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GOODNESS OF FIT OF FACTORS AFFECTING INDUSTRIAL BUYING BEHAVIOUR USING STRUCTURAL EQUATION MODELLING (SEM) TECHNIQUE

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Abstract
As the level of competition keep on increasing in the Industrial buying in Indian Market, it is essential for every supplier and manufacturing companies to understand customer insight in order to either penetrate into these markets or further increase their share of wallet. Thus, it becomes extremely important to understand what factors might influence their customers' decision in purchasing of process lubricants which are high in volumes and value as well. Therefore, the objectives of this research are to study the relationships of various factors that affect the buying behaviour. These factors include of perceived service quality, perceived value, Brand, Environmental Uncertainty and perceived risk that will affect on the purchase decision towards process lubricants.

Industrial Buying behaviour studies gaining equal importance in consumer buying behaviour for both Industrial purchasing management and strategic marketing. Although, the Industrial buying process is extremely complex and time consuming, various research works carried out in the past reveals that understanding of influencing factors help not only in formulating robust marketing strategies but also take appropriate decisions at right time. Therefore, the objective of this research paper is to study reliability of the data collected during the pilot survey by applying Structural Equation Modeling (SEM) technique. This research paper focuses on the reliability of various factors that influences Industrial buying behaviour. These factors include Service Quality, Brand Ranking, Interpersonal relationship, perceived risk, etc. Structural Equation Modeling (SEM) technique is used in studying the reliability of the preliminary (Pilot) survey conducted in various types of metal forming industries. The pilot survey was conducted using convenience sampling of about 60 respondents of metal forming industries in the western part of India. Various industrial groups were studied during the pilot survey. Similarities and differences between these groups of Industrial buyers were statistically analyzed further. But, for the purpose of this research paper, the focus is limited only to apply SEM techniques to the data collected and check for the reliability. Although the sample is diversified across metal forming industries, it is only representative for the purpose of this research work.

Keywords: Reliability Study, Industrial Buying Behavior, Perceived Risk, Service, Quality, Structural Equation Modeling, SEM, Metal Forming Industries.

Introduction

Several empirical studies (Buckner 1967; *Scientific American* 1970) have demonstrated that there is no single decision maker in industrial purchasing situations. Rather, a number of individuals influence the purchase decision. A survey by *Purchasing Magazine* (1965) of chemical industry purchasing executives showed that the purchasing agent alone chose the source of supply in only 13% of the cases. Across this sample, the number of buying influential's averaged about five but ranged up to 50 in a few cases. Empirical results discussed by Harding (1966) and O'Rourke. Shea, and Sulley (1973) generally support this view.

According to Choy Johnn Yee, et.al (2011) defined the three most influential factors in buying bahviour. 1. **Perceived Quality (PQ):** Perceived quality is a critical element for consumer decision making; consequently, consumers will compare the quality of alternatives with regard to price within a category (Jin and Yong, 2005). Perceived quality is directly related to the reputation of the firm that manufactures the product. Whereas Aaker (1991) and Zeithaml (1988a) said that perceived quality is not the actual quality of the brands or products, rather, it is the consumers' judgment about an entity's or a service's overall excellence or superiority. **2. Perceived Value (PV):** "value is always determined by consumer, in his or her own terms, timing and testaments" and that "value is a perception, a view, or understanding made up of measurable components." Perceived value is a comprehensive form of customer evaluation of service. According to Rust and Oliver (1994), value can be conceptualized as the overall evaluation of the service consumption experience and can be encounter specific or a more enduring global evaluation. Value perception may also differ according to the usage situation (Anckar and D'Incau, 2002). Value is a "function of the overall quality and price of the firm's products and services compared to the competition" (Mokhtar *et al.*, 2005). Stonewall (1992) defined value as function of product features, quality issues, delivery, service and price. **3. Perceived Risk (PR):** The concept of perceived risk was introduced by Tzeng *et al.* (2005) and said that risk be conceived in terms of the uncertainty and consequences associated with consumer actions, the result of which may or may not be pleasant. Perceived risk is defined as the uncertainty that consumers face when

they cannot foresee the consequences of their purchased decision. This definition highlights two relevant dimension of perceived risk: uncertainty and consequences. The notion of perceived risk as a key antecedent to consumer behavior has been establish in the past and may be factor influencing the purchased decision. In others words, company will put more effort on measuring the inherent risk associated with the purchase decision-making process.

