capacity that creates economic value (may be measured in terms of total sales, total profits, etc.) for the company is of crucial importance for survival. The right production quantity *Q* is the quantity that generates the maximum value *W* and is obtained from the following optimization model:

$$W = Max \sum_i w_i Q_{iT} \text{ subject to } \sum_i a_{ik} Q_{iT} \leq b_k \text{ , } \forall k \tag{4}$$

where w_i = the economic value contributed by one unit of product *i*, $\forall i$

Q_{iT} = the targeted (optimal) quantity to be produced of product *i*, $\forall i$,

a_{ik} = the amount of capital resource (time on machinery, equipment, department, etc.) of type *k* needed to produce one unit of product *i*,

b_k = the availability level of capital resource of type *k.*

The optimal quantities Q_{iT} 's obtained from the model in (4) are all measured in the same physical units, either in meters or in kilograms, in the case of the company for which this study was done.

Given the actual quantities Q_{iA}'s produced, we define the right economic value index E as

$$E = \frac{S_A}{S_T} = \frac{\sum_i P_{iA} Q_{iA}}{\sum_i P_{iT} Q_{iT}} \tag{5}$$

A value of E smaller than 1 indicates that we have done less than the optimal capacity utilization indicates. It should be noted here that the right economic value index links the marketing function with the production function.

If we continue with the same small hypothetical example again, we already know the values P_{iA}'s, P_{iT}'s, Q_{iA}'s and Q_{iT}'s. Substituting their values in (5) we obtain

$$E = \frac{S_A}{S_T} = \frac{\sum_i P_{iA} Q_{iA}}{\sum_i P_{iT} Q_{iT}} = \frac{(9)(105) + (15)(15)}{(10)(100) + (15)(20)} = \frac{1170}{1300} = 0.90 \text{ ,}$$

a value indicating to what extent the capacity is actually being optimally used to create economic value. In the case of our small example, we are close to the optimal capacity utilization, because E = 0.90, through the quantities actually produced, but quite not there yet because E is not equal to 1.

The concept of the right economic value index E will also be used for evaluating the performance of production function. In particular, the right product mixed quantity Q_T

$$Q_T = \sum_i Q_{iT}$$

will be the basis of calculating the premium per unit of RFT (right the first time) production.

Competitive Marketing Effectiveness Index θ: Now we are in a position to combine these four performance indices of marketing function to define an overall index called "the competitive marketing effectiveness index" θ. Its formulation is

$$\theta = \sqrt[4]{(C)(P)(V)(E)} \qquad (6)$$

where θ is defined as a *geometric mean* of the previously developed four performance indices. There are two reasons for opting for such a model: (1) the overall index θ needs to be interpreted in the same way the other four "right" individual indices are, and (2) a multiplicative model better represents the interdependence among the four performance indices. For a discussion of how a model choice (multiplicative, additive, min, max) is made, the reader is referred to Karnani (1982, 1984, 1985).

Once again returning to our small hypothetical example, by substituting the values of the four indices corresponding to four "rights" found before in equation (6) we get

$$\theta = \sqrt[4]{(C)(P)(V)(Q)} = \sqrt[4]{(0.84)(0.87)(0.96)(0.90)} = \sqrt[4]{(0.54)} = 0.89$$

as the competitive marketing effectiveness level. This value implies that the level of marketing performance is not far from the target value 1.0, although there is a room for improvement.

Earned Premium Percentage – Marketing: Let us assume that the company premium percentage is *F* = 50% when the marketing function hits target performance level θ =1.0. Then the earned premium rate *f* is found by

$$f = F\theta = (0.50)(0.89) = 0.45\,.$$

This value indicates that the marketing people, as a group, will be rewarded with an amount of $ 22,500, assuming that the totality of their salaries is $ 50,000 for the period for which the performance evaluation is being done. Then the total payment to be made to the marketing people becomes $ 50,000 + $ 22,500 = $ 72,500.

Figure 4 summarizes all these calculations for the marketing function. Now we shall present the methodology for evaluating the performance of production function.

