Delayed Differentiation Strategy: An Alternative Option to Customer Satisfaction and Business Performance

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Abstract

This paper seeks to obtain a better understanding of the extent to which delayed differentiation strategy within the Malaysian manufacturing companies enhances the level of performances in the industry. This paper presents the findings from an empirical study examining the relationship between, delayed differentiation strategy, customer relationship performance and business performance in the Malaysian manufacturing industry. Few have attempted to investigate the relationship between delayed differentiation strategy and performance. It is said that delayed differentiation strategy has the potential to not only enhance customer relationship performance but also improve bottom-line results. However, the link of delayed differentiation strategy to performance in the manufacturing industry in Malaysia has not been fully addressed in empirical studies. To address this issue, this study investigates the impact of delayed differentiation strategy or postponement strategy on performance in the Malaysian manufacturing industry using Pearson's correlation analysis, cluster analysis, Friedman's rank test and structural equation modeling. The result of the study reveals that postponement concept, in particular, appears to be of primary importance and exhibit significant impact on customer relationship performance and business performance. Findings of the study provide a striking demonstration on the importance of implementing effective postponement concept for Malaysian manufacturing industry in enhancing its strategic competitiveness.

Keywords: *delayed differentiation strategy, customer relationship performance, business performance, malaysian manufacturing companies, supply chain management, structural equation modeling.*

1. Introduction

Delayed differentiation strategy or postponement strategy refers to postponing or delaying some product differentiation processes in a supply chain as late as possible until the supply chain is cost effective. Generally, the postponement strategy means delaying supply chain activities purposefully, until the customers' order is received. There is a diverse degree of a delay, which is mostly determined by appropriate locations of material decoupling points in a flow of products among parties in a supply chain (Świerczek, 2010). A delayed differentiation strategy aims at

delaying some supply chain activities until customer demand is revealed in order to maintain both low systemwide cost and fast response in order to satisfy customers better. This concept advocates that commitment, as to the form and place of commodities, can be delayed to the latest possible point in the supply chain. The point of product differentiation is close as possible to actual order information. Delayed differentiation or postponement, which is the ability to generate such major supply chain enhancement has not gone unobserved by practitioners (Boone, Craighead, & Hanna, 2007). Postponement has been shown to be an effective supply chain strategy from an inventory-reduction, service-level improvement standpoint. It was only about fifteen years ago that logistics researchers started to classify and learn the concept (Zinn & Bowersox, 1988). Since then, delayed differentiation or postponement strategy has become one of the most popular current discussions especially in relation to supply chain management (SCM). Many industries focus on improving the efficiency of their supply chains. One key initiative that is commonly mentioned is postponement concept between partners in a supply chain (Lee, So, & Tang, 2000). Traditional production-distribution schemes have been dramatically changed due to globalization. New partnership relationships among suppliers, manufactures, retailers and other parties have replaced the conventional free market structures (Yu, Yan, & Cheng, 2001). Supply chain management emphasizes the overall and long-time benefit of all parties on the chain through cooperation and postponement concept between members (Yu, Yan, & Cheng, 2001). An effectively designed and integrated supply chain is considered a source of competitive advantage (Ramdas & Spekman 2000). Delayed differentiation or postponement the technique of delaying final product configuration until the actual order is inenables a company to respond more quickly to market demand while lowering inventory costs. Yet, despite these powerful benefits, relatively few have pursued this strategy. A new survey of supply chain practitioners examines the reasons behind the hesitancy and confirms that, for many companies, the time is right to embrace postponement.

Global market demand is difficult to forecast in times of economic uncertainty. It is even more challenging when you add the competitive pressures of globalization, shorter product cycles, mass customization, and outsourcing. To manage inventory effectively in this environment, companies must anticipate not only when demand will rise but also when it will taper off. Not having sufficient inventory early in the product cycle can cost market share. Yet, products at the end of their lifecycle lose value quickly and risk obsolescence, which can lead to large inventory write-offs. Further complicating the demand challenge is the fact that customer demand for product specification is increasing, and companies must produce several versions of each model. Many manufacturers and retailers today are turning to postponement, or a delayed differentiation strategy, to strike the right inventory balance at all points in the product lifecycle. By holding inventory in a less-finished state that is, postponing final product assembly until actual customer demand is known companies can respond more quickly to market opportunities and offer greater customization options. However, adopting a postponement strategy typically requires a

fundamental redesign of manufacturing processes that typically have been in place for a decade or more. Postponement also calls for a high degree of collaboration and visibility across the supply chain. In short, it is not an easy task. Efficient management of a supply chain comprises thinking creatively about how to incorporate and execute logistics and manufacturing activities (Pagh & Cooper, 1998). Postponement or delayed product differentiation and speculation strategies present opportunities attain delivery of products in a timely and cost-effective way of reorganizing the conventional production and logistics structures, which are often designed and administered separately. In other words, postponement is an orderly method for designing and developing standard, configurable products that can be differentiated, quickly and inexpensively, once real customer demand is identified. Delayed differentiation strategy or postponement strategy is one of the business strategies that maximizes potential benefit and reduces risk by delaying additional investment into a product or service until the last possible moment. Delayed differentiation or postponement strategies can take various forms, such as:

1. Purchasing postponement - Delay purchasing of some expensive and fragile materials
2. Manufacturing postponement - Products in semi-finished forms and can be customized quickly in production facilities
3. Logistics postponement - Products in semi-finished forms and can be customized quickly in production facilities close to customers
4. Time postponement - Finished products are kept in central location and are distributed quickly to customers

This paper explores the role of postponement concepts in association with customer relationship performance and business performance in the Malaysian manufacturing industry. Empirically, the purpose of this study is to present an explicit result on the relationship between postponement concept and performance where other researchers have perhaps known or described them only implicitly. Since the link of postponement concept to performance in the manufacturing industry in Malaysia has not been fully addressed in empirical studies, the result of the study would fill a gap that exists in the literature on the importance of postponement concept in Malaysia. Thus, the main objectives of this paper are:

(1) To empirically determine whether postponement concept has significant association or impact on customer relationship performance.
(2) To empirically discover whether postponement concept has significant association or impact on business performance.
(3) To empirically assess the importance of each postponement concept practices.

