

1 Accessing the Construct and Content Validity of Uncertainty 2 Business Using Sem Approach-An Exploratory Study of 3 Manufacturing Firms

4 Ravindran Ramasamy¹ and Dr. Anbalagan Krishnan²

5 ¹ Curtin University

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7

8 **Abstract**

9 Construct and content validity is necessary to provide purified data for any exploratory
10 research study. The commonly widely used in any exploratory research study is Cronbach
11 Alpah to analyze data validity. However more robust analysis like Confirmatory Factor
12 Analysis (CFA) in Structural Equation Modeling provides more rigorous analysis of model
13 power in relation to construct and content validity. This paper provides insight of this
14 construct and content analysis using the CFA approach by analyzing the Business
15 Environmental Uncertainty research variable. To achieve the intended research objective, the
16 BEU is explored in the context of Malaysian manufacturing sectors. Detailed illustration of
17 the validity, analysis using the CFA approach together with the Cronbach Alpah was
18 provided. The result analysis indicates to improve the model power in relation to the validity
19 any manifest variables below the threshold require to be dropped. Moreover the Cronbach
20 Alpah value is not much affected although some of the manifest variables do not significantly
21 contribute to the research variable. In conclusion, a recommendation was give for future
22 research to test the data validity.

23

24 **Index terms**— Convergent Validity, Loading Factor and Variance Explained.

25 **1 INTRODUCTION**

26 It is common in exploratory study for the survey instrument to be subject to reliability and validity examination
27 (Collis & Hussey, 1995). Reliability reflects the stability and consistency of an instrument in measuring the
28 concept (Page & Meyer, 2000; U. Sekaran, 1992Sekaran, , , 2003)). Numerous exploratory research studies
29 focus on Cronbach alpha to test reliability. This method is commonly used to assess the reliability of each
30 measure. The threshold for Cronbach alpha, is the higher the coefficient alpha values indicate the reliability of
31 measurement instrument, the better. ??unnally and Berstein (1994) suggested that 0.70 to be an acceptable
32 reliability coefficient level. In a similar view, Sekaran (2000) asserted the Cronbach's alpha measure above 0.70,
33 indicates that the instrument has the internal consistency reliability.

34 Lately, research studies examine the reliability and validity of survey instruments using more robust approaches
35 such as SEM technique.

36 Under this technique, data reliability is verified using the Confirmatory Factor Analysis (CFA) approach. The
37 CFA analysis provides standardized loading factor of each indicator where the research variable is quantified from
38 a series of statement known as manifest variable. The standardized loading factor (regression weight) indicates
39 the contribution of each indicator to the respective research latent variable. According to ??air et al., (2006) a
40 good standardized loading factor of each measurement latent variable of which quantified from manifest variable
41 should be above 0.5and ideally 0.7 or higher. Data validity is also tested using the Variance Extracted (VE)

4 UNCERTAINTY QUANTIFICATION

42 approach. The average percentage of Variance Extracted (VE) is a specific Confirmatory Factor analysis testing
43 the convergent validity. According to ??air et al., (2006) the VE of 0.5 or higher as a rule of thumb is good,
44 suggesting adequate convergence.

45 The objective of this research study is to explore the construct and content analysis using the SEM approach.
46 To illustrate this research objective, the study focuses on uncertainty of business environment research variable.
47 For this purpose the study concentrates on firms operating in manufacturing sectors in Malaysia. This paper
48 is organized into four main sections -the first section provides literature of business environmental uncertainty.
49 The second section provides methodology to quantify the uncertainty as well as analytical expression to test the
50 validity of uncertainty research variable using the SEM approach. The third section provides descriptive statistics
51 of firms in the sample study. This is followed by result output of construct and content analysis using the SEM
52 approach. This section also includes discussion of the result output. The final section provides the conclusion
53 and future research recommendations.

54 2 II.

55 3 UNCERTAINTY OF BUSINESS ENVIRONMENT

56 A general definition of business environmental uncertainty is "an individual's perceived inability to predict
57 (an organization's environment) accurately" because of a "lack of information" or "inability to discriminate
58 between relevant and irrelevant data" (Milliken, 1987). According to prominent researchers in I management
59 accounting like Chenhall.R. ?? (2003) and Head (2005), uncertainty is generally described as an information
60 deficit and they define situations in which probabilities cannot be assigned to particular outcomes. Under this
61 circumstances, elements of the environment are very unpredictable, for instance actions of other economic players
62 like competitors, customers, suppliers, and regulators. M. ??leming et al., (2009) asserts that uncertainty makes
63 it difficult for managers to predict the future.