Production Function

The performance management strategy for evaluation of the production function has been simply reduced to the motto “right-the-first-time”. We term this strategy as “RFT Performance Strategy”. Moreover, this strategy is operational and applicable in the cases of all the orders accepted by the marketing function. Said differently, what ever brought as orders by the marketing department, the production people have the responsibility to make the required quantities with “RFT Performance Strategy”. The assumptions and implications of this RFT performance strategy are:

- The orders are strategically shaped by the marketing function and the production function is obliged to confirm with the requirements of the orders. Assuming that the orders are received in the best interest of the company by the marketing people that takes into consideration company’s technological characteristics, technical know how, capacity and competitive forces, the production function is simply required to fulfill these orders. In other words, the outputs of marketing function as orders are the inputs for the production function.

- Implementing a RFT strategy results in (1) considerable reduction in production time, (2) increase in quality performance, (3) handsome decreases in production costs, and (4) tremendous improvements in customer relations.

To fully implement the RFT strategy, the performance of production function is therefore completely based on the RFT quantities produced. For this purpose, a certain amount is determined as a premium to be given per each unit of RFT production. How this certain amount of premium is determined is depicted in Figure 5.

Net Total RFT Quantity: For the period of performance evaluation, let Q_1 be the quantity of RFT production. However, there are also non-RFT quantities; q_j's, with defect type *j.* The nature of defective quantities might have different consequences. Let α_j be the consequence of defect type *j* per unit of q_j. To estimate the likely consequence of the defective quantity q_j, the following factors are taken into consideration:

- Additional chemical and dyestuff used to repair or replace the defective quantity q_j,
- Energy lost because of the additional work done due to the defective quantity q_j,
- Additional labor needed because of the defective quantity q_j
- Business lost due to the defective quantity q_j

Again let us consider the same small example. We produced 105 tons of product group 1 and 15 tons of product group 2. Out of 105 tons of product group 1, $q_1 = 25$ tons have defect type 1, and $q_2 = 10$ tons of defect type 2. This implies that 70 tons of product group 1 were produced without any defect; that's, RFT production. Similarly, out of 15 tons of product group 2, $q_3 = 2$ tons of defect type 3 and $q_4 = 3$ tons of defect type 4. This implies that the RFT production is equal to 15 – (2+3) = 10 tons. Let us assume now the multiplier effects of the defect types are given by $\alpha_1 = 0.2$, $\alpha_2 = 0.3$, $\alpha_3 = 0.5$, and $\alpha_4 = 3.0$. Given these data, we have $Q_1 = 70 + 10 = 80$ tons of direct RFT production and

$$Q_2 = \sum_j (q_j - \alpha_j q_j) = \left[25 - (0.2)(25) + 10 - (0.3)(10) + 2 - (0.5)(2) + 3 - (3.0)(3)\right] = 22$$

tons of adjusted equivalent RFT production, totaling $Q = Q_1 + Q_2 = 80 + 22 = 102$ tons of net RFT production (see Figure 6).