2. Literature Review

The concept of delayed product differentiation or postponement beyond manufacturing has been discussed for over 50 years (Bucklin, 1965). Bucklin (1965) provided arguments on how postponement differentiation would be tough in manufacturing environment

mainly operating on a make-to-stock basis. However, as companies started to shift from the traditional make-to-stock to make-to-order policy, delayed differentiation has become an attractive option. Zinn and Bowersox (1988) described varying types of postponement that could be implemented in the supply chain and these include labeling, packaging, assemblying, manufacturing (form delayed differentiation) and time delayed differentiation. The different types refer to the different points in the supply chain where postponement customizes semi-finished product into an end product after understanding the customer demand (Zinn & Bowersox, 1988). Postponing product differentiation of different assembly can slash product expenditure (Zinn, 1990). Postponement that signifies a main option to sales-forecast allocation, offers a chance for firms to distinguish themselves from their competitors by presenting customers with wider variety of products while keeping a low investment in inventory. A decade later, extending the ideas of Zinn et al. (1988), Pagh and Cooper (1998) developed a straightforward and conceptual model to clarify the range of delayed product differentiation strategies that could be applied by companies.

Four generic strategies were identified; full speculation, logistics delayed product differentiation, manufacturing delayed product differentiation and full delayed product differentiation (Pagh & Cooper, 1998). The full speculation strategy signifies an absolute confidence in forecasting, whereby the manufacturing operations are carried out before the product is sent to the market. Manufacturing postponement represents form based postponement while logistics delayed product differentiation represents time delayed product differentiation. The strategy of full delayed product differentiation represents the highest level of delay in the supply chain. The preference about which strategy to use is fundamentally a trade-off between diverse levels of customer service and inventory, production and distribution costs. Li et al. (2002), developed the economic-order-quantity (EOQ)-based model with perishable items to evaluate the impact of a form postponement strategy on the retailer in a supply chain. They worked out models for a postponement system and an independent system to lessen the total average cost function per unit time for ordering and keeping perishable end products.

Gregory and Michael (2006) found in their exploratory depth interviews with company managers that product integrity, operations scheduling, and organizational readiness may affect postponement implementation. Theoretical analysis and computational results by Li et al. (2006) showed that a postponement strategy for perishable items can give a lower total average cost under certain conditions. Postponement strategy has been revealed to be an efficient supply chain strategy from an inventory-reduction, service-level enhancement viewpoint (Graman & Magazine, 2006). While investment choices have to be made years before demand is known, pricing decisions can simply be postponed until product commencement, when more precise demand information is obtainable (Biller, Muriel, & Zhang, 2006). Their computational experiments illustrated that allowing for price delayed differentiation at the planning stage leads to a big decrease in capacity investments, especially in the more expensive flexible capacity, and a considerable increase in earnings. Biller et al. (2006) found that demand correlation, elasticity and diversion, ratio of fixed to variable

capacity costs, and uncertainty remaining at the time the pricing and production decisions are made, all have an impact on a firm's profit. In contrast to earlier findings, the delayed differentiation strategy is highly triumphant in a broad variety of industries that need high differentiation such as high-tech industry, food industry, and fashion industry (Jian, Cheng, & Shouyang, 2007). Applying a postponement strategy involves basic modification to a firm's manufacturing processes and internal operations.

When the supply chain has an unbalanced structure, it should employ purchasing postponement strategy or product development differentiation strategy (Yeung, Selen, Deming, & Min, 2007). Li et al. (2007) found that postponement strategy can provide a lower total average cost under certain circumstances. However, analysis shows that implementing postponement at the firm level can result in the supply chain carrying more inventories. In order to attain its full potential, postponement needs to be applied across organizations in the supply chain (García-Dastugue & Lambert, 2007). In short, the capability of an organization to implement a successful postponement strategy depends on how well it can adapt the process and product uniqueness to the market requirements.

Mass Customizing and Postponement

Every customer need is different. By putting the "custom" into the "customer", a company can create differentiated products. This strategy can only be designed-in at the "develop" stage of supply chain management. Postponement or delayed configuration is a strategy to design products using a common platform, components or assemblies and pushing back final customization towards the point of customers' order when actual customers' requirements become clearer. Thus, mass customization allows a wide variety of products to be offered at lower total cost.

Postponement is a systematic approach to designing and developing standard, configurable products that can be differentiated quickly and inexpensively once actual customer demand is known. This model allows companies to transit from a "push"-oriented supply chain to a "pull" or a demand-driven supply chain. Implementing a postponement strategy involves fundamental changes to a company's manufacturing processes and internal operations. Most companies follow traditional manufacturing practices—mass-producing finished products in predetermined, set quantities. That is about as straightforward as it gets. In sharp contrast, stopping production at a generic product state and offering a range of different configurations and options, requires a flexible, just-in-time production model. If poorly implemented across the supply chain, such mass customization can result in cost overruns and longer lead times. Postponement is a systematic approach to designing and developing standard, configurable products that can be differentiated, quickly and inexpensively, once actual customer demand is known.

Postponement is not a new concept. The reluctance to leave inventory in a less finished state and therefore, further from the customer is understandable.

Delayed differentiation strategy or postponement, as a concept, is counter-

intuitive (like leaning away from the mountain when learning to ski). Instead of warehouses full of ready-to-ship products, inventory requires customization, light assembly and packaging before an order can be filled. Configure-to-order production demands a high degree of collaboration and visibility across the supply chain.

