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## An Assessment of Supplier Development Practices in Competitive Environment

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### **Abstract:**

*In recent years, many companies have come to recognize the crucial role that purchasing and materials management activities play in determining overall corporate performance. A major concern in many companies is the supplier development program. Although the purchasing literature contains extensive research support for the assertion that supplier development is an integrated means of achieving and sustaining competitive advantage, neither the impact of supplier development on buyer-supplier performance nor the linkage between them have been empirically examined.*

*The main objective of this research is to explore the role of supplier development in the context of buyer-supplier performance from a buying firm's perspective. Factor analysis yielded five factors including transaction-specific supplier development: Supplier development programme, Effective communication, Supplier commitment, Long term contract and rewards, Strategic Process. Since supplier development is not successful every time when undertaken, it is essential to examine supplier development factors which can impact the success of supplier development.*

*This research examines aspects associated with the success of supplier development strategies within a number of industrial sectors. The purpose of the study is to determine what factors are required to make the supplier development a success; furthermore it shows that some factors have more significant influence than others on supplier development. Analyses were conducted in this project using three main statistical tools.*

- *Firstly, validity test was conducted with the help of factor analysis through varimax rotation method.*
- *Secondly, Reliability test was conducted with the help of Cronbach alpha of full scale and of individual factors.*
- *Thirdly, Multiple regression method was used to test the hypotheses. Multiple regression analysis allows for determining the degree of strength and the direction of the linear relationship among various variables.*

*The findings of the current research confirm the general positive impact of supplier development on buyer-supplier performance improvement. Given the resource implications associated with developing suppliers, this study provides useful insights and challenges from a perspective that is both academic and practical.*

### **1. Introduction**

*“We are now entering the era of ‘supply chain competition’. The fundamental difference from the previous model of competition is that an organization can no longer act as an isolated and independent entity in competition with other similarly ‘stand-alone’ organizations. Instead they need to create value delivery systems that are more responsive to fast-changing markets and that are much more consistent and reliable in the delivery of that value requires that the supply chain as a whole be focused on the achievement of these goals.” (Christopher, 1998:28)*

This paper is a quantitative study of critical factors for supplier development strategies. The study is based primarily upon a survey of supplier development managers and professionals involved in this field.

#### *1.1. Background of Study*

A global economy is emerging and resources are becoming concentrated on core business activities rather than diversification, which is why there is a move toward outsourcing. As a result, outsourcing increased from \$91 billion to \$416 billion in the last 20 years (Tunstall, 2002), and it is expected to increase further. In 2009 the value of outsourcing deals alone in the logistics area were estimated to be \$80 billion (Hyatt, 2009). Due to the liberal use of suppliers, buying companies have to rely on their suppliers to deliver defect free product in a timely and cost effective manner. Buyers must ensure that their supplier capabilities match their expectations in order to compete in the competitive market (Krause & Ellram, Success factors in supplier development, 1997). “Any effort of a buying firm with its supplier to increase the performance and capabilities of the supplier and meet the buying firms supply needs”. (Krause & Ellram, 1997).

### *1.2. The Problem Statement*

Supplier development requires both the supplier and buyer to commit to maximum efforts to achieve the greatest results out of the program. Even though both sides agree that a strong commitment is required, there is still no guarantee that the supplier development will be successful. In the early 90's companies started reducing the number of direct suppliers and started to maintain more cooperative relationships with the remaining suppliers (Hartley & Choi, 1996). Approximate one-third of the projects failed due to the supplier's underperformance. Thus the success in the supplier development is not a foregone conclusion. Supplier development is considered a long term business strategy and there are various factors which affects this strategy. These factors not only affect the end result of supplier development process but also influence each other.

### *1.3. Research Justification*

A large number of companies execute supplier development programs and yet they fail at surprising rates. Not all supplier development initiatives are successful – in fact, as many as 50% are not successful due to poor implementation and follow-up. (Handfield,2002). This failure takes a toll that is not only financial but also psychological. Failure demoralizes employees who have laboured diligently to complete their share of the work in the supplier development project. The supplier development project success depends on both parties, so a dedicated study is required to find out what factors make the supplier development process a success.

In 2000, according to reader's poll of purchasing magazine, 53% of the companies claimed that they were involved in a supplier development program, but it was found that only 20% of the companies were providing financial support to the suppliers and only 14% of the companies were putting their employees in the supplier's facilities for the development purpose. Eleven percent of the companies had given the suppliers an invitation to come to the buyers place and learn. Only 11% of the companies had a formal program for supplier development, others were doing it without any the formal program. ("Half work with suppliers, half don't", 2000). This shows that even though companies were involved in supplier development program, they were not fully implementing them in an appropriate way.