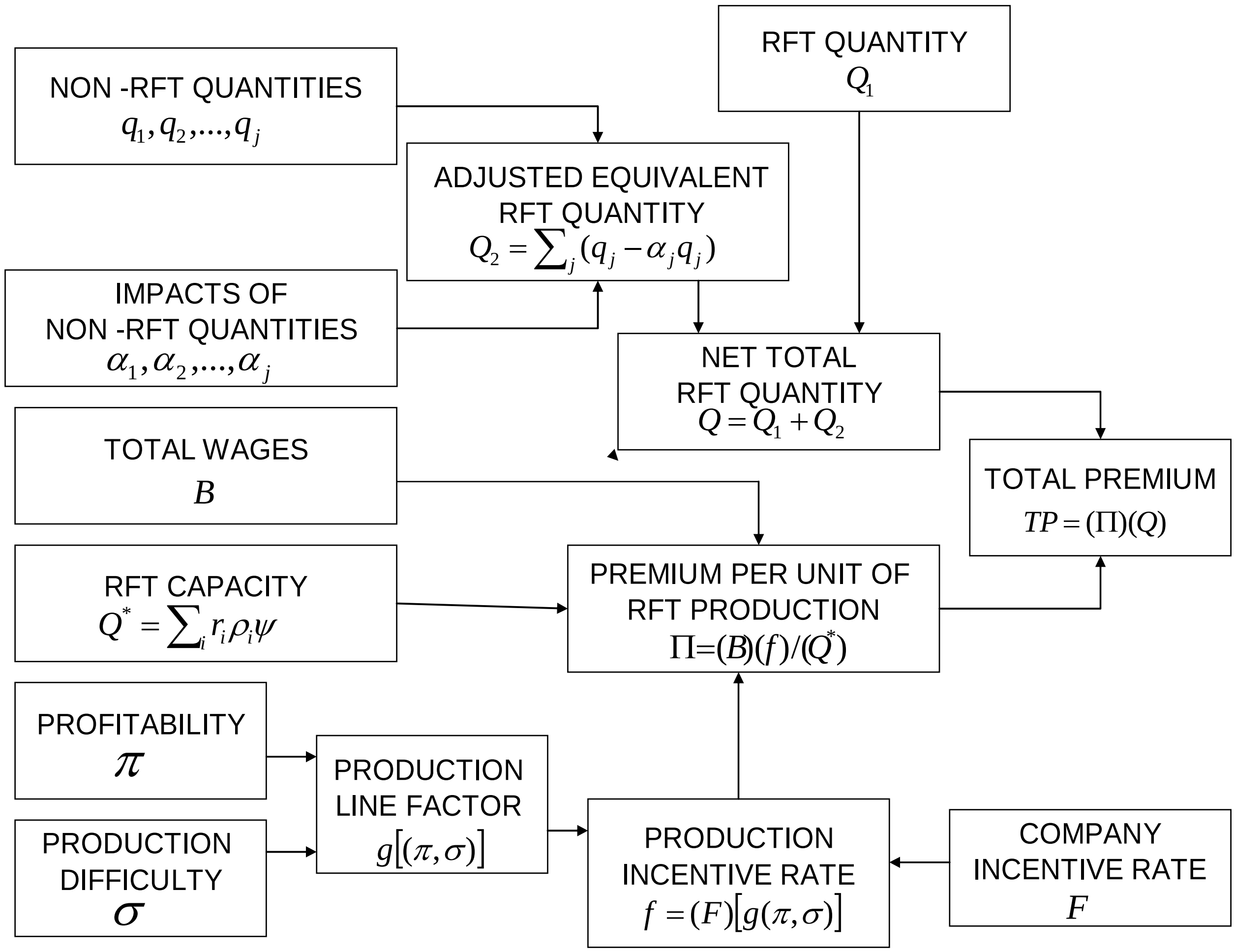

Figure 5: Methodology for Computing Premium - Production

RFT Capacity: Based on the actual product-mix production, this is the total quantity that could have been produced without any defects. The RFT capacity is the basis of calculating the amount of premium that will be given per ton of quantity produced without any defect and will be used in determining the total amount of premium to be awarded to the people working on the production line.

Let us assume that the RFT time required to make quantity Q_{iA} is t_i. The total RFT time needed to make $Q_A = \sum_i Q_{iA}$ is then $t = \sum_i t_i$. On the other hand, let us assume that the total RFT time required to make $Q_T = \sum_i Q_{iT}$ is ψ. Then the ratio $\rho_i = t_i / t$, represents the actual relative time used to make Q_{iA}. This ratio will be maintained in calculating the RFT capacity that is based on the actual product-mix. In this case, the RFT capacity reflecting the actual product-mix is given by

$$Q^* = \sum_i Q_i^*$$

where Q_i is the RFT quantity that could have produced within the time period of $\rho_i \psi$. If the targeted RFT production rate of product *i* is r_i, then $Q_i^* = r_i \rho_i \psi$. The RFT capacity is then

$$Q^* = \sum_i Q_i^* = \sum_i r_i \rho_i \psi \qquad (7)$$

Again referring to our small hypothetical example, the targeted quantity of product group 1 was 100 tons and would have been produced in 10 time units, implying a targeted production rate of 10 tons of output per unit time ($r_1 = 10$). But the actual quantity of product group 1 is 105 tons and it took 15 units of time. Similarly, the targeted quantity of product group 2 was 20 units and would have been produced in 10 time units, implying a targeted RFT production rate of 2 tons per unit time ($r_2 = 2$). The actual figures, on the other hand, are 15 tons of output in 10 units of time.