Outsourcing adds another layer of complexity. As more of the value chain moves outside of the organization, the company is increasingly reliant on outside suppliers and contract manufacturers. While outsourcing partnerships enable Original Equipment Manufacturers (OEMs) to improve their financial performance and focus on their core competencies, there is a downside in terms of inventory. Incorrect decisions increase procurement costs, and if products do not move, the costs are unrecoverable. Therefore, postponement strategies must manage variability in supply, as well as demand, and recognize that cost and risk characteristics will change over time. A delayed differentiation strategy or postponement strategy also is dictated by the product lifecycle; not having the right inventory early in the lifecycle will mean missing customer service level targets and the opportunity to gain market share. Products at the end of their life cycle lose value quickly and risk obsolescence, resulting in costly write-offs. Moreover, if old products are held in a generic state, their components and parts can be 'recycled' for next-generation products.

Delayed differentiation strategy or a postponement implementation involves fundamental changes to a company's manufacturing processes and internal operation. Product design and production must be restructured to support product standardization and design modularity. The company must convince its supplier and partner network to go along with pushing the point of product differentiation closer to the customer. As any supply chain professional knows, deviating from standard business practices will have seismic ramifications up and down the supply chain. For comparison purposes, think of coordinating relay races where the final destination is not known until mid-way through each event - that is, from the point of standardization, forward. With a conventional production model, each business unit within the company and each supplier performs a discrete job (the equivalent of running a leg of the race) and then 'passes the baton' to the next group. With postponement, teamwork is critical. When the order specifications are known, the supply chain partners must respond by pulling in the right people and gearing production accordingly. Delayed differentiation strategy or postponement will only succeed if customized products are turned around within a reasonable time frame.

Delayed differentiation strategy or postponement adopters are finding innovative ways to support delayed differentiation, such as transforming warehouses into advanced fulfillment centers to perform customization of goods at a point closer to the consumer. Instead of pre-configuring products for different languages and countries, products are shipped in a generic state, in bulk, to these regional centers. The final customization, assembly and packaging are undertaken as orders come in. From an operational and logistical standpoint, this is the preferable model for a multinational product vendor. Bulk shipments of 'raw' equipment are

considerably less expensive to ship and store than 'shrink-wrapped' products. Moreover, with common inventory, companies can more effectively forecast market fluctuations in world markets. Now, if a shortage exists in one market, excess inventory from another can be sent to close the gap.

Delayed differentiation strategy or Postponement and Performance

By pushing the point of product differentiation closer to the customer, postponement can improve service levels and delivery performance, while reducing inventory investments and improving margins. Implementing a delayed differentiation strategy requires major business process alignment and greater organizational accountability. Advancements in supply chain management (SCM) and information technology have minimized, and often eliminated, many of the risks traditionally associated with the implementation of postponement. Enterprise software solutions built around a unified data infrastructure provide the collaborative platform for coordinating activities internally, and with suppliers, partners and customers. Inventory optimization solutions enable decision making about where to postpone, when to postpone and how to postpone across product groups. Successful delayed differentiation strategy or postponement implementation will turnaround orders at acceptable market levels. Therefore, it is imperative that the customization process gets underway as soon as possible.

Automating and standardizing business processes across the enterprise is critical in meeting competitive service and delivery targets. Delayed differentiation strategy or postponement will be most effective when companies have implemented strategic sourcing and formal buying strategies, such as vendor-managed inventory (VMI) or consignment, to reduce financial risk, supply variability and lead times. At the heart of postponement is a company's ability to maintain competitive service and delivery performance levels. The most important benefits of a successful postponement implementation are improving customer satisfaction while minimizing inventory costs. Another chief benefit noted is increased flexibility that increases a company's ability to offer a wider range of customized goods.

Customers reportedly are seeing improved fill rates and decreased lead times. The company and its suppliers enjoy reductions in inventory costs through better resource planning and allocation. This is attributed both to shorter forecast cycles and shifting inventory upstream to a less expensive generic state. Overall, delayed differentiation strategy or postponement's primary benefits are to reduce the effects of market uncertainty and to meet customer needs, while effectively managing supply chain costs.

In summary, the time is right for postponement and the benefits of a well-implemented strategy will deliver new 'highs' and 'lows'; lower overall supply chain costs, lower inventory obsolescence, lower procurement costs, lower infrastructure costs (i.e., people, process, technology, equipment) and lower manufacturing and shipping costs, as well as, higher order fulfillment accuracy and higher levels of customer satisfaction.

3. Theoretical and Conceptual framework

The underpinning theory that governs the theoretical framework of this paper is program theory. Program theory (Weiss, 1998) focuses on the model underlying a policy program. Program theory links inputs with activities to outcomes. For instance, a delayed differentiation strategy or postponement concept geared to identify new strategies for better decision making, provides a rationale for the program with a variety of causal variables related to performance as the dependent variable. In other words, program theory describes what the intended intervention is expected to do and an explanation of the underlying rationale for achieving the expected results. Weiss (1998) defined program theory as 'theories of change' relating programs to desired outcomes. The relationship performance and business performance. Delayed differentiation strategy or program investigated in this study is postponement concept. The outcomes here refer to customer postponement concept creates value by focusing on key performance gap which in turn helps a company to identify new ideas for better decision making in order to push the company ahead. Delayed differentiation strategy or postponement concept makes it easy to identify the gap between where the organization would like to be and where it actually is. This gap provides a measure of the improvement that organizations need to make. Ignoring this gap will in turn decrease long-term survival opportunities. The delayed differentiation strategy or postponement concept improves processes and helps to meet customer expectations better. As a result, it will enhance the company's performance against its competitors. All programs have an underlying logic, or a set of explicit and often, implicit assumptions that suggest how the desired outcomes should be affected by variables in their context, as well as by program inputs and processes. The underpinning logic model represents the "program theory" (Bickman, 2000; Suchman,1967). The program theory is most obvious if there are clearly stated program goals, such as performances. When less evident, managers are useful "key informants" on a program's theory, and should be tapped for this information.