In General Motors, after implementation of supplier development program, supplier productivity was improved 50%, lead time was reduced by 75%, and inventory was reduced by 70% during the one week workshops (Pazirandeh & Mattsson, 2009). Honda of America's Best Practices (BP) team reduced a supplier's costs by more than \$200,000 per year by changing the layout of a welding process. Furthermore, layout change increased the efficiency of supplier and ultimately bestowed advantage to buying company (Hartley & Choi, 1996). Also, one of the purchasing managers for a power tool producer indicated that in three years of developing suppliers, his company had seen quality rejects fall from 38.4% down to 0.5% while supplier on-time delivery had risen from 76% to 97.5%. Likewise, another proponent of supplier development cites an average supplier quality metric of 98.5% and on-time supplier delivery at 97%. They claim to have "improved quality, response time, prices and cycle time improvements." The VP for a major California-based computer maker discussed about how assistance from his firm allowed one subassembly supplier to "ramp up the production in only six weeks." ("Half Work with Suppliers, Half Don't", 2000). Although ramping up the production and performance took only 6 weeks but usually supplier development is very time consuming and long process which consumes plenty of resources. Sometimes the output of supplier development program might not be worth the resources being consumed and ordinary results are not acceptable by companies. Thus to find out the success factors for supplier development was essential (Easton, 2000).

### *1.4. Overview of Methodology*

A structured survey questionnaire with a five-point Likert scale was developed. Web Email were used to circulate and gather information regarding what supplier development professionals think about supplier development activities. The survey was divided into five small sections. The questions were mailed to a random sample of 250 supplier development professionals. The survey solicited information about a single instance of supplier development performed by them. The survey was both face and content validated. Of 250 surveys circulated, 100 usable responses were obtained. The responding population represents a wide range of industry types. Also before e-mailing the survey, a set of interviews with supplier development managers were conducted. The interview was designed to narrow down the success factors which were collected after reviewing existing literature and to help focus on those that appear to be reliable and important success factors that might have a large effect on supplier development success.

## **2. Literature Review**

The research cited identifies critical factors associated with the success of supplier development projects. Following will be the review of literature on strategic process supplier recognition, effective and enhanced communication, and commitment of suppliers. The chapter will conclude with a summary of literature. Examples of the key words used in searching for scholarly papers are: supplier development, supplier relationship, supplier evaluation, supplier management, supply chain management and buyer supplier relationship. Also, combinations of keywords were used to conduct the search of literature.

### *2.1. Past Literature*

The first documented application of supplier development comes from Toyota in 1939. Toyota discussed the need of working together with suppliers to improve collective performance. Thereafter, in 1963, Nissan implemented their first supplier development project, Honda joined the club in 1973 (Monczka, Handfield, Glunipero, & Patterson, 2009). It is essential to understand the significance of the various factors and the role they play in supplier development process. Past research can be categorized as (a) Theoretical, (b) Conceptual, (c) Empirical, (d) Conceptual and Empirical.

In the 1990's, the research moved towards establishing a relationship between various supplier developments constructs whereas in 2000 the research moved towards the influence of supplier development on innovation and purchasing strategy (Easton, 2000). In today's business, many buying firms pursue aggressive strategies such as outsourcing in order to increase their future rate of capabilities improvement (Monczka, Trent, & Callahan, 1993). Toyota discussed the need of working together with suppliers to improve collective performance (Monczka et al., 2009). Supplier development has been ubiquitous in Japan and Korea for a number of years, but is less evident in US firms due to a perceived lack of instant return on investment. Interestingly this practice was recognized early in the 1900's by the US automotive industry when Ford required improved supplier capacity (Krause, Handfield, & Tyler, 2006). Countries and large firms started to realize the benefits of supplier development. From the national perspective, benefits of supplier development were improvement in domestic suppliers, reduction in off shoring and increase in GDP (Krause & Ellram, 1997).

From the corporate and large firm perspective, supplier development helped in improving quality, reliability and manufacturability of new design. Besides that supplier development also helped in knowledge sharing and improved collaboration. Furthermore responsiveness to customer needs and market dynamics also increased with supplier development (Krause & Ellram, 1997). The data gathered from 527 purchasing executives (Krause, 1997) revealed that supplier development attributed to timely delivery, completed orders, reduction in defects & scrap and reduced order cycle time. Research by (Blonska, Rozemeijer, & Wetzels, 2008) established that supplier development encourages preferential buyer status and supplier adaptability. Supplier adaptation is perceived as a goal of supplier development aimed at supplier performance improvement (Blonska et al., 2008). With the help of two in depth case studies, (Reed & Walsh, 2002) established that supplier development activities enhance technological capabilities in their suppliers. Also, some of the firms expected technological improvement follows from improved business processes. Supplier development also helped in developing mutual trust between buyers and suppliers (Reed & Walsh, 2002). BMW strives to be 20% above industry average in quality performance. Management believed supplier development made it possible to attain that quality standard and increase in revenue (Rhodes, Warren, & Carter, 2006). Also, at Honda dramatic improvement was seen in product quality since they began to develop suppliers in North America. In 1985 quality level was 7000 defects per million; and in 1995 quality level was improved to only 100 defects per million (Berlow, 1995). A team of purchasing professionals from Honda of America worked with 12 stamping suppliers to reduce cost by \$4 million in six months in 1995 through its supplier development efforts (Berlow, 1995).

