Developing and Evaluating a New Scale for Product Positioning Uncertainty in India

Susmita Ghosh, Bhaskar Bhowmick

Abstract— Managing uncertainty is a major challenge for the start-ups.This paper aims to examine the reliability and validity of a new uncertainty scale as an instrument for measuring the variables necessary for product positioning for start-ups in India and its underlying dimensions. The literature is under developed in providing a comprehensive list of product positioning uncertainty constructs and its underlying variables. Therefore, an uncertainty scale measuring the variables of product positioning is required. Initially the scale consisted of 16 items under three conceptual subscales.151 founders and co-founders of start-ups from all over India participated in the study. This paper presents the result of the final scale of the factor structure that resulted from PCA and consists of 12 items out of the 16 items, which has been supported by strong evidences.

Index Terms— Competitor, Customer, Market, Product Positioning, Reliability, Scale, Uncertainty, Validity

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1 Introduction

Presently, environmental uncertainty has become the focal point of interest for the researchers. It has been revealed by past researchers that the perceived environmental uncertainty regarding the external environment affects the new product development (NPD) process and its outcome [1],[2],[3]. Uncertainty in product development is boosted by the speedy change in the external environment [4]. This creates the process of product development for new firms nonlinear and chaotic. Researchers in the past have identified that various types of perceived uncertainty aggregate to create perceived environmental uncertainty [5],[6],[7],[8]. These observations lead the researchers to study the specific factors of the environment that are responsible for uncertainty [9]. The key factor that leads to uncertainty on decision making in an organization is environmental variability [10].

The positioning of product is conceptualized within a space of interlinked utility and benefits, identified by the targeted customer base. Poducts that are customer centric are much moe successful than poduct centric products.Market acts as a channel to reach the customers for product communication and offerings. This shows that product success depends on multi-dimensional factors. Therefore customer's preference, competitor's action nd marketing strategy anchored togather acts as an important variable for decision making. This is because from market point of view, satisfaction of the customer and market share measures the product success. Customer, competitor and market are some of the factors that actively participate in decision making and lies in the firm's external environment. Souder and Song [11] suggested that product success under low market familiarity is affected by decision making. Thus NPD has multidimensional success factors.

Perceived uncertainty is experienced only during the decision making process of a firm [12].The certain or uncertain nature of the environment is decided when it is perceived differently by different firms for different products [13],[14]. Miles and Snow [15] explained that environmental uncertainty should be considered through various factors of the environment that affects the organization's product development process. Thus, for understanding the trait and effectiveness of the environmental uncertainties researchers extended a significant amount of theoretical and empirical effort [5,6, 17] . Since long researchers tried to identify and quantify the various environmental factors that contribute in uncertainty [18, 8, 6, 19]. Some of the studies that used scales developed by Duncan [8] and Lawrance and Lorsch [18] showed that the scale reliability are marginal or has not been reported properly and clearly [15].The scales were also less generalizable as they were used for a single study and were not suitable for other contextual studies.They developed scales to measure the various uncertainties that are caused by the different environmental factors but none of them measured the product positioning uncertainty constructs and its variables comprehensively. None of the studies reported measurement of product positioning uncertainty for start-ups in developing countries. So, there is a need of comprehensive scale for identifying the factors of product positioning uncertainty construct and its measures.

The theories of customer, market and competitor is grounded on the marketing theories. As marketing theories

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have greater knowledge depository on customer, market and competitor but the same product positioning problem has not looked from the uncertainty view point. Hence, scale development in uncertainty literature related to the three factors i.e. customer, competitor and market in decision making can do a better justice in answering the questions related to product positioning.

2 Literature Review

It has been observed that the product positioning plan acts as a cornerstone of any firm's marketing strategy for any market [21] .Product positioning is defined as "detecting or dveloping product attributes which are expected to establish a competitive advantage and, may therefore, be transformed into valuable arguments and appeals in advertising" [22]. Product positioning models focuses on "spatial representation of existing products in the attribute space and do not explore the determinants of the product positions or how positions can be achieved" [22]. So, product positioning results from the complex combination of customer's perception, impression, and marketing strategies to accomplish a desired market position. Positioning is an important strategic decision for evaluation of the product performance in the market and achieving firm's success [23]. Product positioning is an important activity of the firm for their sustenance and growth [25]. Success of a new product is mostly dependent on designing the product according to the customer need and wants [25] and this leads the firm to predict the environmental factors that are important and effects the survival of the firms. So, scanning the business environment is necessary for appropriate prduct positioning of the firms [26,27]. Thus, match between the firm and its environment leads to better effectiveness of the firm [29].