Study of Industrial Buying behaviour has greater significance for both strategic decision making and purchasing & Marketing Management. While studying industrial buying behaviour, the identification of "selection Criteria" is of utmost importance in designing strategy for a specific target segment. There are various factors which influences the purchasing decision in the industrial environment such as Product, Price, quality, Supplier reputation and capability, ease of doing business, etc. However, some additional factors such as perceived Risk, Service Quality, Interpersonal relationship, Brand ranking, etc. also have a significant influence on the decision Making process. In this research paper an attempt has been made to determine the reliability of the industrial buying behaviour w.r.t. service quality and Brand ranking using Structural Equation Modeling (SEM) techniques. The model is designed during the pilot study for all the factors under consideration. Brand Ranking and Service quality has been analyzed for the purpose of this reliability study.

Every business in B2B segment is strive to create and deliver products or services which aims to solve or satisfy a customer's need and meet the expectations (Kotler et al. 2007). To identify a customer or a market which has a clear demand of something or identify an issue which the customer or market might have but is not aware of (Tidd et al. 2005) in an important task of marketing manager. Recent industrial environment is intensely technical and highly competitive and each businesses globally depends on the development of new product and *innovations* (McDermott et al. 2002). This makes it highly relevant for the marketer to understand the different factors affecting this process; thus by understanding the influencing factors the marketer can adjust the market plan and thereby properly manage the spread of the new product or service and ensure a high adoption rate of the marketed product (Parkinsson & Baker, 1986). Kotler & Armstrong (2008) explain the importance of organizations understanding the industrial buying behavior. Understanding this will help the selling organization understand their customers and thereby be able to create added value for them.

All forward looking companies now regard Brand positioning and technical service quality at the heart of competitive marketing strategy. As the ultimate aim of any business strategy is to satisfy the customer, gaining a valued position in the minds of customers is essential. Some people argue that branding is really positioning, stating that unless a brand has a position, it has no unique value in the minds of consumers. You can establish a brand personality, and through precise market segmentation identify and reach your target audience, but what links them together is positioning the brand in the minds of that audience. But, what is a position and how do you arrive at a good strategy for achieving one. The branding process seeks to create a unique identity for a company, product or service, which differentiates it from the competition. And every brand has to have a strategic platform (Srivastava, 2013).

Literature Review

The number of individuals involved and the resultant complexity of the buying process, several researchers have tried to structure organizational buying according to phases of the process and the roles of individuals in the process. Those phases generally range from "need recognition" through several stages of "search and information acquisition" to "final approval" (Bradley 1977; Brand 1972; Kelley 1974; Ozanne and Churchill 1971; Robinson and Faris 1967; Webster and Wind 1972; Wind 1978).

The militiaperson nature of the buying process has led to the concept of the *buying center* (Webster and Wind 1972). The buying center includes all organizational members involved in a purchase situation. It is an "informal, cross-sectional decision-unit in which the primary objective is the acquisition, importation and processing of relevant purchasing-related information" (Spekman and Stern 1979, p. 56). The composition of the buying center may change from one purchasing situation to the next, evolves during the purchasing process, and differs among firms. Fisher (1969) proposed a simple model to integrate the factors infiuencing the buying process and the degree of involvement of different functional areas of the firm, with product complexity and commercial uncertainty as the main factors affecting the process. Another widely held view of the purchasing process was developed by Robinson and Faris (1967), who have labeled buying situations as "new task," "straight rebuy," and "modified rebuy."

The specific individuals involved in the buying decision process are likely to depend on the type of purchase situation (Brand 1972). Although much research has helped produce a general understanding ofthe nature of industrial buying behavior (see Bonoma, Zaitman, and Johnston 1977 or Johnston 1981 for a review), the applications of this knowledge to specific product situations are few and the results unclear (see Moriarty 1982 for an exception). Webster and Wind

(1972) talk about users, gatekeepers, influencers, etc. Brand's (1972) categorization consists of general management, technical personnel, etc. These conceptual categories are not easy to operationalize.