In the context of supplier development, suppliers and buyers state that they want to practice more supplier development methods to enjoy its benefits but there are myriads of barriers that hinder the effective supplier development strategies. Research by (Lascelles & Dale, 1989) utilizing survey responses from UK based suppliers to 3 major customers in automotive industry illustrated that poor communication and feedback, unstructured quality improvement programs, credibility of buyers, misconceptions regarding purchasing power and supplier satisfaction were the foremost barriers in the supplier development programs. Also in an empirical study with 89 minority goods and service providers (Krause, Ragatz, & Hughley, 1999) demonstrated that the main barriers towards minority owned supplier development were poor communication, non-profit situation and racial biases. Results also indicated that small minority owned suppliers were less positive about supplier development activities as compared to large minority owned suppliers (Novak, 2008). Another survey (Handfield R. et al., 2000) on supplier development strategies with 84 companies established several other barriers apart from those already mentioned that deter supplier development strategies. It included lack of supplier commitment, insufficient supplier resources, lack of trust, and poor alignment of organizational cultures, unsupportive upper management and insufficient inducement to suppliers. Research by (McDuffie & Helper, 1997) established that supplier development might fail if suppliers do not have a strong identification or if suppliers are not dependent on buyers. Another major barrier towards supplier development is the difference between perceptions of buyer and suppliers about supplier development practices. These differences in perception are due to a disparity in understanding the preference, intention, and process of a supplier development program (Forker, Ruch, & Hershauer, 1999). A supplier might agree initially but later fail to implement due to a difference in understanding.

Researchers came up with number of conceptual models for building solutions to overcome these barriers. A seven step process model was developed based on the examination of in-depth responses to survey questions.. This model increased the supplier's capability to act on its own and the improvement effort to continue once the buying firm finishes its activities (Wagner S. M., 2006). Also, supplier structure was developed on the basis of specific vendor development strategy. A conceptual link was generated between business unit strategies based on framework proposed by Porter and supplier development strategies, in other words, linkage between supplier development strategies and company strategies (Chakraborty & Philip, 1996).

A review of the research on supplier development resulted in the identification of several elements that appear to be critical to the success of the supplier development program. These comprise of effective and enhanced communication, supplier commitment, strategic processing and "long term commitment and supplier recognition/rewards" (Krause & Ellram, 1997).

- **7 Step Supplier Development Model**

"Big things happen when you do little things right" (Don, 2000). In this case, if small steps for supplier development are deployed correctly, then it can contribute towards success in supplier development. (Handfield R. et al., 2000) developed a seven step process map for set up supplier development activities.



Figure 1: 7 Step supplier development model

#### 2.1.1. Identify Ritical Commodities

In many companies such as Shell, Alcatel, Philips and Siemens, a corporate level executive committee analyzes the 'Kraljic purchasing portfolio' developed during the strategic process. This analysis is extension of company strategic planning (Handfield R. et al., 2000; Weele & Arjan, 2002). As a result of this planning, critical commodities are identified and warranted for supplier development activities. The steps adopted here are mainly observed in a strategic approach to supplier development where in a reactive approach; respondents skip this step in the supplier development process (Krause et al., 1998).

#### 2.1.2. Identify Critical Suppliers

Choosing which supplier to develop is a critical task because supplier development involves resources such as money and time. Thus the decision should be strategic not reactive (Gordon, 2008; Handfield R. et al., 2000). To decide which situation needs supplier development is a judgment call. Companies have a formal supplier measurement system which they use to assess a supplier's performance. If any gap is found in measured and expected results, these suppliers are identified for a development process, where in reactive approach the company might skip this step in supplier development activities (Krause et al., 1998). Also buying firms carefully evaluate suppliers quality, volume, delivery cost performance, launch readiness and potential kaizen opportunities to identify a prospective supplier development program (Novak, 2008).

#### 2.1.3. Form a Cross Functional Team

Each firm must develop their suppliers according to their own requirements. For example, some firms need managerial assistance and some need technical assistance. Thus it is essential to evaluate each supplier individually to create a plan that benefits both supplier and buyer (Daghfous, Campa, & Hamde, 2008). As a result, to face this complex challenge of developing dissimilar suppliers, innovative ideas are required to break down the knowledge barrier between buyers and suppliers, a cross functional team is necessary (Blindenbacj-Driessen, 2009). Before approaching suppliers and asking for enhanced performance, it is also important for the buyer needs to have established its own cross functional processes and capabilities before expecting commitment from suppliers (i.e. to be able to serve as a role model) (Monczka et al., 2009).

#### 2.1.4. Meet with Supplier's Top Management

Upper management involvement is again involved, but this time it is on supplier's side. The cross functional team must meet with the upper management of the supplier side and establish strategies which will help to align the technology of the supplier and buyer.

Jointly the buyer and supplier will establish the means for measuring the capability of a supplier's side; as an example whether suppliers have infrastructure, resources, time and potential to implement the suggestions provided by buyers.

#### 2.1.5. Identify Key Projects

Among all the projects identified after meeting with upper management, supplier development managers must categorize the projects on the basis of return on investment. The main idea is to find the importance and impact of the project in business. After evaluating most important projects, goal is to decide whether they are achievable or not. Additional criteria used to evaluate the key project include willingness of supplier to implement changes. (Handfield R. et al., 2000).

#### 2.1.6. Define Details of Agreements

After identifying the project, the parties need to agree on the specific metrics for monitoring its success. Prior to setting up the supplier development program and investing in supplier development activities, goals need to be established and decisions made on how to achieve these goals (Wagner & Krause, 2009). The metrics may include the percent of cost saving to be shared, the percent of quality improvement to be achieved or the percent of delivery time reduction etc. The agreement also must specify milestones and deadlines for improvement as well as the role of each party: who is responsible for the project success and how and when to deploy the allocated resources. Upon reaching an agreement the project should begin (Krause et al., 1998).