Environment has been conceptualized as a multi-dimensional construct [8,15], as a total entity which is composed of social and physical factor that actively participates in decision-making in an organization [8,15]. This leads us to conceptualize that environment is comprised of various factors extraneous to the organization but within the boundaries of the decision making units or organizations. These factors consist of both social and physical factors and lies within and outside the boundary of an organization and are responsible for decision making in the organization [15]. Environmental uncertainty often rises due to inability of understanding and unpredictability of the changes in the market [28].This change in the market affects the internal structures and processes of an organization [29]. The unknown factors that are responsible for instability of the market are referred as market uncertainty [30]. Narver and Slater [31] explained that customer positioning and competitor positioning can be used as a measure for market positioning. It has also been cited in the literature that the nature of competition within the industry affects the performance of NPD and the environment of the market. High uncertainty in the environment is caused due to lack of market information that needs immediate response and reaction [32]. Customer has been identified as a resource for furnishing information to firms [33,34].Customers are also sources of product ideation. In marketing literature, it has been well defined that customers are reliable sources for conceptualization and ideation of new products [35,36, 37, 38]. It has also been cited in the literature that customers also serve as excellent source of innovation. In industrial products customers play an active role as co-creator [39]. Thus, market uncertainty plays a pivotal role in decision-making for product positioning. In addition, customer and competitor uncertainty acts as catalyst to the decision making process. These three factors togather helps in better product positioning for better success of a firm.

Earlier two scales were developed for measuring the perceived environmental uncertainty construct. The scales developed by Lawrance and Lorsch [18], served the purpose of examining the job related uncertainty in an organization. Duncan's [8] scale of uncertainty had two dimensions: complexity and dynamism. This scale measured the factor that is important for a firm's performance and its impact on decision of a firm's executive. Milliken [6] reviewed and suggested that the scale developed by [18], does not appropriately assess the general environment of a firm. She also suggested that Duncan's scale of uncertainty is unable to follow the definition of environmental uncertainty but explains the alternative form of environmental uncertainty. This leads to the fact that the scale developed by [8], is not adequate to measure the individual's perceived uncertainty. Researchers suggested that when tested empirically, measurement properties of both the scales are significantly weak [6,8].Both the scales have shown low reliability. Insignificant results were shown when correlation was performed between the two instruments and among the subscales of individual instruments. Unsuccessful results have been created when these scales were validated using 'objective measures of environmental volatility' [6,8,].Convergent test of both the scales developed by Duncan and Lawrance & Lorsch showed unsuccessful results. [40], performed an evaluation of the sub-scale of uncertainty developed by Lawrence and Lorsch [18]. Even though the intercorrelations of the items were not perfect and reported properly, Lawrance and Lorsch [18] combined the items of each subscale. While performing correlation between the subscale scores and alternative measures of uncertainty showed insignificant results. When factor analysis and internal reliability of the scales was performed, it showed that the instrument is not adequate methodologically. A six item scale was developed by Miles and Snow [15] who included competitors, suppliers, government and regulatory agencies, customers, financial markets, and unions. Ireland, Hitt, Bettis, and de Porras [41], performed a reliability test for this perceived environmental uncertainty scale and its subscales. The overall reliability of the scale resulted to be 0.80. This suggested that the scale can be used for further research purpose [8]. The measurement properties of the scale developed by Miles and Snow [15] were conducted by Buchko [20]. He concluded that the internal consistency of the scale was significant but the stability of the scale showed inadequate results. When considered the case of firm diversification, correlation of the scale with criterion measures showed insignificant results. Rai and Hindi [42](2000), used a 3-item instrument for measuring task uncertainty in a study to assess the impact of development process on modeling in software development project. These items were '1) fluctuation in users' requirements; 2) information available to perform the tasks; 3) the extent to which the project was subject to uncertain events. Researchers in the past have used the scale of uncertainty developed by Duncan [8] for performing several studies [43, 44, 45,46]. In relation with the above mentioned measurement properties, the scale have been questioned by [47] .It has also been stated by Buchko [20] ,that conceptualization of the uncertainty construct was not consistent. They were conceptualized in a variety of form such as predictability to controllability. This leads to a difference in conceptualizing the definition of uncertainty constructs. This creates difficulty in interpreting and generalizing the results. Several other researchers have utilized the uncertainty scale for their studies [48,49]. These scales were peculiar for a single study and reliability of the scales was not accounted or was accounted with very marginal results. Additionally, the definition of perceived uncertainty used in these studies varied widely and included the concepts of heterogeneity, complexity, turbulence which made the interpretation of the results debatable.