This paper explores the relationship among delayed differentiation strategy or postponement concept, customer relationship performance and business performance within the context of the Malaysian manufacturing industry. The proposed conceptual model, as depicted in Figure 1.

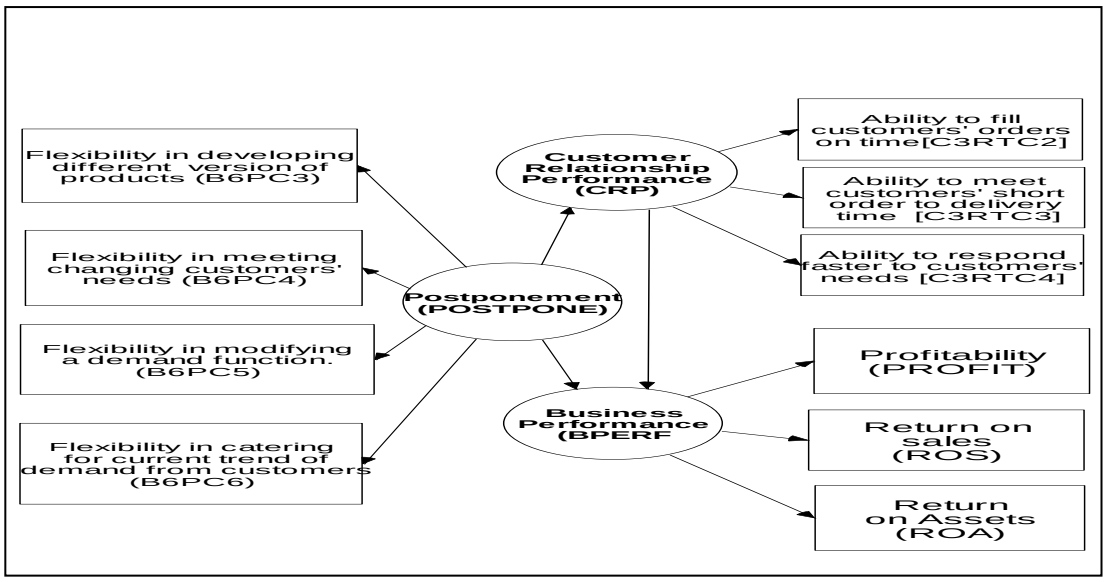

Figure 1. The conceptual model linking delayed differentiation strategy or postponement strategy, customer relationship performance and business performance

Four dimensions of postponement concept identified from several sources (Zairi, 1998; Murray, 1997; Mabert, 1992; Richman & Zachary, 1993) are considered to relate to distinctive features of postponement concept and are therefore incorporated in the present conceptual model (Figure 1). These delayed differentiation strategy or postponement concept dimensions include; 'Flexibility in developing different version of products'- (B6PC3), 'Flexibility in meeting changing customers' needs '- (B6PC4), 'Flexibility in modifying a demand function' - (B6PC5) and 'Flexibility in catering for current trend of demand from customers ' - (B6PC6). Meanwhile, customer relationship performance is based on three pertinent dimensions; namely, 'Ability to fill customers' orders on time' (C3RTC2), Ability to meet customers' short order-to-delivery time cycle' (C3RTC3) and 'Ability to respond faster to customers' needs' (C3RTC4) (Kotler 1994, McGaughey, 1991). Lastly, business performance in this study is derived from three important business performance variables, which comprise profitability (PROFIT), return on sales (ROS) and return on assets (ROA).

4. Hypotheses

The underlying premise of this study is the notion that postponement concept determinants have influence on the overall results such as customer relationship performance and business performance. A structural model is used in this study to analyze the structural effect of postponement concept on performance results. Therefore, the following hypotheses are put forward:

H_1: Postponement concept in SCM has a positive structural effect on customer relationship performance.

H_2: Postponement concept in SCM has a positive structural effect on business performance.

H_3: Customer relationship performance has a positive structural effect on business performance.

In investigating the structural effect of postponement concept on overall results such as customer relationship performance and business performance, it is also pertinent to determine the structural loadings of each postponement determinants. Therefore, this study also attempts to test the following hypotheses:

H_{1A}: Flexibility in developing different versions of product has a positive structural loading on postponement concept.

H_{1B}:Flexibility in meeting changing customers' needs has positive structural loading on postponement concept.

H_{1C}: Flexibility in modifying a demand function has a positive structural loading on postponement concept between supply chain partners.

H_{1D}: Flexibility in catering for current trend of demand from customers has a positive structural loading on postponement concept.

More importantly, this study aims to test the overall model fit based on the main null hypothesis:

H_0: The overall hypothesized model has a good fit.

For structural modeling, accepting this main hypothesis indicates that the model presented adequately reproduce the observed covariance matrix (Bollen, 1989; Joreskog, 1989; Mueller, 1996) and suggest that the data fit the proposed model.

5. Research Methodology

The instrument used in this study was a structured survey questionnaire, which consists of two major parts. The respondents were asked to indicate the current practice in the SCM including postponement concept based on the scale of 1 (very low degree of current practice) to 7 (very high degree of current practice). In order to capture the multi-dimensional nature of performance measures, this study divided the performances into two types: 1) customer relationship performance and 2) business performance. Sampling frame was derived from the Federation of Malaysian Manufacturers Directory-FMM.