Although some major buying roles are persisting overall buying situations, the membership of buying center in any type of B2B industries is dynamic (Mattson, 1988). This means an active participation and involvement is necessary from much simple buying situation to more complex buying decision. Buying center in B2B industries cannot be restricted by limited boundaries. Various people and functions are involved in the buying center with different knowledge and expertise and at different levels in the organization. The roles everyone plays in the decision process are greatly influenced by the perceived risk of an individual and affected by environmental uncertainty. A key point to realize is all the members of buying center resides within the buying organization and factors like perceived risks and uncertainties hovering over individual has influential role in decision making. Uncertain environment both internal and external will affect the decision making process to a greater extent. The Internal uncertainties are within the control of the buying organization whereas external influences enclose the company's environment. They are outside the firm's control. (Robinson, Faris, Wind, 1967)

It is important to assess the entire decision making process of the buying organization and variable that affects directly or indirectly the entire process. This will help to know who is at the central position of the buying center and who is responsible for procurement related activities. This will also help and assign various roles each member of the buying center plays during the decision process. It should be noted however that in different buying situations represented by multiple buying groups, the various organizational roles shown are the combination of overall functional and hierarchical levels within the organization. It may differ depending upon the buying situations and buy Class.

In 1988, The Theory of Planned Behavior was added to the existing model of the Theory of Reasoned Action as an extension of this model, and aims to further explain the link between attitudes and behavior.The major difference between these models is the addition of a third determinant of behavioral intention, known as perceived behavioral control, which is determined by two factors: control beliefs and perceived power (Cooke
& French, 2007).

Material and Methods

For the purpose of this research work, a study is conducted in an industrial cluster in the state of Maharashtra. The Industrial clusters are located in the central and western part of Maharashtra. Since the research work is restricted to the process lubricants used in the metal forming Industries, the respondents are selected only from the relevant industries. The basic methodology that followed is the questionnaire method. Structured questionnaire is designed and distributed. Each instrument is designed to gain the maximum relevant information from the cross sections of the representative organizations under consideration. Questionnaires are distributed among the randomly selected organizations to carry out statistical analyses to extract the insights in the detail. For this research study both the primary and secondary sources of data are used. The questionnaires are checked for incomplete, inconsistent, and ambiguous responses and discarded due to unsatisfactory responses. This has resulted in the final sample size as shown in Table 1.

Table-1: Responses considered for Statistical Analysis (Sample size).

Questionnaire Distributed	No. Of Respondents	No. of responses Excluded	No. of Responses considered	Response Rate (%)
100	82	6	76	76

The response rate 76.00% is considered as acceptable for the statistical analyses

Structural Equation Modeling

Sampling Design – Primary research method of questionnaire survey is used to collect the data for the purpose of this research work. During the pilot study, 100 questionnaires were distributed to key personnel from various functions such as Manufacturing, quality, Purchase, Maintenance and Management. The responses received are from personal interview, telephonic discussions, digital media and through conferences. 5-point Likert scale is used for the questionnaire design with Strongly disagree Scale of '1' and Strongly agree scale of '5'. Convenience sampling method is used for this research work

to obtain a sample of element in the entire metal forming industries spread across Maharashtra State. The convenience sampling method is selected because of getting the right responses of right people at right time who are involved in the decision making process. Moreover, this method is cost efficient and also can save time. The surveys are conducted at various time and days to ensure that the reliable responses are available for the statistical analysis.

Internal Reliability Test :- Cronbach Alpha (α)