This provides a huge scope for exploring the variables of product positioning uncertainty in totality. This gives an opportunity for developing a scale for capturing and measureing a comprehensive list of product positioning uncertainty constructs and its underlying variables through statistical tests and evaluates the scale for its reliability and validity.

3 OBJECTIVE

Start-ups face uncertainties regarding decision making during new product development activity. A comprehensive list of market uncertainty variables need to be captured. A scale is needed to be constructed and its reliability and validity to be tested. Identifying factors of market uncertainty is also important. We also aim to identify the factors and its sub-dimensional measures by grouping and labeling the uncertainties through statistical tests.

4 METHODOLOGY

4.1 The Instrument

The instrument was developed to measure the factors that are responsible for market uncertainty in start-ups in developing country like India. This instrument is an uncertainty scale and consisted of 8 items referring to three types of uncertainty subscales. They are: (1) Uncertainty regarding the customer's preference and choice (CU2,CU4), (2) Uncertainty from the competitors activity(CM1 ,CM3) and (3) Uncertainty regarding the market identification(MU2,MU3,MU4,MU5).ove 8 items have created the above 3 different uncertainty subscale, thus the above subscales are the result of explanatory factor analysis. Each Item of the instrument was scored on a five point Likert-type scale that ranged from 1-strongly disagree to 5-strongle agree. The chronbach's coefficient (α) for this instrument was 0.743 for this study.

4.2 Sample

The sample consists of 151 founders and co-founders of start-ups in various domains in India. Questionnaires were mailed to 180 founders and co-founders of start-ups of which 100 was returned on the first instant after several mails and phone calls. Another 51 was returned after several attempts. A total of 151valid questionnaire was collected back.

4.3 Method

This study aims to test the validity and reliability of the uncertainty scale which was designed with an idea to measure the factors responsible for market uncertainty in start-ups in Indian context. The reliability (internal consistency) of the instrument was evaluated by Cronbach's α [50].This coefficient value depends on the correlations between the variables [51] and on the number of variables/items of the questionnaire. The index 'α ' is the most important reliability index and is resulted from the mean of correlation of al variables and is independent of their arrangement order [52]. By internal consistency or reliability of an instrument we mean that its result remains same after repeated operations and the results are not connected to the experimental errors.

The scale construct validity was determined using principal component analysis method. This method was used with varimax rotation. To test the suitability of the subscales for factor analysis, two statistical tests were performed. The first one is the Bartlett's Test of Sphericity. This test is performed to examine the inter-independency of the subscales of the scales. The other statistical test is the Kaiser-Meyer Olkin Measure of Sampling Adequacy

(KMO) [53], for examining the sample sufficiency. The main component is nalysed with right-angled rotation of varimax type for extracting factors. This is done to maximize the variance between the variable loads on a specific factor [52].

The extracted factors (components) are linearly irrelevant [52]. Two statistical tests were performed for determining the number of factors to be extracted. The first one is the Latent Root Criteria or the criterion of eigenvalue, where factors with Eigen value ≥ 1were retained [53,54, 55]. For acceptance of the model, each variable with loading more than 0.5 on a factor and less than 0.4 on other fators are considered in the variable cluster [56]. Moreover, each factor must consist of two or more variables. Additionally, the contribution of the variables with high communality (h2) is greater on the factorial model [55].S.P.S.S., of 16th edition was used to perform the factorial analysis of the questionnaire.

5. Evaluation of the scale

5.1 Reliability

The Reliability Statistics of Table 1 depicts that α coefficient for the research scale is 0.880=88%. This indicates a high level of internal consistency the product positioning uncertainty scale developed for this study.As shown in Table 2, the mean of the scale is 58.97. The variance and the standard deviation of the Scale is 98.632 and 9.931.