Two hundred responses were received from a total of 300 sample companies chosen which represent 67 percent response rate. The primary purpose of the research is to measure senior production managers' and SCM managers' perception of lean production and to gain insight into the benefits of implementing lean production in the manufacturing industry. The goal is to understand and find determinants of lean production that can enhance customer relationship performance and bottom line result (profitability, return on sales and return on assets). Face-to-face interviews with production managers were carried out to ensure accuracy of information, validate the outcome of analysis and develop an understanding of practical aspects of lean production principles adoption.

Table 1: Descriptive Statistics of Critical Variables.

Postponement concept determinants:	Mean	Std. Dev.	Exploratory Factor Analysis – EFA(Varimax Rotation)		
			Factor Loadings1 (Lean)	Factor Loadings2 (CRP)	Factor Loadings3 (BP)
Flexibility in developing different version of products (B6PC3)	5.2200	1.25278	**.831**	.113	.132
Flexibility in meeting changing customers' needs (B6PC4)	5.3900	1.17251	**.863**	.213	.117
Flexibility in modifying a demand function. (B6PC5)	5.2700	1.18496	**.854**	.127	.155
Flexibility in cateringfor current trend of demand fromcustomers (B6PC6)	5.3000	1.11635	**.845**	.200	.188
Customer Relationship Performance (CRP):					
Ability to fillcustomers' orders on time [C3RTC2]	5.1900	1.13150	.188	**.866**	.285
Ability to meetcustomers' short order-to-delivery cycle time[C3RTC3]	5.1600	1.14935	.213	**.865**	.274
Ability to respondfaster to customers'needs [C3RTC4]	5.3000	1.04665	.192	**.869**	.284
Business Performance:					
Profitability (PROFIT)	4.9550	1.20007	.206	.215	**.837**
Return on Sales (ROS)	4.8900	1.23105	.171	.289	**.876**
Return on Assets (ROA)	4.8350	1.15952	.144	.327	**.862**

Table 2: Factor Analysis and Reliability Test

CONSTRUCT	Exploratory Factor Analysis –EFA (Varimax Rotation)			Confirmatory Factor Analysis - CFA		Reliability Test
	Eigenvalue	% of Variance Explained	Cumulative Variance Explained	GFI	CFI	Cronbach's Alpha
Postponement concept	3.089	30.887	30.887	0.903	0.906	0.870
Customer Relationship Performance	2.603	26.032	56.919	0.985	0.994	0.957
Business Performance	2.539	25.386	82.305	0.996	0.998	0.969

Extraction Method: Principal Component Analysis.
Rotation Method:Varimax with Kaiser Normalization (KMO= 0.859),
Bartlett's Test of Sphericity (Chi-Square)= 1513.410 (p=0.000)

Exploratory factor analysis, confirmatory factor analysis and Cronbach's reliability analysis were used to select and assess the final items that would be used for hypothesis testing. The critical variables of postponement concept in this study had content validity because an extensive review of the literature was conducted in selecting the measurement items. The postponement concept determinants in this study were adopted from prominent studies or sources (Zairi, 1998; Murray, 1997; Mabert, 1992; Richman & Zachary, 1993). In the initial data analysis, the four determinants of postponement concept were subjected to validity and reliability tests. Exploratory factor analysis was conducted to investigate whether the constructs as described in the literature fit the factors derived from the factor analysis. The result from the factor analysis indicates that the KMO (Kaiser-Meyer-Olkin) measure is 0.887 with significant chi-square value (Barlett's Test of Sphericity). The value of KMO in this analysis surpasses the threshold value of 0.60 as recommended by Hair et al. (1998). All variables or determinants

exhibit high factor loadings and fall into the designated factors. This result provides evidence to support the theoretical conceptualization of each construct. In addition, confirmatory factor analysis (CFA) or a measurement model using AMOS 5 was employed for examining construct validity of each scale by assessing how well the individual items measured the scale (Ahire et al., 1996). The goodness of fit indices (GFI) and comparative fit index (CFI) of the exogenous determinants exceeded the 0.90 criterion suggested by Hair et al. (1998), hence, establishing the construct validity (see Table 2). The reliability analysis was conducted by calculating the Cronbach's alpha for the main constructs. The result shows that the Cronbach's alpha measures for the main constructs exceeds the threshold point of 0.70 suggested by Nunnally (1978). Alpha coefficients for postponement concept scales and performance scales ranged between 0.954 and 0.962 after the alpha maximization processes were carried out (Table 2).

6. Preliminary Results

(a) Correlations between Postponement Concept, Customer Relationship Performance and Business Performance

As a preliminary analysis, Table 3 exhibits correlation among the postponement variables as well as the result of multicollinearity statistics. The result indicates that the postponement determinants have significant correlations with one another. In addition, it suggests that those practices complement each other and need to be implemented in a holistic manner. Furthermore, the collinearity test did not indicate any multicollinearity problem. Table 4 and Table 5 exhibit Pearson's correlations between postponement determinants and customer relationship performance as well as business performance. Most of the customer relationship performance indicators have high correlations with postponement concept especially with determinants, 'Flexibility in catering for current trend of demand from customers' and 'Flexibility in meeting changing customers' needs'. Specifically, customer relationship performance has significant correlations with all the four postponement concept determinants. On the other hand, business performance measures such as profitability, return on sales and return on assets have significant correlations with 'Flexibility in catering for current trend of demand from customers' and 'Flexibility in modifying a demand function'. These findings are consistent with several previous studies that proclaimed better organizational transformations as a result of postponement concept initiatives (Zairi, 1998; Murray,1997; Mabert, 1992; Richman & Zachary, 1993). In addition, postponement concept can eliminate waste and improve a company's market share.