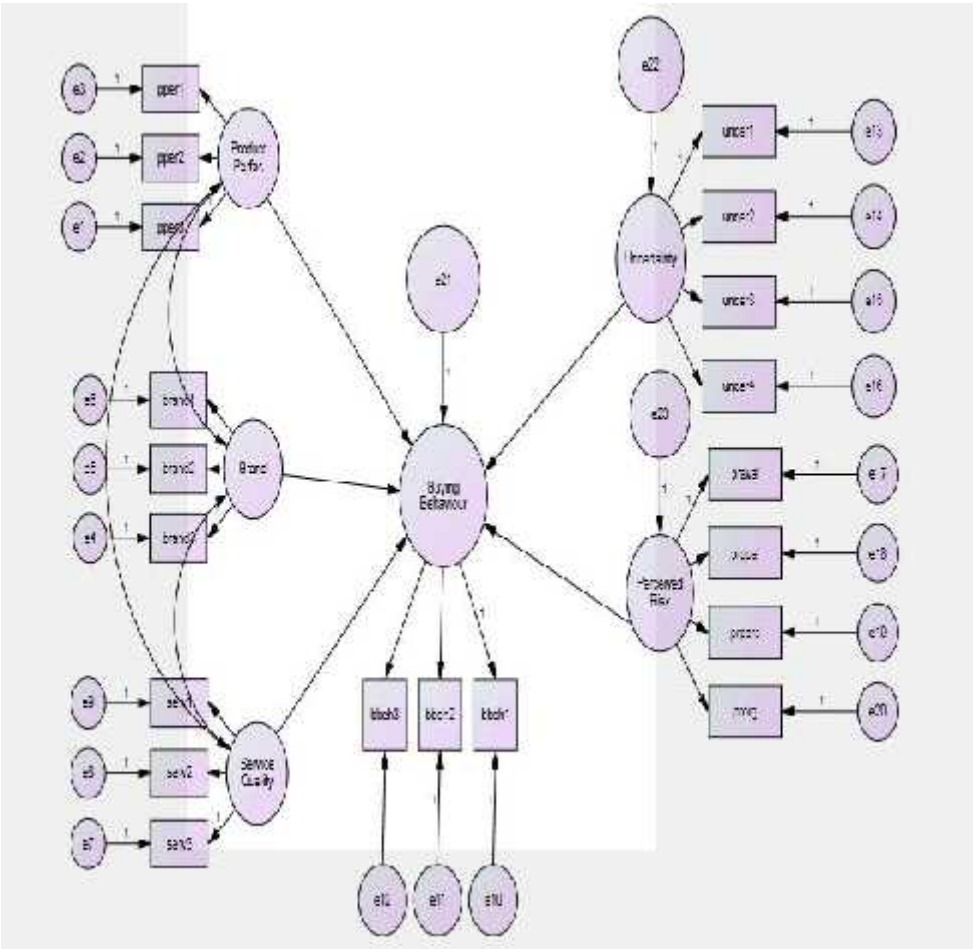
Reliability test is sued to determine the stability and consistency with which the research instruments measures the constructs (Malhotra, 2004). In simple words, reliability is concerned with the stability and consistency in measurement. Cronbach Alpha is an effective tool for measuring the reliability, which is a numerical coefficient of reliability and validity. Alpha coefficient ranges from 0 to 1 and may be used to describe the reliability of the factors extracted. The higher the score, the more reliable is the generated scale and alpha value 0.7 is to be considered as an acceptable reliability.

From the Reliability test shown in Table 3, items have been included in measuring perceived risk and coefficient value is 0.759. By using four items in perceived value, the alpha value is 0.8181.For brand ranking and service quality, there are 4 items used in the scale of measurement and the alpha value is 0.7907 and 0.8569 respectively. From the data and measurement of Cronbach Alpha value which is above 0.7, all of the measures of constructs adopted have internal consistency and reliability.

Table -3: Reliability of questionnaire used

Cronbach Alpha and Related Statistics				
	Cronbach Alpha	Std.		Average
All itmes	0.7824	0.7933	0.7281	0.5613
Perceived Risk	0.759	0.761	0.7728	0.4433
Perceived Value	0.8181	0.8183	0.7713	0.6002
Brand Ranking	0.7907	0.7913	0.7233	0.5583
Service Quality	0.8569	0.8572	0.8073	0.6668

Here, an index of reliability for all the items i.e. Cronbatch"sAlpha), α = 0.7824 which is considered as with good internal reliability of the scale and the questionnaire can be used for the statistical analyses.



In SEM, it is usually assumed that the sample data follow a multivariate normal distribution, so that the means and covariance matrix contain all the available information. The methodology takes into account fixed parameters and equality constraints which will maximize the fit of the model. For the purpose of this research work, five independent variables such as Service Quality, Brand Ranking, Product Performance, Perceived Risk and environmental uncertainty are mapped and its influence on the Buying behaviour. Each construct has four questions on a 5 point likert scale and about 100 respondents contacted for the purpose of this research work. Although the sample size considered is less for Structural Equation Modelling, the purpose this research paper is to assess the consistency and reliability of the Questionnaire and goodness of fit. This is only a pilot survey; the sample size is restricted to 100. More the sample size, more significant the statistical analysis will be. Structural Equation Modelling provides a very general and convenient framework for statistical analysis that include several traditional multivariate procedures, e.g. Factor Analysis, regression analysis, etc. Structural equation Models are often visualized by a graphical path diagram as shown above.