Given these pieces of information, we have, $t = 15 + 10 = 25$, $\rho_1 = t_1/t = 15/25 = 0.60$ and $\rho_2 = t_2/t = 10/25 = 0.40$. These figures, which are based on the actual product mix, indicate that 60% of $\psi = 10 + 10 = 20$ would have been used for the production of product group 1 and 40% for product group 2. Thus the actual product mix RFT capacity becomes

$$Q^* = \sum_i Q_i^* = \sum_i r_i \rho_i \psi = (10)(0.60)(20) + (2)(0.40)(20) = 136$$

tons of output.

Premium per Unit of RFT production: As can be observed from Figure 5, the premium to be paid per unit of RFT production is based on several factors: (1) RFT capacity Q^*, (2) total wages B for the period of performance evaluation, (3) profitability π of the production line, (4) technological difficulty level σ of the production line, and (5) company incentive rate F.

The RFT capacity Q^* is already given in (7). The total wages B is the sum of the wages to be paid to all those who are working on the production line. The profitability π indicates the relative profitability of the production line when it is compared with the other two production lines. Higher the profitability levels of a production line, higher the level of premium to be paid for the activities of that production line. Similarly, the technological difficulty level σ indicates the relative difficulty level of the production line when it is compared with the other two lines. This feature is also to be taken into consideration while determining the level of premium to be paid for the activities of the three production lines. Given the above features and factors, one can formulate the amount of premium π to be paid per unit of RFT production as:

$$\Pi = (B)(f)/(Q^{*}) \tag{8}$$

where $f = (F)\left[g(\pi,\sigma)\right]$ and $g(\pi,\sigma)$ is the value indicating the relative profitability and technological difficulty level of the production line when compared with the other two production lines. For the most profitable and difficult production line we assume that $g(\pi,\sigma) = 1$, which is the case for the production line of fabrics making. This assumption implies that $f = (F)\left[g(\pi,\sigma)\right] = (0.50)(1.0) = 0.50$. For the other two production lines, the values of $g(\pi,\sigma)$ are less than 1, implying that the values of f are less than 0.50. The nature of the function $g(\pi,\sigma)$ will be more evident when we are discussing the Stage 1: Transitional Implementation in the following section.

Now we are in a position to demonstrate how to calculate the premium to be paid for one ton of RFT production. Substituting the appropriate values in (8) we obtain

$$\Pi = (B)(f)/(Q^{*}) = (200{,}000)(0.50)/(136) \cong \$\ 735$$

as the premium to be paid per unit output of RFT production. Given this premium amount per unit output of RFT quantity, we can find the total premium to be paid to the workers of the production line as

$$TP = \Pi Q(102)(735) \cong \$\ 75{,}000.$$

The reader is referred to Figure 6 for the steps of the calculations.