Table 3: Pearson's correlation among postponement concept determinants

Postponement concept determinants		1 (B6PC3)	2 (B6PC4)	3 (B6PC5)	4 (B6PC6)	Collinearity Statistics	
						Tolerance	VIF
1	Flexibility in developing different version of products (B6PC3)	1				.445	2.249
2	Flexibility in meeting changing customers' needs (B6PC4)	.714(**)	1			.348	2.877
3	Flexibility in modifying a demand function. (B6PC5)	.610(**)	.709(**)	1		.376	2.661
4	Flexibility in catering for current trend of demand from customers (B6PC6)	.653(**)	.713(**)	.748(**)	1	.355	2.815
	1. *P≤0.05, **P≤0.01 2. All t-tests are two-tailed						

Table 4: Pearson correlation between postponement concept determinants and Customer Relationship Performance

Postponement concept determinants		Ability to fill customers' orders on time [C3RTC2]	Ability to meet customers' short order-to deliverycycle time [C3RTC3]	Ability to respond faster to customers' needs [C3RTC4]
1	Flexibility in developing different version of products (B6PC3)	.315(**)	.372(**)	.348(**)
2	Flexibility in meeting changing customers' needs (B6PC4)	.365(**)	.412(**)	.405(**)
3	Flexibility in modifying a demand function. (B6PC5)	.330(**)	.350(**)	.361(**)
4	Flexibility in catering for current trend of demand from customers (B6PC6)	.410(**)	.440(**)	.419(**)

** Correlation is significant at the 0.01 level (2-tailed).* Correlation is significant at the 0.05 level (2-tailed).

Table 5: Pearson correlation between postponement concept determinants and business performance

Postponement concept determinants		Profitability	Return on Sales	Return on asset
1	Flexibility in developing different version of products (B6PC3)	.284(**)	.309(**)	.278(**)
2	Flexibility in meeting changing customers' needs (B6PC4)	.313(**)	.308(**)	.325(**)
3	Flexibility in modifying a demand function. (B6PC5)	.341(**)	.324(**)	.278(**)
4	Flexibility in catering for current trend of demand from customers (B6PC6)	.381(**)	.353(**)	.345(**)

** Correlation is significant at the 0.01 level (2-tailed).* Correlation is significant at the 0.05 level (2-tailed).

(b) Cluster Analysis and Friedman's Test

This study also tries to highlight which of the postponement concept determinants are more emphasized or prioritized by successful companies. Since customer relationship performance and business performance are very important bottom-line outcomes, the classifications are based on average customer relationship performance and business performance clustering. Two cluster analyses were carried out to further explore on the segmentation of manufacturing companies in this study. As an example, Table 6 and Table 7 highlight further information about the cluster analysis result. The first cluster analysis categorized companies into one of two groups:

(1) "Excellent" customer relationship performers
(2) "Average" customer relationship performers

Table 6: Rankings of postponement concept determinants based on Customer Relationship Performance clustering using Friedman's rank test

Postponement concept determinants	Excellent customer relationship performers(n=134, chi-square = 7.045, significant=0.070, cluster's mean = 5.528)				Average customer relationship performers(n=66, chi-square = 2.030, significant=0.566, cluster's mean = 4.822)			
	Friedman's Test	Rank	Mean	Std Dev	Friedman's Test	Rank	Mean	Std Dev
Flexibility in developing different version of products (B6PC3)	2.43	4	5.4627	1.2545	2.36	4	4.7273	1.10308
Flexibility in meeting changing customers' needs (B6PC4)	2.68	1	5.6567	1.1246	2.61	1	4.8485	1.08475
Flexibility in modifying a demand function. (B6PC5)	2.43	3	5.4851	1.2061	2.49	3	4.8333	1.01653
Flexibility in catering for current trend of demand from customers (B6PC6)	2.47	2	5.5075	1.1355	2.55	2	4.8788	.95297

"Excellent" customer relationship performers place higher emphasis on postponement concept especially 'Flexibility in meeting changing customers' needs' and 'Flexibility in catering for current trend of demand from customers' followed by 'Flexibility in modifying a demand function' and 'Flexibility in developing different version of products'.

Since business performance is also a very important bottom-line outcome, the second classification is based on average business performance clustering. This second cluster analysis categorized manufacturing companies into two groups:

(1) "High" business performance achievers
(2) "Average" business performance achievers

From the result, we can also infer that a higher level of postponement is more prominent in "Excellent" product quality producers and "High" business performance achievers. These companies seems to prioritize 'Flexibility in catering for current trend of demand from customers', 'Flexibility in meeting changing customers' needs', 'Flexibility in modifying a demand function', and 'Flexibility in developing different version of products'. Nonetheless, the findings highlight the importance of postponement concept in both clusters.

Table. 7: Rankings of postponement concept determinants based on business performance clustering using Friedman's rank test

Postponement concept determinants	High business performance companies (n=108, chi-square = 4.850, significant=0.183,cluster's mean = 5.593)				Low business performance companies (n=92, chi-square = 6.665, significant=0.083, cluster's mean = 4.946)			
	Friedman's Test	Rank	Mean	Std Dev	Friedman's Test	Rank	Mean	Std Dev
Flexibility in developing different version of products (B6PC3)	2.39	4	5.500	1.272	2.41	3	4.891	1.153
Flexibility in meeting changing customers' needs (B6PC4)	2.60	2	5.685	1.116	2.72	1	5.044	1.147
Flexibility in modifying a demand function. (B6PC5)	2.41	3	5.528	1.211	2.49	2	4.967	1.084
Flexibility in catering for current trend of demand from customers (B6PC6)	2.60	1	5.658	1.043	2.38	4	4.880	1.057

7. The Result of Structural Equation Modeling

The relationship between postponement concept, customer relationship performance and business performance is depicted in the structural equation modeling (SEM) analysis. A structural model can be viewed as simultaneous linkages that allow a researcher to determine the relative strength of relationships between variables. In this statistical analysis, we would expect the model developed to fit the data, therefore the acceptance of the null hypothesis of the overall model is expected. Hence, in this test of goodness of fit for the SEM, the probability should be higher than 0.05.The result of the SEM analysis indicates that the resulting Chi-square value is 53.264 with 41 degrees of freedom and p-value of 0.095 (Figure 2). These findings support the null hypothesis that the SEM model has a good fit(H_0). The p-value is considerably substantial (p-value > 0.05), in supporting the main null hypothesis that the overall model fits the data.