TABLE 1:
RELIABILITY STATISTICS

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.880	.880	16

TABLE 2:
SCALE STATISTICS

Mean	Variance	Std. Deviation	N of Items
58.97	98.632	9.931	16

The table Item-Total Statistics (Table 3) gives some of the following important information in particular.The numbers in the fourth column 0.869,0.874,0.873,0.866,0.878,0.868,0.874,0.865,0.881,0.866,0.871, 0.872,0.875,0.874,0.878,0.875 means that the specific items CU1,CU2,CU3,CU4,CM1,CM2,CM3,CM4,CM5,CM6, MU1, MU2, MU3, MU4, MU5, MU6 appear the Pearson coefficient of correlation of the class 86.9%, 87.4%, 87.3%, 86.6%, 87,8%, 86,8%, 87.4%, 86.5%, 88.1%, 86.6%, 87.1%, 87.2%, 87.5%, 87.4%, 87.8%, 87.5%. The fourth column of Table 3 also presents the value that Cronbach's alpha would be if that particular item was deleted from the scale. We can see that removal of any items(CU1,CU2,CU3,CU4,CM1,CM2,CM3,CM4,CM5,CM6, MU1, MU2, MU3, MU4, MU5, MU6), would result in a lower Cronbach's alpha. Therefore, none of the items will be removed from the scale

TABLE 3:
ITEM-TOTAL STATISTICS

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CU1	55.26	84.513	.600	.869
CU2	55.44	87.808	.483	.874
CU3	55.39	86.400	.506	.873
CU4	55.28	82.722	.670	.866
CM1	55.58	87.352	.419	.878
CM2	55.34	84.881	.636	.868
CM3	55.26	89.409	.480	.874
CM4	55.35	84.376	.706	.865
CM5	55.25	92.013	.301	.881
CM6	55.38	84.183	.676	.866
MU1	55.05	87.511	.566	.871
MU2	55.41	88.350	.550	.872
MU3	55.50	89.252	.464	.875
MU4	54.93	89.001	.500	.874
MU5	55.01	90.407	.387	.878
MU6	55.09	89.978	.452	.875

5.2 Sample suffiency test and sphericity test

Table 4 gives information about the sample adequacy of the set of variables. From the table, it can be observed that the sample sufficiency index KMO (Compares the size of the coefficient of the observed correlation to partial correlation for the sum of variable) is 79.6 %. This shows that the result exeeds the minimum criteria of 0.50 and it is reliable. The Sphericity Test given by Bartlett's test shows that null hypothesis (All correlation coefficients are not quite far from zero)is rejected at

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the level of significance p<0.0005 for approx. Chi-Square =1163.187. All the coefficients are not zero, satisfying the second acceptance of the factor analysis. Thus we can proceed as both the acceptances for conducting factor analysis are satisfied [52].

TABLE 4:
KMO AND BARTLETT'S TEST

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.796
Bartlett's Test of Sphericity	Approx. Chi-Square	1163.187
	df	120
	Sig.	.000

Figure 1 presents the Scree plot graph shows that 4 factors are above the Eigen value greater than 1. Thus we can consider these 4 factors (5.874, 1.690, 1.584, and 1.309). It is also shown in Table 5 that the cumulative proportion of variance criteria would also require 4 components to satisfy the criterion of explaining 60% or more of the total variance.

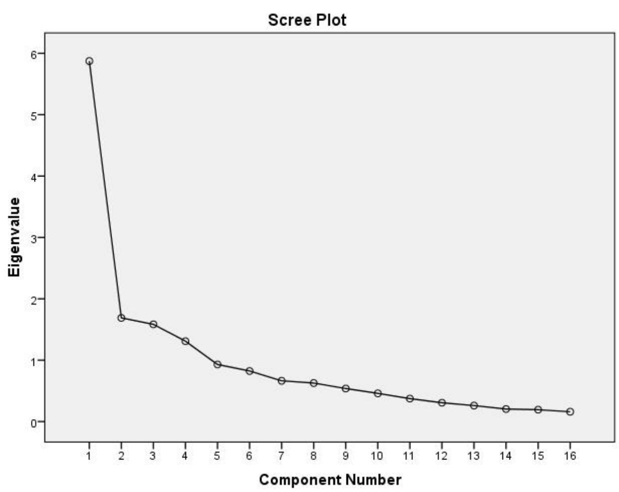

Figure 1: Scree Plot

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.87	36.71	36.712	5.874	36.71	36.7
2	1.69	10.56	47.272	1.690	10.56	47.2
3	1.58	9.901	57.173	1.584	9.901	57.1
4	1.30	8.183	65.356	1.309	8.183	65.3
5	.930	5.814	71.170			
6	.824	5.151	76.320			
7	.664	4.152	80.473			
8	.628	3.924	84.397			
9	.538	3.363	87.759			
10	.459	2.869	90.629			
11	.374	2.339	92.967			
12	.307	1.920	94.887			
13	.261	1.630	96.516			
14	.204	1.276	97.792			
15	.193	1.208	99.000			
16	.160	1.000	100.000			