### 2.1.7. Monitor Status and Monitor Strategies

To ensure continued success, management must actively monitor progress and revise the strategies if business is warranted (Wisner, Tan, & Leong, 2009). Communication is the key to success in this step as the exchange of information is required to drive the project towards success. Unremitting communication is required with the supplier community via supplier councils. The suppliers as a part of a supplier council provide feedback on the buyer's performance (Krause et al., 1998).

## 3. Hypothesis Development

The primary aim of this research was to collect and analyze empirical data to validate supplier development success factors. The data are based on survey questionnaire and interviews of supplier development managers.

### 3.1. Research Variables

Some of the buying firms were more content than others with the results of their supplier development programs. Generally, every buying firm focused on several of the factors while implementing its program. The strategic process emphasizes strong supplier development efforts to improve alignment in the suppliers (Handfield R. et al., 2000). Firms approaching strategic supplier development focus on classifying critical commodities with the intent to create a world class supply base. In contrast, firms taking a reactive approach are motivated by supplier non performance including defects, delays or poor services. (Krause et al., 1998).

So with the support of interviews and literature review, the following hypotheses were postulated:

- H1: Strategic processing plays a positive role in the success of a supplier development project.
- H2: Strategic processing plays a positive role in enhancing supplier communication.
- H3: Strategic processing plays a positive role in a supplier recognition in the form of long term contracts.
- H4: Supplier recognition plays a positive role in commitment of suppliers
- H5: Enhanced communication plays a positive role in the success of the supplier development process.
- H6: Supplier recognition in the form of long term contracts plays a positive role in the success of supplier development
- H7: Commitment of suppliers plays a positive role in the success of the supplier development process.

### 3.2. Hypothesized model

With the help of the interviewees and the relevant literature, the relationships can be illustrated as in Figure 1. This Figure summarizes how critical factors affect the outcome of supplier development projects.

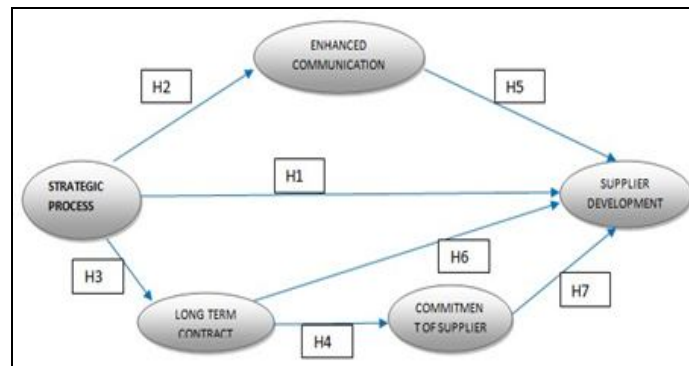


Figure 2: A hypothesized model

## 4. Research Methodology

In order to prove the hypotheses defined in the previous chapter, it was decided to use a survey instrument for gathering data. The survey focused on the following factors: Strategic process, supplier commitment, communication, long term commitment/rewards and the success of supplier development program. Once the quantitative data were collected, statistical tests were performed to test the various hypotheses and check for possible correlations among factors.

### 4.1. Survey Design

The survey design consists of the steps: literature survey for previous studies, constructing the survey instrument, validating the instrument and pilot testing the instrument.

For surveys measuring customer satisfaction, it has been suggested to have only 10-20 questions (Janes, 1999). It will not be too brief and, therefore, will not make the customer feel that their feedback is not important. Since the survey was not sponsored by any company, and it was a cold call survey on a specific topic, it was kept to an optimum length which can be finished in 10 minutes. Most respondents dislike answering long questionnaires (Kitchenham & Pfleeger, 2002). By compelling the respondent to give answers to a long survey, it might be possible to get inaccurate answers because respondents might be tempted to fill out the first choice for all answers for a quicker questionnaire. Thus, with the longer survey, the researchers usually get insignificant results. If the topic of the survey is important to respondents then they will be willing to spend more time in taking the survey (Kitchenham & Pfleeger, 2002). Also, many of the respondents felt that 10 minutes was the maximum time they could spend on the survey. The minimum time they expected a survey to take was 4 minutes. So, a survey was created which could be finished in 6-10 minutes (Nilsson & Soderstorm, 2005). Although covering all the factors is important, a trade off between insignificant

results and more coverage is unacceptable. The research consists of the following sections: selection of research method, population and sampling, questionnaire selection, data collection, data capturing and data statistical analysis.

#### 4.2. Survey Instrument

The survey questionnaire was developed with the help of existing research instruments as a way to achieve the content validity and reliability. To further aid in the development of the instrument, manuals, articles, books and existing theses on marketing research were consulted (Chidambaranathan, Muralidharan, & Deshmukh, 2009; Fink, 2003; Krause & Ellram, 1997; Tamir, 2008).

The survey instrument consists of 15 questions, every question corresponding to one of the six factors including the success of supplier development itself. To keep the survey short and to get a higher response rate, a limited number of questions were kept in the survey (Tamir, 2008). To examine each factor, three questions were designated and one question was to find out whether buyers had ISO certification or not.