In addition, other statistical structural indices such as Bentler comparative fit index CFI (0.993), Normed fit index NFI (0.972) and Goodness of fit index GFI (0.956) further suggest that the model has a satisfactory fit (Table 8). Since the probability value and structural modeling indices are well above the recommended level, the model is considered to be a reasonable representation of the data (Hair et al., 1998). The direct structural effect of postponement concept on customer relationship performance (0.475) is considered high, given the complex causal linkages. The direct effect of postponement concept on business performance (0.147) although low, still indicates significant and positive linkage. The findings also suggest the importance of postponement determinant especially 'Flexibility in catering for current trend of demand from customers', 'Flexibility in meeting changing customers' needs', 'Flexibility in modifying a demand function' and 'Flexibility in developing different version of products' in improving customer relationship performance and ultimately business performance in the Malaysian manufacturing industry. Therefore, there is enough evidence to accept the proposition that postponement strategy has positive and significant structural effect on customer relationship

performance(H_1). Postponement also demonstrates positive significant direct effect on business performance(H_2), and customer relationship performance exhibits significant direct effect on business performance(H_3).

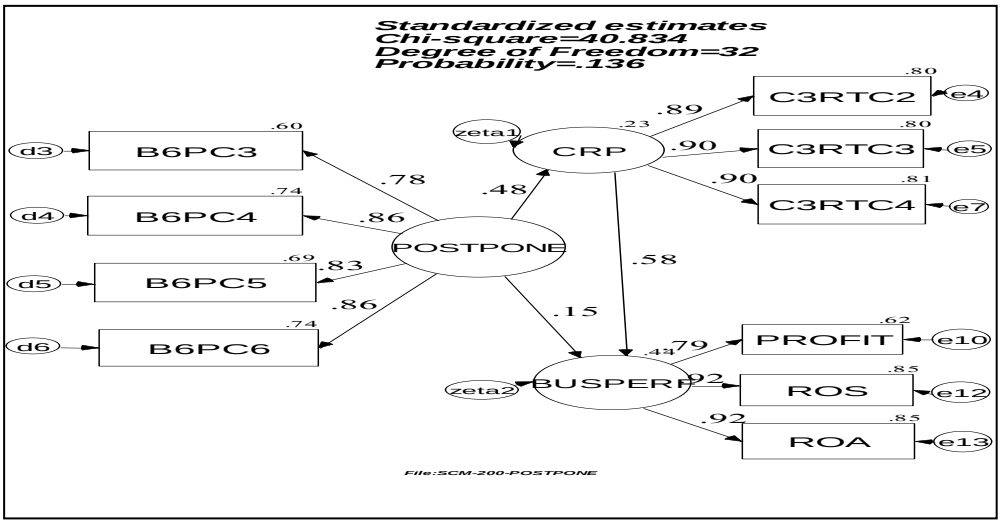

Figure 2: The structural model showing the structural linkage between postponement concept, customer relationship performance and business performance.

Using SEM, the impact of postponement concept on customer relationship performance and business performance were investigated simultaneously. In addition, SEM is able to measure the magnitude and contribution of those constructs. The SEM results suggest that postponement strategy has positive effects on customer relationship performance and ultimately improve business performance.

Table 8: Measurement results of SEM model

Statistics	Model Values	Recommended * values for good fit
Chi square	53.264	-
Probability Level	0.095	≥ 0.05
Degree of Freedom	41	-
χ^2 /df	1.299	≤ 3.00
Bollen (1989) Incremental Fit Index (IFI)	0.994	≥ 0.90
Tucker & Lewis (1973) TLI	0.992	≥ 0.90
Bentler (1988) comparative fit model (CFI)	0.994	≥ 0.90
Normed fit index (NFI)	0.974	≥ 0.90
Goodness of fit index (GFI)	0.962	≥ 0.90

*Chau (1997)

Looking at the loadings of the postponement concept determinants (Table 9) on the main construct, it is understood that 'Flexibility in catering for current trend of demand from customers' (structural loading = 0.859, std. error = 0.077 and critical ratio = 12.885) has the highest contribution towards postponement concept and it is followed by 'Flexibility in meeting changing customers' needs' (loading = 0.858, std. error = 0.080 and probability value = 0.000), 'Flexibility in modifying a demand function' (structural loading = 0.832, std. error = 0.082 and critical ratio = 12.435), and 'Flexibility in developing different version of products' (structural loading = 0.776, std. error = 0.075 and critical ratio = 12.875). All these indicators have significant probability values (critical values ≥ 2.00), giving statistical evidence that their contributions towards postponement concept are significant and positive. It can be suggested that postponement concept can help manufacturing companies to improve their customer relationship performance and subsequently, it is also safe to state that postponement concept can ultimately enhance and sustain business performance of the Malaysian manufacturing industry in the long run.

Thus, a manufacturing company can enhance its customer relationship performance and business performance by integrating the postponement concept. The examination of residuals also reveals that variances among variables of the construct are perfectly explained by the respective constructs. The result highlights the unique contribution of postponement concept on customer relationship performance and business performance and supports the notion that the structural model has a satisfactory fit.