TABLE 5:
TOTAL VARIANCE EXPLAINED

6 Results

The 151 valid questionnaires were collected for carrying out on a pilot study. This study is concerned on the validity and reliability of the questionnaire designed for the study. We opted for principal component analysis with the variance-covariance matrix, as 13 variables were obtained on a 5 point Likert-type scale. The sample adequacy KMO=0.796>0.50, which indicates that the sample is suitable for factor analysis. The Sphericity test (Bartlett's sign<0.001) proved that the principal component analysis is significant. The high values of the communalities can be identified from Table 6. It is ascertained from the table that majority of the questions has a value greater than 0.50.This represent a satisfactory measurement quality. For achieving better results, items with communalities less than 0.60(CU1, CM1 and CM3) is removed and then rotated component matrix is computed. According to the analysis of Table 5, four uncorrelated factors explain 65.356% of the whole inertia of data. The internal consistency (α) was computed to be 88% for the total questionnaire and was statistically significant.

TABLE 6:
COMMUNALITIES

	Initial	Extraction
CU1	1.000	.506
CU2	1.000	.639
CU3	1.000	.708
CU4	1.000	.793
CM1	1.000	.577
CM2	1.000	.646
CM3	1.000	.519
CM4	1.000	.601
CM5	1.000	.688
CM6	1.000	.669
MU1	1.000	.667
MU2	1.000	.641
MU3	1.000	.836
MU4	1.000	.640
MU5	1.000	.656
MU6	1.000	.671

The rotated component matrix shows the components/ factors along with its underlying dimensions and loadings obtained through Principal Component Analysis. It is observed that the first three components has more than 3 variables making these three components/ factors acceptable but on the other hand component/ factor 4 shows only one variable(CM5). So, this variable is removed and again analysis of the rotated component matrix is performed. Table 7 shows the rotated component matrix after deletion of the variable CM5.

TABLE 8:
ROTATED COMPONENT MATRIX

	Component		
	1	2	3
CU2	.169	.750	.055
CU3	-.006	.856	.195
CU4	.384	.792	.095
CM2	.595	.263	.399
CM4	.554	.375	.361
CM6	.465	.201	.636
MU1	.545	.469	.132
MU2	.792	.147	.098
MU3	.904	.063	-.010
MU4	.077	.151	.759
MU5	.398	-.199	.631
MU6	-.078	.210	.817

Based on the product positioning uncertainty presented by the factor analysis, questions CM2 (Uncertainty about change in competitors market), CM4 (Uncertainty about number of competitors and rivalry intensity), MU1 (Uncertainty about demand and proper forecasting), MU2 (Uncertaity about availability of substitute product), and MU3 (Uncertainty about availability of complementary product) with high loading (0.558, 0.523, 0.522, 0.806, and 0.911) load on first factor axis F1. The Eigen value of factor 1 is 5.874.Factor 1 explains 19.874% of the total dispersion. The first factor represents uncertainty about market competition.

Questions CU2 (Uncertainty about recognition of product value by customer), CU3 (Uncertainty about recognition of product utility (value and vis-à-vis cost) by customer), and CU4 (Uncertainty about relationship with customer) with loadings (0.734, 0.858 and 0.790) load on second factor axis F2. The Eigen value of factor 2 is 1.690. Factor 2 explains 16.041% of the total dispersion. The second factor represents uncertainty about market demand.

Questions CM6 (Uncertainty about enrty of new firms in the market), MU4 (Uncertainty about time to market), MU5 (Uncertainty about money for advertise / marketing) and MU6 (Uncertainty about setting market domain) with loadings (0.667, 0.739, 0.636 and 0.810) load on third factor axis F3. The Eigen value of factor 3 is 1.584. Factor 3 explains 15.560% of the total dispersion. The third factor represents uncertainty about market positioning.

7 CONCLUSION

Hence, evaluation of the reliability and validity of the product positioning uncertainty scale is performed. The product positioning uncertainty scale consisted of 16 items focusing on three types of variables (market, customer and competitor) that are responsible for product positioning uncertainty during decision-making.These three factors were derived from PCA based on the input of 151 founders and co-founders of start-ups in India. The scale promises to be considered as a research instrument for identifying the product positioning uncertainty. In future this quantitative study can be further supported by qualitative study. New discussions and implications can be drawn from the comparative study of the empirical and qualitative results.

Principal component analysis (PCA) resulted in four factors that can be a cause of uncertainty. The factors are: i) Uncertainty in market competition ii) Uncertainty about market demand, and iii) Uncertainty about market positioning.

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