Results

Table 4 :- Assessment of Normality (Group Number 1)

Variable	min	max	skew	c.r.	kurtosis	c.r.
prorg	2.000	9.000	.892	5.149	6.005	17.336
prpers prqual	2.000	9.000	1.323	7.641	9.967	28.771
praval uncer4	2.000	9.000	1.284	7.411	9.641	27.830
uncer3 uncer2	2.000	9.000	1.264	7.298	8.196	23.660
uncer1 bbeh3	2.000	9.000	1.853	10.700	24.066	69.471
bbeh2 bbeh1	2.000	9.000	2.463	14.217	19.694	56.853
serv1 serv2	1.000	9.000	.426	2.458	9.992	28.843
serv3 brand1	2.000	9.000	.551	3.179	9.266	26.748
brand2 brand3	1.000	9.000	.939	5.424	8.154	23.539
pper1 pper2	1.000	9.000	1.369	7.906	10.199	29.441
pper3	1.000	9.000	.590	3.409	6.072	17.528
Multivariate	1.000	9.000	.007	.042	3.582	10.340
	1.000	9.000	2.799	16.159	14.941	43.131
	1.000	9.000	.116	.668	3.594	10.374
	2.000	9.000	.280	1.615	7.468	21.559
	2.000	9.000	-.045	-.259	3.668	10.589
	2.000	9.000	.671	3.875	7.086	20.456
	1.000	9.000	.654	3.778	12.068	34.839
	2.000	9.000	.620	3.581	8.597	24.817
	2.000	9.000	.517	2.988	5.989	17.290
	162.795	38.805				

Table 5 - CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model Saturated model Independence model	48	277.269	162	.05	1.712
	210	.000	0		
	20	2432.692	190	.05	12.804

Table 6 :- RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model Saturated model Independence model	.099	.881	.846	.680
	.000	1.000		
	.247	.319	.247	.289

Table 7 : - Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.886	.866	.949	.940	.949
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 8 - FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	1.393	.579	.367	.831
Saturated model	.000	.000	.000	.000
Independence model	12.225	11.270	10.489	12.088

Discussions

Joreskog and Sorbom (1989) have introduced two goodness of Fit indices called GFI (Goodness of Fit) and AGFI (Adjusted GFI). The GFI Indicates Goodness of Fit and AGFI attempts to adjust the GFI for the complexity of model. Two other well known measures are the Tucker Lewis Index (TLI), also known as the Non-Normed Fit index or NNFI and the Normed Fit Index NFI 9Bentler and Bonnett, 1980). Both the TLI and NFI adjust the complexity of the model. The result shows that all these indices are still depend somewhat on sample size, TLI of 0.940 shows the best overall performance. For a perfectly fit model, the fit indices should have a value of 1. But, in reality this may not hold true due to variations and dispersion in the sample size and population. Usually, value of 0.7 and above for GFI and AGFI are considered to be acceptable for the model fit. Whereas gor GFI and AGFI value above 0.8 is required to judge the model fit as "good". In the research work, the value of GFI and AGFI are 0.881 and 0.846 respectively which are well above the acceptable values and goodness of fit. It is important to assess how well a given model approximates a true model and the results are in favour of the same.

Some of the previous research work carried out takes 0.90 and above GFI value for goodness of fit. But, all these are rules of thumb. There is always a scope of improvement in the existing model and it becomes a common practice to modify the model by excluding parameters those are not significant. Sometimes, new parameters are also added to improve the goodness of fit.

Conclusion

While purchasing process lubricants in Industrial application, customers will consider the risk and value alongwith the brand when they want to use the product due to Financial and performance related risks. Therefore, they face uncertainty if the decision goes wrong in purchasing of process lubricants. So, customers will opt to procure lubricants which result in lower risk and higher value. Some of the interesting facts resulting out of this statistical data are; the information needs of buying center increases in response to conditions of higher environmental uncertainty. The various tasks within the group become less routine and less differentiated. As a result increase in shared responsibility in the decision making process contributes to a more flexible design.

The resulting model fits which has CMIN/Df value of 12.804 and 1.712 and p value of 0.05. The various goodness of Fit indices are also acceptable; with GFI of 0.881 and AGFI of 0.846; TLI of 0.940, NFI of 0.886 and CFI of 0.949.

Therefore, the goodness of fit indices GFI, AGFI, TLI/NNFI, NFI and CFI are all well above 0.7 and 0.8, thus we can accept the proposed model of SEM.

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