Table 9: Measurement results of the SEM model

(I)Constructs and indicators	Std. Loadings	Std. errors	Critical Ratio	Probability (significant)
a. POSTPONEMENT CONCEPT (POSTPONE)				
Flexibility in developing different version of products (B6PC3)	0.776	.075	12.875	0.000
Flexibility in meeting changing customers' needs (B6PC4)	0.858	.080	12.878	0.000
Flexibility in modifying a demand function (B6PC5)	0.832	.082	12.435	0.000
Flexibility in catering for current trend of demand from customers (B6PC6)	0.859	.077	12.885	0.000
b. Customer Relationship Performance (CRP)				
Ability to fill customers' orders on time [C3RTC2]	0.893	.054	18.268	0.000
Ability to meet customers' short order-to-delivery cycle time[C3RTC3]	0.897	.049	21.284	0.000
Ability to respond faster to customers' needs [C3RTC4]	0.901	.049	18.562	0.000
c. Business Performance (BPERF)				
Profitability (PROFIT)	0.785	.055	14.944	0.000
Return on Sales (ROS)	0.924	.082	14.804	0.000
Return on Assets (ROA)	0.921	.077	14.765	0.000
(ii) Exogenous/endogenous Path				
a. POST→ CRP [$\mathbf{H_1}$ is supported]	0.475	.076	6.767	0.000
c. POST → BPERF [$\mathbf{H_2}$ is supported]	0.147	.069	1.511	0.040
b. CRP → BPERF [$\mathbf{H_3}$ is supported]	0.582	.076	7.878	0.000

8. The Malaysian Postponement Concept Index (MPCI) for the Manufacturing Industry

In this paper, an attempt is made to calculate the Malaysian Postponement Concept Index (MPCI) in the context of customer relationship performance and business performance for the Malaysian manufacturing industry. The index is calculated by utilizing unstandardized weights from structural equation modeling output. The purpose of calculating this index is to determine the level of postponement strategy practices in the electrical and electronics companies in Malaysia. Since findings from several statistical analyses above strongly indicate that the postponement concept is very crucial, this study is intended to explore the level of postponement practices in the Malaysian manufacturing industry by calculating the Malaysian Postponement Concept Index (MPCI). The calculation of the MPCI is based on ACSI as suggested by Fornell et al. (1996). This paper proposes the following formula for the index:

$$MPCI = \frac{\sum_{i=1}^{4} w_i \bar{x}_j - \sum_{i=1}^{4} w_i}{6 \sum_{i=1}^{4} w_i} X\ 100$$

MPCI= 61.36

Where,
MPCI =Malaysian Postponement Concept Index
w_i's = the unstandardized weights
x_j= the measurements variables

Having calculated the index, Malaysian Postponement Concept Index (MPCI) for the manufacturing industry is equal to 61.36. An estimated score of 61.36 for the Malaysian Postponement Concept Index (MPCI) for the manufacturing industry is considered moderate. The result suggests that Malaysian manufacturing companies need to be more actively involved in postponement practices, processes and programs. More effort should be carried out by the manufacturing companies in Malaysia to encourage postponement strategies and initiatives in order to generate more productive efforts toward enhancing customer relationship performance and business performance.

9. Conclusion

This paper is intended to investigate the structural relationship between postponement concept in SCM, customer relationship performance and business performance in the Malaysian manufacturing industry. It is important to note that by using SEM, this study focuses on examining the strength of the relationships between postponement concept, customer relationship performance and business performance as a whole, and not on the individual effect of the five postponement concept practices (similar to beta in the regression analysis).

The results of the study assist in understanding how postponement strategy may influence customer relationship performance and business performance. This study leads to several main conclusions:

(1) Postponement concept determinants; namely, 'Flexibility in catering for current trend of demand from customers', 'Flexibility in meeting changing customers' needs', 'Flexibility in modifying a demand function' and 'Flexibility in developing different version of products' have **positive** and **direct**effects on customer relationship performance.
(2) Postponement concept has **positive** and **direct** effects on business performance.
(3) Customer relationship performance has **positive** and **direct** effects on

business performance (namely profitability, return on sales and return on assets).

(4) The Malaysian Postponement Concept Index (MPCI = 61.36) for the manufacturing industry is considered average indicating moderate postponement concept involvement initiatives.

The conclusion emerging from this study is that delayed differentiation or postponement strategies will ultimately result in positive gains. The results validate some of the key linkages and support beliefs and evidence by other researchers of the relationships between delayed differentiation or postponement concept and customer satisfaction as well as business performance (Za'faran Hassan & Arawati Agus, 2010; Za'faran Hassan, et al. 2013). It is also important to note that this study attempts to enrich the literature review and make a contribution in postponement concept and quality-related studies. In addition, its purpose has been to make explicit what other researchers have perhaps known implicitly but without solid measurements. The empirical results support long-standing beliefs and anecdotal evidence by researchers about the relationships between the exogenous (postponement concept) and endogenous results (performances), and lend credibility to causal hypotheses that improving internal process leads to improvements in external performance results. This study to some extent helps in resolving controversy about the magnitude and measurements of performance gains from postponement concept. By strengthening delayed differentiation or postponement competitive strategies, improved performance and customer satisfaction will be most likely to occur.

The paper will be of particular interest to practicing production managers or top level managers as it suggests the importance of postponement strategies in the Malaysian manufacturing industry. The benefits of implementing delayed differentiation or postponement strategies in place of the traditional anticipatory distribution strategy, include:

- Reduced inventory cost
- Reduced transportation cost
- Reduced risk of obsolescence
- Reduced demand variability
- Improved service by offering customized products quickly
- Delayed specific packaging
- Easy forecasting

The result indicates that manufacturing companies should give greater attention to the degree of postponement concept programs in enhancing bottom-line performance and customer satisfaction. This study may also serve as a useful resource for supply chain researchers and also contribute to the progress of delayed differentiation or postponement thoughts and theory. Based on the findings of this study, both practitioners and researchers alike may be encouraged to view delayed differentiation or postponement strategies as a useful tool for reconfiguring the entire supply chain within and amongst organizations.

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