64 According to ??ohnson and Scholes (1999), the extent of business environmental uncertainty is viewed as
65 a function of the level of increase in environmental dynamism and complexity. Jabboun (2003) noted there
66 is a difference between dynamic environment and environmental complexity as explained below:-? Dynamic
67 environment is typified by change in environmental variables constituting the uncertainty dimensions such
68 as technology, customer needs and tastes, demand and supply conditions, and competition. These changes
69 generate uncertainty for the firm. ? Environmental complexity is summed up by the number and diversity of
70 variables influencing the uncertainty dimensions in the environment. According to Milliken (1987), perceptions
71 of environmental uncertainty occur when executives are unable to predict future changes in components of the
72 environment or possess an incomplete understanding of the relationship among components of the environment.
73 According to the author there are three categories of uncertainty of business environment:

74 ? Effect uncertainty which is an inability to predict the nature of the effect of a future state of the environment
75 on the organization; ? Response uncertainty which is the inability to predict the likely consequences of a response
76 choice and ? State uncertainty which is the perceived environmental uncertainty. The perceived environmental
77 uncertainty occurs when administrators perceive an organization's environment to be unpredictable.

78 Research studies have concentrated extensively on the relationship between perceived environmental un-
79 certainty and organizational characteristics such as firm size, strategy, structure, and performance measures
80 (Gordon & V.K.Narayanan, 1984; Gul. & Chia., 1994); for instance, empirical studies by ??ordon and
81 Narayanan (1984), ??henhall and Morris (1986) and subsequently Gul and Chia (1994) found that perceived
82 environmental uncertainty is associated with the characteristics of management accounting information. Thus,
83 business environmental uncertainty is an important research topic of management accounting and performance
84 measurement system (Gordon & D.Miller, 1976).

85 To achieve the research objective of this study, the uncertainty of business environment is explored using
86 Desarbo et al., ??2005) model. This model consist of three categories of uncertainty namely, market environment,
87 technological environment and competitive environment as illustrated in the following figure. Using this model,
88 data was collected from Malaysian manufacturing firms and tested for construct and content validity.

89 4 UNCERTAINTY QUANTIFICATION

90 As depicted in figure ??1 above, the environmental uncertainty survey instrument consists of 19 questions. The
91 statement quantifying the market environment and the competitive environment is retained with some minor
92 modification to the statements to improve understanding and to suit the current business environment. As
93 for the Technological environment, the original instrument consisting of six questions has been reduced to five
94 questions as one of the questions carries a similar meaning. Redundant questions are omitted not to confuse the
95 respondent and also to prevent missing data problems if the majority respondents failed to answer. In replacement
96 to this redundant question, a new question was added addressing obsolete statements. This is necessary as this
97 issue has a significant impact on technological development, particularly in the current business condition. The
98 respondents were asked, on a five-point scale ranging from 1 "Strongly Disagree" to 5 "Strongly agree", to indicate
99 their organization's level of uncertainty in accordance the three categories. ? companies with stable (and low)
100 environmental uncertainty are defined as firms whose average score was less than or equal to 3.5; ? companies
101 with moderate environmental uncertainty are identified as firms whose average score was greater than 3.5, but

102 less than 4.5; and ? companies with high environmental uncertainty are defined as firms whose average score was
103 greater than or equal to 4.5.

104 The following analytical expression illustrates the methodology determining the firm's uncertainty level of
 105 business environment as explained above.
$$\Delta \text{uncertainty} = \sqrt{3.5 \times 2 \times 3.5} = 3.5$$

 106
$$\Delta \text{uncertainty} = \sqrt{4.5 \times 3 \times 4.5} = 4.5$$
 (1)

107 Where: δ ???" δ ???" ?? = Firm's uncertainty of business environment ?? = Summated Mean Score ?? = Three
 108 uncertainty of environment -Market Environment, Technological Environment and Competitive Environment
 109 ?? = Respondent 1, ?, K As explained above, Uncertainty is quantified based on the three categories of
 110 environment. In SEM approach, the Business environment uncertainty is classified as endogenous while the
 111 other three categories of uncertainty are considered as exogenous. The Uncertainty endogenous quantified from
 112 the three exogenous manifest variables are statements in the questionnaire as discussed earlier. The following
 113 analytical expression depicts the manifest variables for Uncertainty endogenous latent variable.

114 Business Environmental Uncertainty manifest variable?? ?? ??? = ?? ?????? ?? 1?????? + ?? ????.??(2)

115 Where ?? ?? ??? = Manifest variables in the questionnaire ?? ????? = Manifest variables factor loadings ??
116 1?????? = Business environmental uncertainty ?? ????.?? = Manifest variables indicators error

117 As illustrated in the above formulae, the manifest variables factor loading or regression weight is calculated for
118 all three categories of exogenous. The identified factor loading of each manifest variable indicates the significance
119 of each manifest variable that quantified the endogenous variables. Any of the manifest variables factor loading
120 below than the threshold level that is below 0.5 is purged to improve the model fit. As discussed earlier, the
121 convergent validity is tested using the Variance Extracted (VE). The Variance Extracted (VE) value is indicated
122 as Total Variance Explained presented together with the standardized manifest loading factors. The following
123 segment provides the details of the firms analyzed followed by the result output of the construct and content
124 analysis.