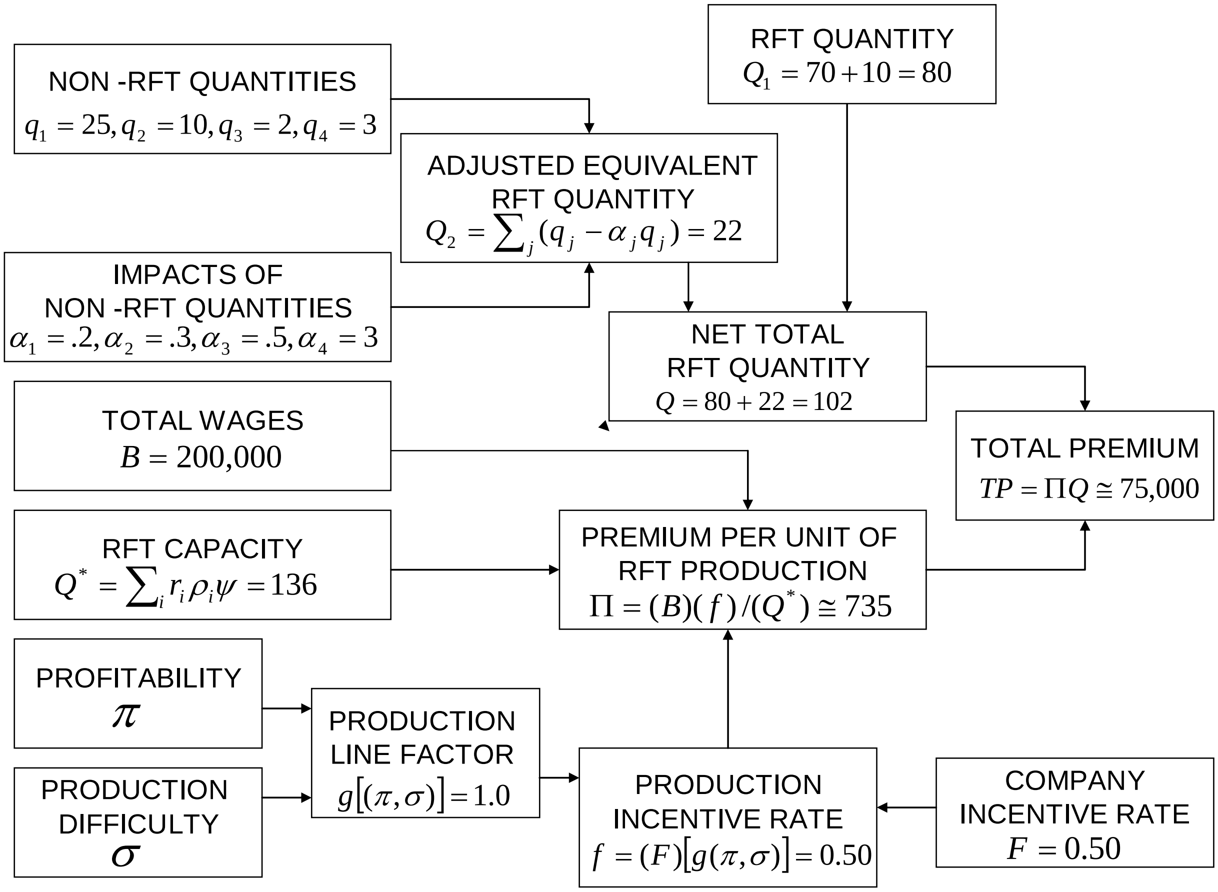

Figure 6: Computing Premium for Production – Numerical Example

4. IMPLEMENTATION

The implementation of the PMS as presented in the previous section has been realized in two consecutive stages: Stage 1: Transitional Implementation and Stage 2: Full Implementation. The transitional implementation is basically needed for two reasons: (1) as a preparation stage for the full implementation, and (2) as a learning instrument for all implied in the process of performance management. The full implementation is the use of the methodology with all details at the product level. In what follows we shall discuss how the transitional implementation is being realized and the preparations being made for the full implementation.

Stage 1: Transitional Implementation

The transitional implementation is based on four groups of fabrics: (1) viscose/elastic (viscose fabric with lycra), (2) cotton/elastic (cotton fabric with lycra), (3) 100% cotton, and (4) mercerized fabrics. The performance of marketing function is being periodically evaluated according to the formulas developed in the previous section for the case of the four groups of fabrics above. The four "right" indices (C, P, V, E) are found and converted into overall marketing effectiveness index θ. Regarding the performance evaluation of the production function, on the other hand, rather a pragmatic approach is being employed because of the nature of the function $g(\pi, \sigma)$ as well as the relative strategic importance of the above four product groups. As can be observed from Table 1, the premium Π per unit of RFT production is defined as the product of three multipliers; namely, profit and technology multiplier (Column A), strategic multiplier (Column B) and base multiplier (Column C). The profit and technological multiplier indicates the relative importance of the product group in question with respect to "base" product, which is the bleached fabric having the simplest technological process and the lowest profitability. For instance, the viscose elastic fabric group has the value of $g(\pi, \sigma)$ = 8, indicating that it has 8 times more important than the "base" group bleached fabric with respect to profitability and technological difficulty. In a sense, the profit and technology multiplier is in fact the function $g(\pi, \sigma)$ as perceived by the managers using their "mental" models. The strategic multiplier is the commercial importance of the product group in question relative to the base product group "bleached fabric". The base multiplier is the premium to be given per unit of RFT production for the "base" product group, bleached fabric. This multiplier value of $ 32 per ton of RFT production is found by taking into consideration the company premium percentage F and total wages B.