The survey instrument comprised qualitative questions on a 5-point Likert scale to give respondents the option to be more expressive. The scores range from 1-5 as follows (Jacoby & Matell, 1971; Nyengane, 2007; Rensis, 1932):

- 1 - Strongly Disagree
- 2 - Disagree
- 3 - Neutral
- 4 - Agree
- 5 - Strongly Agree

The questions dealing with our variable of interest-success of a supplier development program were put in the beginning of the survey. This was done to make the survey more logical to the respondents. Questions were formulated so that respondents could answer them easily and accurately. The response format was standardized so that respondents knew their choice of answers and would not need to waste time by reading the choices, question by question. There were no open questions in the survey to avoid misinterpretation; all the questions were closed as the questions were on an ordinal scale.

#### 4.3. Population and Sampling Procedures

Population is the group of people which are the focus of the research, and the sample refers to the people who are selected to be in a study. To increase reliability, the survey was targeted mainly to supplier development professionals, procurement professionals, and buyer and quality professionals that have personally witnessed or participated in supplier development programs. All respondents in the survey were selected so that the sample could be categorized as a subjective population. Out of several sampling methods, the simple random sampling procedure was followed. The random sampling procedure gets tedious when sampling from an unusually large target population, but in this study the population is rather small.

To test the above hypothesis I carried out a survey in Assam in various firms. The firms include a wide range of industries.

Industry type	Frequency	Percentage
Food and beverage	4	2.88
Textile	3	2.15
Chemical and related product	4	2.88
Pharmaceutical and medical	1	.72
Rubber and plastics	12	8.63
Smelting and pressing	3	2.16
Metal products	4	2.88
Machinery	29	20.86
Transport equipment	9	6.47
Electrical machinery and products	11	7.91
Communication and computer related products	40	28.78
Instrument and related products	4	2.88
others	18	12.95

Table 1: Survey Industries

## 5. Survey Results

### 5.1. Response Rate

The survey was initially sent to 139 respondents. Out of the 139 returned responses, 100 were found to be complete and utilizable. Some people in the sample group were not interested in participation due to various reasons. 100 usable responses resulted in a response rate of 72%.

The sample size of 100 out of a population of 139 produced results with a statistical confidence level of 95% and a confidence interval of +/-10%, utilizing the finite population ("Sample Size Formulas for our Sample Size Calculator":Novak, 2008).

### 5.2. Descriptive Statistics

Descriptive statistics are used to illustrate the main features of a dataset in quantitative terms. It aims to quantitatively summarize a data set, rather than being used to support inferential statements about the population that the data are thought to represent. ("DescriptiveStatistics", 2010).

Survey Question	Mean	Std. Deviation
PS1: The objectives of the supplier development program were met	2.11	.962
PS2: During the supplier development program suppliers learned new processes	1.9	.7
PS3: We observed that progress continued even after the supplier development program was ended	2.23	.965
EC1: We provided a clear picture of the anticipated positive impact that the supplier development program will have on supplier's business	1.9	.752
EC2: We communicated with supplier at regular interval	1.54	.633
EC3: We communicated accurately quality requirements with supplier	1.7	.798
SC1: Supplier provided several suggestions to enhance the supplier development program	2.17	.946
SC2: Supplier was concerned about the success of supplier development program	2.35	.964
SP1: The supplier development program helped our organization to get some advantage over our rivals (Competitive advantage strategy)	2.2	.872
SP2: The supplier development program helped our organization to secure a cost advantage of some kind – lower average cost, lower labor costs, etc. (Cost advantage strategy)	1.94	.871
SP3: The Supplier Development Program helped our organization to look at new ways of doing the things to leverage our organization performance (Re engineering strategy)	2.06	.796
LTC1: Suppliers expected that we will be doing business with them for the long term	1.79	.72
LTC2: We invited suppliers to our site to increase their awareness of how their product is used	1.75	.799
LTC3: We promised benefits to the supplier's, such as consideration for future business	2.2	.9

Table 2: descriptive statistics

All variables contain a sample size of 100 which verified consistency in capturing the data. The statistical mean value for all the variables falls between 1.5 and 2.2 which shows a fragment of divergence on this subject. The greatest standard deviation is 0.965 in the success of the supplier development component.

### 5.3. Kurtosis and Skewness Statistics

Kurtosis	Skewness
1.267	1.244
.318	-.08
.614	-.626
.818	1.315
1.281	2.71
1.399	2.031
.943	.699
.81	.347
.117	-.853
.523	-.567
.394	-.304
.549	-.263
1.151	1.765
.68	.16

Table 3: Kurtosis and skewness statistics

Kurtosis and skewness statistics and calculations demonstrate that the distribution is normal because kurtosis and skewness are in between -2 and +2, thus data is normally distributed and had reasonable variance to use in subsequent analysis (Mardia, 1974).

### 5.4. Scale Purification

#### 5.4.1. Validity Test

Validity refers to the degree to which a survey instrument actually measures what it purports to measure (Fink, 2003). In this validity test, content and criterion validity were checked with the help of factor analysis through varimax rotation. Table 3 demonstrates that the value of the KMO (Kaiser-Meyer-Olkin) measure is 0.772 which indicates that the factor analysis is a good idea because it exceeds the minimum requirement of 0.50 for overall MSA (Measure of Sampling Adequacy) (Child, 2006).