The last column in Table 1 includes the amounts of premium to be paid per ton of RFT production. Suppose that the quantities produced of each product group are as follows: viscose/elasthane fabrics = 40 tons, cotton/elasthane fabrics = 45 tons, cotton fabrics = 20 tons, mercerized fabrics = 15 tons, a total of 120 tons of fabrics. If all quantities were of the RFT production type, then the total amount of premium would have been $TP = (40)(512) + (45)(448) + (20)(192) + (15)(960) = \$58{,}880$. However, there are non-RFT quantities. For the transitional implementation, a pragmatic approach is being used. The actual time spent to make orders is analyzed and divide into two parts: the RFT time *t* needed to make the actual orders and the time wasted τ for repairs and reprocessing. Then the additional cost (energy, dyestuff, chemicals, labor, etc.) incurred during the time wasted τ is estimated. Now the question is how much RFT quantity is to be produced in order to recover the additional cost due to repairs and reprocessing. The corresponding RFT quantity is found by dividing the additional cost by the unit profit. This corresponding RFT quantity is deducted from the total quantity produced. The result is the net total RFT quantity Q, the quantity that is to be used in estimating the amount of total premium TP to be distributed to the workers of the fabric production line.

Table 1: The Function $g(\pi,\sigma)$ in Table Format

Product Group	Profit and Technology Multiplier $g(\pi,\sigma)$ A	Strategic Multiplier B	Base Multiplier $h(F,B)$ C	Premium per Ton of RFT Production Π = (A)(B)(C)
Viscose Elastic Fabric	8	2	32	$ 512
Cotton Elastic Fabric	7	2	32	$ 448
Cotton Fabric	6	1	32	$ 192
Mercerized Fabric	15	2	32	$ 960
Bleached Fabric (Base Product for Comparison)	1	1	32	$ 32

At the time of writing this paper, the transitional implementation is over and the infrastructure for the full implementation is being put in place. Some details of the full implementation are given below.

Stage 2: Full Implementation

The data and information needed for the full implementation of the methodology presented in Section 3 can be summarized, in connection with Figure 3 and Figure 5, as in Table 2 below.

Table 2: Data and Information and Their Sources

Data and Information	The Source
Marketing Function	**Marketing Function**
• Right Customer Portfolio	• Management and Marketing Department
• Right Product Portfolio	• Management and Marketing Department
• Right Pricing	• Management and Marketing Department
• Right Quantity	• Management, Company ERP
• Competitive Marketing Index	• Performance Management System
• Earned Premium	• Performance Management System
Production Function	**Production Function**
• Non-RFT Quantities	• Quality Control Department
• Impacts of Non-RFT Quantities	• Management, OrgaTEX, SKADA
• Adjusted Equivalent RFT Quantity	• Management, OrgaTEX, SKADA
• Total Wages	• Human Resources
• RFT Capacity	• Management, OrgaTEX, SKADA
• Profitability	• Management and Marketing Department
• Production Difficulty	• Management and Company ERP
• Company Incentive Rate	• Management
• Production Incentive Rate	• Performance Management System
• Premium per RFT Production	• Performance Management System
• Total Premium	• Performance Management System

The OrgaTEX system, in summary, is software that enables collecting and processing data from dye machines on real-time basis for production control and reporting purposes. The OrgaTEX system is used to schedule production on dye machines as well as reporting the actual performance of each machine in terms of batches, parties, and orders. More specifically, the OrgaTEX system is useful in analyzing the performance of each dye machine: actual time used for a batch against theoretical or programmed time needed to do the same batch. It also reports when there are additional use of chemicals and dyestuff. This analysis is the basis of evaluating the performance of the production function in the dye house.