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	Bartlett's Test of Sphericity		
	Approx. Chi-Square	df	Sig.
.772	615.124	105	.000

Table 4: KMO & Bartlett's Test of Sphericity

The KMO Measure is an index for comparing the magnitude of the observed correlation coefficients to the magnitude of the partial correlation coefficients. In Bartlett’s test of sphericity, the value of observed significance level was found to be 0.000, which is small enough and implies that we could reasonably proceed with factor analysis for this data set (Child, 2006). Factor analysis was performed to test the validity of the model. Factor analysis attempts to identify underlying variables, or factors, that explain the pattern of correlations within a set of observed variables. Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance that is observed in a much larger number of manifest variables. Thus, factor analysis was performed to measure the validity of all the factors of the model, and the idea was to take out a factor, if necessary, on the basis of low factor loading.

FACTOR	EIGEN VALUES	COMPONENTS
1	5.713	EC1,EC2,EC3
2	2.134	SP1,SP2,SP3
3	1.162	PS1,PS2,PS3
4	.834	SC1,SC2
5	.677	LTC1,LTC2,LTC3

Table 4: Factor Analysis

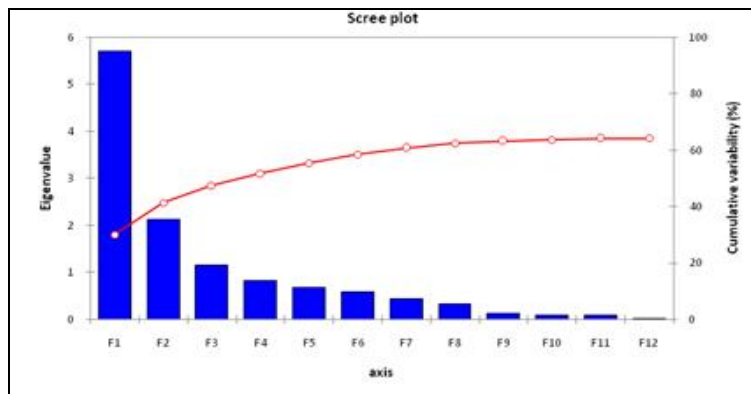


Figure 3: Scree plot

Varimax rotation method was chosen to check the construct validity. Varimax rotation is an orthogonal rotation method that minimizes the number of variables that have high loadings on each factor (SPSS 17.0 Help). This method simplifies the interpretation of the factors and helps to identify which variables are loaded on which component. In practice, interpretation of factors is difficult because they are correlated with several variables at a time, but with redistribution of variables, factors become interpretable. Rotation reduces the number of variables correlated with a given factor, but at the same time maximizes the size of correlation with a given factor (Chakrapani, 2004).

Ideally, the research identifies the highest loading of each variable on a certain factor and approximately zero on others. Thus, while looking at the resulting components, information provided by variables can be represented by five variables. Component 1 includes variables representing enhanced communication EC1, EC2 and EC3. Variables representing strategic processing, SP1, SP2 and SP3 come under factor 2. Program success variables PS1, PS2 and PS3 come under factor 3. Variables representing supplier commitment SC1 and SC2 come under factor 4, and variables representing LTC1, LTC2 and LTC3 come under factor 5. Table 5 shows the loading factors for components in a rotated component matrix.



Variable	Factor				
	1	2	3	4	5
PS1	.167	.193	.856	.082	-.028
PS2	.457	-.001	.326	.394	.094
PS3	.256	.102	.762	.228	.297
EC1	.773	.342	.046	.168	-.098
EC2	.660	.167	.286	.042	.228
EC3	.784	.001	.235	-.183	.046
SC1	.179	.094	.126	.697	.326
SC2	.126	.156	.137	.837	-.193
SP1	.103	.879	.227	.073	.182
SP2	.163	.915	.046	.115	.121
SP3	.459	.569	.246	.156	.297
LTC1	.463	.375	.019	.168	.567
LTC2	.502	.356	-.229	.361	.328
LTC3	.008	.186	.168	.008	.867

Table 5: Loadings for Components in Rotated Matrix

#### 5.4.2 Reliability Test

Reliability analysis allows investigation of the properties of measurement scales and the items that compose the scales. Interclass correlation coefficients can be used to compute inter-rater reliability estimates.

Cronbach's alpha analysis is a model of internal consistency and is based on the average inter-item correlations. According to (Chakrapani, 2004), the value of Cronbach's alpha of less than 0.5 is considered poor, and greater than 0.5 is considered acceptable.

Factor	Cronbach's Alpha	% of Variance	Cumulative %	Components
Full Scale	0.822	100	100	Full Scale
1	0.713	35.213	35.213	EC1,EC2,EC3
2	0.836	9.381	44.594	SP1,SP2,SP3
3	0.674	8.13	52.724	PS1,PS2,PS3
4	0.513	6.473	59.197	SC1,SC2
5	0.644	6.258	65.455	LTC1,LTC2,LTC3

Table 5: Cronbach's Alpha

For this study, the value of Cronbach's alpha for every factor is greater than 0.50 which indicates that the instrument is a reliable one (Nyengane, 2007). Multiple regression analysis was performed to test the hypothesis on a re-specified model with the remaining constructs. The next chapter will discuss the results of hypothesis testing.