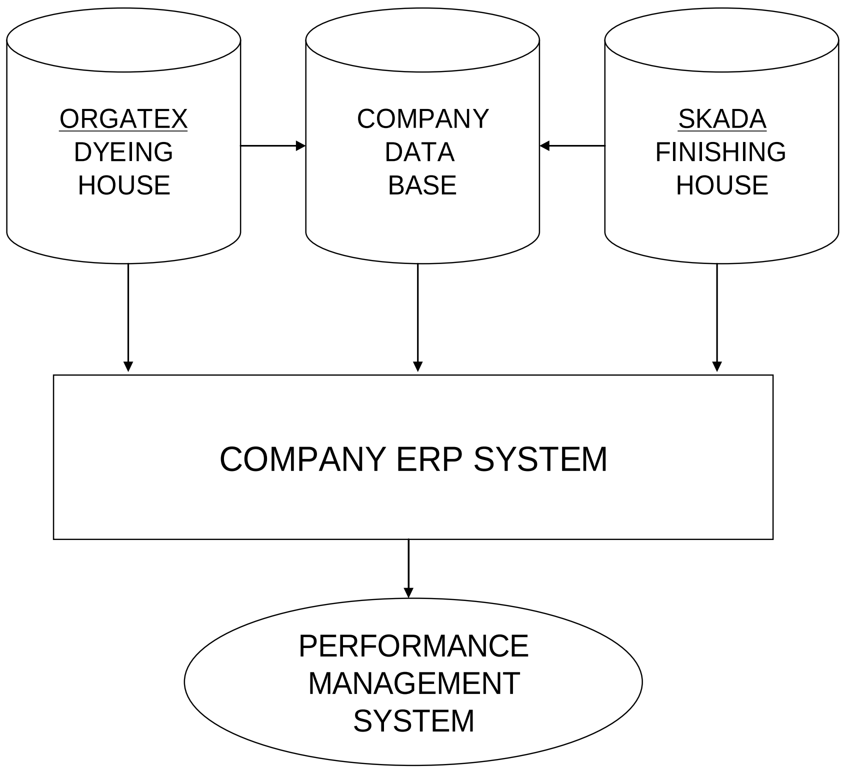

Figure 7: IT Infrastructure for Performance Management System

Dyed fabrics go to finishing house for chemical and mechanical treatment to make the final fabrics according to their specifications. In the case of finishing house, the system used for controlling production and analyzing performance is a combination of hardware and software called SKADA. Like OrgaTEX, SKADA also serves the same purpose; that is, it provides means of comparing the theoretical or programmed parameters inputted into system for treatment with the actual values of the parameters. Analyzing the differences between the programmed values and actual values of the treatment parameters, one is able to evaluate the performance of the production function in the finishing house.

The feature of IT infrastructure for the implementation of the methodology developed is rather important because of the nature and frequency of performance evaluation. It is envisaged that the performance evaluation will be conducted on a monthly basis first and then weekly once the system is fully operational. Figure 7 summarizes the IT infrastructure for PMS in connection with company ERP system and data bases.

5. CONCLUDING REMARKS

This paper presented a methodology for designing and implementing a PMS in textile company. It accentuates the importance of the integration of marketing and production functions for creating and sustaining competitive advantage. Especially the importance of the performance management strategy “right activity right-the-first-time” is emphasized. This kind of approach has been forced on the company because of the very nature of global competition. It is also in line with the research agenda suggested in the area (Den Hartog, Boselie, Paauwe 2004.)

Also discussed was, albeit briefly, the two phases of the implementation in terms of data and information and IT architecture. It is the intention of the authors to continue to work on the current PMS from the perspectives of human resources management and organizations behavior. It is of great interest to study how such a PMS is instrumental in motivating people and creating competitive advantage.

It should also to be noted that no PMS can totally replace management and make it a routine. There will always be a need for the judgment, intervention, and guidance of management to develop and motivate company people to perform better. However, the PMS as presented in this paper will reduce the work load of management. Moreover, efforts in this direction are also instruments for learning and effective communication among company people. The reader is referred to Arthur (1994) and Ukko *et al* (2007) for more detailed discussions on these issues.