## 6. Hypothesis Testing

Multiple regression method was used to test the hypotheses outlined. Multiple regression analysis allows for determining the degree of strength and the direction of the linear relationship among various variables. The guidelines to assess the correlation coefficients for the study are as follows: coefficients of less than 0.5 represent weak relationships, coefficients greater than 0.5 but less than 0.8 are considered acceptable relationships, and coefficients greater than 0.8 represent strong relationships (Nyengane, 2007). The backward elimination method was used, to simplify the detection of relevant variables (Anderson D.R., Sweeney, & Williams, 2009). Backward elimination starts with all of the predictors in the model. The least significant variable is removed, and the model is refitted. Each following step removes the least significant variable in the model until all remaining variables have individual significant values smaller than a certain value, such as 0.05 or 0.10 (Dallal, 2008).

### 6.1. Hypothesis One

- H1: Strategic processing plays a positive and significant role in the success of supplier Development

	Un-standardized coefficients		Standardized coefficients	T	Sig
	B	Std. Error	Beta		
(constant)	.496	.275		1.803	.075
SPAvg	.130	.114	.139	1.145	.256

Table 6: Hypothesis One

It can be observed that there is a positive but very weak and insignificant relationship between strategic processing (SP) and the success of supplier development activities (PS) ( $r=0.139$ ,  $sig>0.05$ ). Thus, there is insufficient evidence to support the hypothesis 1 at a 5% level of significance, the relationship between strategic processing and success of supplier development programs.

#### 6.2. Hypothesis two

- H2: Strategic processing plays a positive and significant role in the success of Supplier Development by Enhancing Communication.

	Un-standardized coefficients		Standardized coefficients	T	Sig
	B	Std. Error	Beta		
(constant)	.584	.261		4.218	.000
SPAvg	.262	.129	.572	3.862	.029

Table 7: Hypothesis two

It can be observed that there is a positive, strong and insignificant relationship between strategic processing (SP) and supplier communication development activities (EC) ( $r=0.579$ ,  $sig<0.05$ ). Thus, there is sufficient evidence to support the hypothesis 2 at a 5% level of significance and the relationship between strategic processing and communication of the supplier is strong.

#### 6.3. Hypothesis Three

- H3: Strategic processing plays a positive and significant role in supplier recognition in the form of long term contracts.

	Un-standardized coefficients		Standardized coefficients	T	Sig
	B	Std. Error	Beta		
(constant)	.903	.169		5.348	.000
SPAvg	.489	.077	.581	6.343	.000

Table 8: Hypothesis three

It can be observed that there is relative intermediate strength, and a significant and positive relationship between strategic processing (SP) and long term contract(LTC) rewards ( $r=0.581$ ,  $sig<0.0001$ ).

Thus, there is sufficient evidence to support the hypothesis 3 at a 5% level of significance, that there is a positive and significant relationship between strategic processing and supplier recognition.

#### 6.4. Hypothesis Four

- H4: Supplier recognition in the form of long term contracts plays a positive and significant role in the success of supplier development.

	Un-standardized coefficients		Standardized coefficients	T	Sig
	B	Std. Error	Beta		
(constant)	1.604	.276		5.821	.000
LTCAvg	.342	.137	.270	2.497	.015

Table 9: Hypothesis four

It can be observed that there is a low strength yet significant and positive relationship between supplier recognition (LTC) and the commitment of suppliers (SC) ( $r=0.270$ ,  $sig<0.05$ ). Thus, there is sufficient evidence to support the hypothesis 6 at a 5% level of significance, that there is a positive and significant relationship between supplier's recognition (LTC) and commitment of suppliers (SC).

#### 6.5. Hypothesis Five

- H5: Enhanced communication plays a positive and significant role in the success of the supplier development process.

	Un-standardized coefficients		Standardized coefficients	T	Sig
	B	Std. Error	Beta		
(constant)	.496	.275		1.803	.075
ECAvg	.205	.087	.233	2.357	.021

Table 10: Hypothesis five

It can be observed that there is relatively medium strength but a significant and positive relationship between enhanced communication (EC) and the success of supplier development (PS) ( $r=0.350$ ,  $sig<0.05$ ). Thus, there is sufficient evidence to

support the hypothesis 9 at a 5% level of significance, that there is a positive and significant relationship between enhanced communication and the success of the supplier development process.

6.6. Hypothesis Six

- H6: Supplier recognition in the form of long term contracts plays a positive and significant role in the success of supplier development.

	Un-standardized coefficients		Standardized coefficients	T	Sig
	B	Std. Error	Beta		
(constant)	1.296	.234		5.544	.000
LTCavg	.411	.116	.369	3.531	.061

Table 11: Hypothesis six

It can be observed that there is a positive but relatively low strength and insignificant relationship between long term contracts (LTC) and success in supplier development (PS)( $r=0.369$ ,  $sig>0.05$ ).

6.7. Hypothesis Seven

- H7: Commitment of suppliers plays a positive and significant role in the success of the supplier development process.

	Un-standardized coefficients		Standardized coefficients	T	Sig
	B	Std. Error	Beta		
(constant)	.496	.275		1.803	.075
SCAvg	.205	.087	.233	2.357	.021

Table 12: Hypothesis seven

There is sufficient evidence to support the hypothesis 7 at a 5% level of significance, that there is a positive and significant relationship between the commitment of suppliers and the success of supplier development programs.

7. Conclusion

Based on the survey results and based on the analysis described previously it was concluded that supplier commitment and enhanced communication are the critical factors responsible for the success of supplier development activities. Moreover, the strategic process and supplier recognition play indirect roles in the success of supplier development activities by enhancing communication and rousing supplier commitment.

Table shows that overall there is a positive and linear relationship between all the factors and the supplier development activities. Also, it was established that the sample data was normally distributed around the mean and median for all the variables.

Hypothesis	Independent variable	Dependent variable	Positive/Negative	Significant relationship with 5% Sig. level
1	Strategic process	Success of SD	Positive	Insignificant
2	Strategic process	Enhanced communication	Positive	Significant
3	Strategic process	Supplier recognition	Positive	Significant
4	Supplier recognition	Supplier commitment	Positive	Significant
5	Enhanced communication	Success of SD	Positive	Significant
6	Supplier recognition	Success of SD	Positive	Insignificant
7	Supplier commitment	Success of SD	Positive	Significant

Table 13: Results summery

Therefore, Research findings emphasize the benefits of improving communication between buyers and suppliers; also, research findings emphasize increasing the supplier commitment toward the supplier development project in order to make the project successful. The key reason for a positive and significant relation between supplier commitment and success of the program might be that the supplier views the supplier development project as a help and dedicated effort by the buyers, and thus the commitment reciprocates in the supplier development projects. Also, it was established that if communication is done efficiently then the supplier can actually implement the processes as per the buyer's requirement, and eventually the improvement or success is a

foregone conclusion (Blindenbacj-Driessen, 2009). Moreover, the findings of the research extend the supplier development literature by indicating the indirect importance of the strategic process across the different projects.

Though previous researches had focused on the factors, such as upper management involvement and supplier commitment, none of them empirically tested for the relation between strategic process and success in the supplier development program. When implementing the supplier development projects, supplier development professionals should keep proven success factors in mind. Supplier commitment, a verified success factor from the research, is often difficult to improve. Sometimes suppliers lack the engineering resources, equipment, information systems, skills or training required, and this might lead to diminution of commitment, but to overcome this insufficiency, an organization should adopt a certain methodology. To achieve supplier commitment, buyers must delineate the potential rewards for the supplier organization or must promise certain improvements after a fixed interval of time, or else suppliers might not be fully committed towards the supplier development program. Suppliers might agree to initial proposals but will fail to implement them due to insufficient dedication or lack of resources. To overcome these difficulties, buyers could set small goals for suppliers and choose to work on simple projects where the chances of success are possible in short duration of time to achieve supplier commitment. Thereafter, spending some additional time and resources, further improvements in big projects are possible. Also, evaluating suppliers and testing suppliers regarding their standing after the supplier development program might be helpful to get suppliers committed towards the program.

In addition, enhanced communication, another proven success factor, should be put into practice in the supplier development program. Enhancing communication will lead towards reduction in the dependence of supplier development teams on upper management directions, and eventually project teams won't waste time on directions and instructions.

Better communication can enhance the commitment of suppliers and eventually improve the success of supplier development. For example, if every step is communicated appropriately then every member in the whole chain will know what to do at what time, which eventually will increase the efficiency and commitment of suppliers. Also, information learned from one project can then be applied to other projects. Moreover, communication will allow the creation of a permanent liaison of suppliers with the supplier development teams, which will result in more successful projects.

Undeniably, the most significant finding is that the supply chain professional cannot focus on a single factor to make the supplier development program successful. Since all of the factors in the research had low to medium correlation with the success of supplier development programs, every factor must be taken into consideration while implementing the program at any of the supplier's sites. As a result, only those suppliers will be successful who have processes that give attention to all the factors collectively.

Supplier development programs must be incorporated with all the factors mentioned in the literature review, such as strategic process, upper management involvement, enhanced communication and supplier recognition, and supplier commitment. Buyers must ensure that all these factors are incorporated in the supplier development programs to obtain positive results. This can be made possible by a conference or a meeting with upper management involvement to strategically plan and discuss how to enhance the communication between the suppliers and buyers and other elements of the program. Also, meetings can provide ways to identify possible techniques to recognize the suppliers and to improve supplier commitment towards the supplier development program. For instance in the meeting, upper management can motivate purchasing managers to achieve bigger milestones in critical areas of supplier development processes. The whole purchase requirement becomes strategic because of its impact on finished product quality, technology and total costs. Thus, management must align supplier development activities within the purchasing strategic plan and for that it is highly desirable to clearly quantify the past performance, measure the current status of supplier development process, identify objectives and previous strategies to recognize the strength, weaknesses, opportunities and threats. If the past performances are not sufficient then upper management must consider changes in the supplier development strategies and approaches.

Moreover, upper management must endow with resources and the involvement at a level which supports in achieving improvements through the implementation of aggressive strategy approaches. Aggressive strategy can include frequent visits to suppliers to evaluate their processes, founding of a system to reward and recognize supplier improvements, providing training to suppliers, alliance with suppliers in improving existing and new materials, and involving the supplier in the company's new product development process. A strong purchasing mission statement reflects and dives strategic emphasis and alignment. Development of world class suppliers base can also help in attaining the strong purchasing mission and strategic alignment.

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