REFERENCES

Abernathy, W.J., K.B. Clark, A.M. Kanton, "The New Industrial Competition," 1981, September-October, *Harvard Business Review,* pp.68-81.

Amoako-Gyampah, K. And M. Acquaah, "Manufacturing Strategy, Competitive Strategy and Firm Performance: An Empirical Study in a Developing Economy Environment," *International Journal of Production Economics,* 2008, Vol.111, pp.575-592.

Arthur, J.B., "Effects of Human Resource Systems on Manufacturing Performance and Turnover," *Academy of Management Journal,* 1994,Vol.37, pp.670-687.

Chen, K.S., M.L. Huang, P.L. Chang, "Performance Evaluation on Manufacturing Times," *International Journal of Advanced Manufacturing Technology,* 2006, Vol.31, pp.335-341.

Chee-Cheng, C. and C. Wen-Ying, "Customer-Focused and Product-Line-Based Manufacturing Performance Measurement," *International Journal of Advanced Manufacturing Technology,* 2007, Vol.34, pp.1236-1245.

Den Hartog, D., P. Boselie, J. Paauwe, "Performance Management: A Model and Research Agenda," *Applied Psychology: An International Review,* 2004,Vol.53, No.4, pp.556-569.

Dutta, B.K., W.R. King, "A Competitive Scenario Modeling System" *Management Science*, 1980, Vol.26, No.3, pp.261-273.

Hayes, R.H. and S.C. Wheelwright, *Restoring Our Competitive Edge: Competing Through Manufacturing,* 1984, Wiley, New York, N.Y.

Kaplan, R.S. and D.P. Norton, "The Balanced Scorecard: Measures That Drive Performance," *Harvard Business Review,* January-February 1992, Vol.70, pp.71-79.

Kaplan, R.S. and D.P. Norton, "Putting the Balanced Scorecard to Work," *Harvard Business Review,* September-October 1993, Vol.71, pp.134-142.

Karnani, A., "Equilibrium Market Share – A Measure of Competitive Strength," *Strategic Management Journal,* 1982, Vol.3, pp.43-51.

Karnani, A., "Generic Competitive Strategies – An Analytical Approach," *Strategic Management Journal*, 1984, Vol.5, pp.367-380.

Karnani, A., "Strategic Implications of Market Share Models," *Management Science,* 1985, Vol.31, No.5, pp.536-547.

Oral, M., "A Methodology for Competitiveness Analysis for Strategy Formulation in Glass Industry," *European Journal of Operational Research,* 1993, Vol.68, No.1, pp.9-22.

Oral, M. And C-R. Dominique, "An Analytical Approach to Competitive Strategy Formulation in Mature Industries," *IIE Transactions,* 1989, Vol.21, No.3, pp.271-278.

Oral, M., "An Industrial Competitiveness Model," *IIE Transactions,* 1986, Vol.18, No.2, pp.148-157.

Porter, M.E., *Competitive Strategy: Techniques for Analyzing Industries and Competitors,* 1980,Free Press, New York, N.Y.

Porter, M.E., *Competitive Advantage,* 1985, Free Press, New York, N.Y.

Prahalad, C.K. and G. Hamel "The Core Competence of the Corporation," *Harvard Business Review,* 1990 March-April, Vol. 68, pp.79-91.

Skinner, W., "Manufacturing – Missing Link in Corporate Strategy, *Harvard Business Review,* 1969, Vol.47, pp.136-145.

Rathore, A., R.P. Mohanty, A.C. Lyons, N. Barlow, "Performance Management Through Strategic Total Productivity Optimization," *International Journal of Advanced Manufacturing Technology,* 2005, Vol.25, pp.1020-1028.

Ukko, J., J. Tenhunen, H. Ramtanen, "Performance Measurement Impacts on Management and Leadership: Perspectives of Management and Employees," *International Journal of Production Economics,* 2007, Vol.110, pp.39-51.

Ward, P.T. and R. Duray, "Manufacturing Strategy in Context: Environment, Competitive Strategy and Manufacturing Strategy," *Journal of Operational Management,* 2000, Vol.18, pp123-138.