125

126 5 UNCERTAINTY VALIDITY ANALYSIS

127 The target population of this study is Malaysian firms operating in the manufacturing sector. Majority of
128 the respondents were from industry related to manufacturing products representing 50% (126 respondents).
129 Respondents from the Electronic and Electrical products companies represented 24% (60 respondents). This is
130 followed by respondents involved in manufacturing Medical products which consist of 11% (28 respondents).

131 6 ??

132 = Level of uncertainty (1 -Stable, 2-Moderate, 3-high) The respondents' firm ownership structure analysis revealed
 133 that out of the 244 firms, 159 firms are Malaysian owned firm which represents 63% and 79 firms consisting of 31%
 134 are Foreign owned firms. A very small percentage of firms which is 2% (n= 6 firm) operates on the basis of joint
 135 venture business ownership structure. From the total of 253 firms, 9 (4%) firms failed to indicate their business
 136 ownership structure. Analysis of standardized loading factor for Business Environmental Uncertainty (BEU)
 137 endogenous variables revealed some of the manifest variables values are below the threshold of 0.5. As shown in
 138 the table, the Market Environment exogenous variable recorded few manifest variables value below 0.5 compared
 139 to other two exogenous categories. The Technological Environment and Competitive Environment consist of
 140 manifest variable one each where the values are below 0.5. Due to the low manifest variable's loading factor,
 141 the convergent validity for business environmental uncertainty endogenous is severely affected. The Variance
 142 Extracted value 43% is below the recommended value of 50% although the Cronbach Alpa value is above the
 143 recommended level which is 0.7. As recommended by ??air et al., (2006) any manifest variable standardized
 144 loading factor below 0.5 is required to be eliminated in order to improve VE value of above 50%. Dropping
 145 manifest variables with loading factor below 0.5 is also necessary to remove errors in measurement. By removing
 146 this error, the researcher will only take the purified data to improve the overall SEM model fit. The following
 147 table provides details of manifest variables that need to be purged. As seen in the table, the Market environment
 148 exogenous variables, a total of 5 manifest variables were removed. Among the Market Environment manifest
 149 variable, retaining the Productrelated needs although closer to the loading factor of 0.5 still produce the VE
 150 value below 0.5. Thus, this variable was also purged to achieve the acceptable VE value.

Under the Technological environment and Competitive environment exogenous variables as mentioned earlier, one each manifest variables are removed. As seen in the Table 1.4 below, the standardized factor loading of the three exogenous manifest variables are within the range of 0.5 to 0.9 with the highest recorded for Product preferences change quite often (0.932) from Market Environment exogenous variables and the lowest recorded for Technology becomes obsolete quickly (0.521) from Technological Environment exogenous. After removing the standardized loading factor, the overall percentage of Variance extracted (VE) improved from 43% to 58%. Thus the endogenous business environmental uncertainty after the modification provides greater convergent validity of data for further SEM analysis.

159 After removing the manifest variable with loading factor below 0.5, the Business Environmental Uncertainty
 160 endogenous comprised twelve manifest variables. According to ??air et al., (2006) as a rule of thumb, the number
 161 of manifest variable per latent variable must be at least three. The SEM diagram as shown in Figure ???.3 above

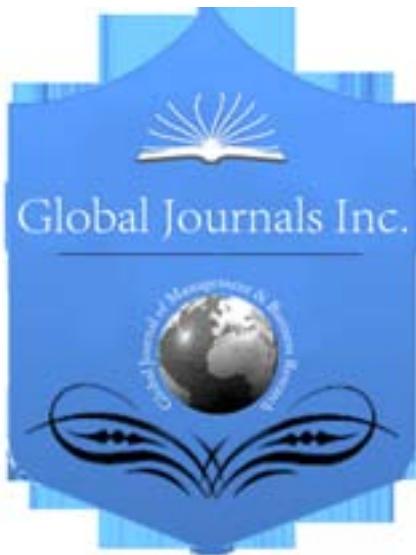
7 CONCLUSION

162 indicates the BEU endogenous after the modification consists of 12 manifest variables above the recommended
163 values. Thus the overall 12 items for Business environmental uncertainty measurement is now qualified for further
164 SEM analysis.

165 7 CONCLUSION

166 A point to note on both analyses before the modification and after the modification, the Cronbach's Alpha
167 coefficient value is well above the recommended level of 0.7. As seen in the table, the value before modification
168 is 0.83 while the value after modification is 0.84. The overall Cronbach's Alpha analysis or even item by item
169 analysis provide indication of the data reliability. However, the test of convergent and construct validity is further
170 improved with SEM approach. One of the major advantages of the CFA approach under the SEM analysis is that
171 it provides the researcher the power of model validity by indicating the Total Variance Explained. In summary
172 the higher standardized factor loading and higher percentage value of VE of the endogenous variables enable
173 the examination of the significance of research variables more precisely and improvement of the data analysis.
174 Thus it is strongly recommended that any future study use the Confirmatory factor analysis together with the
Cronbach Alpha to achieve better results to support the research study.

^{1 2 3 4 5}



11

Figure 1: Figure 1 . 1 :

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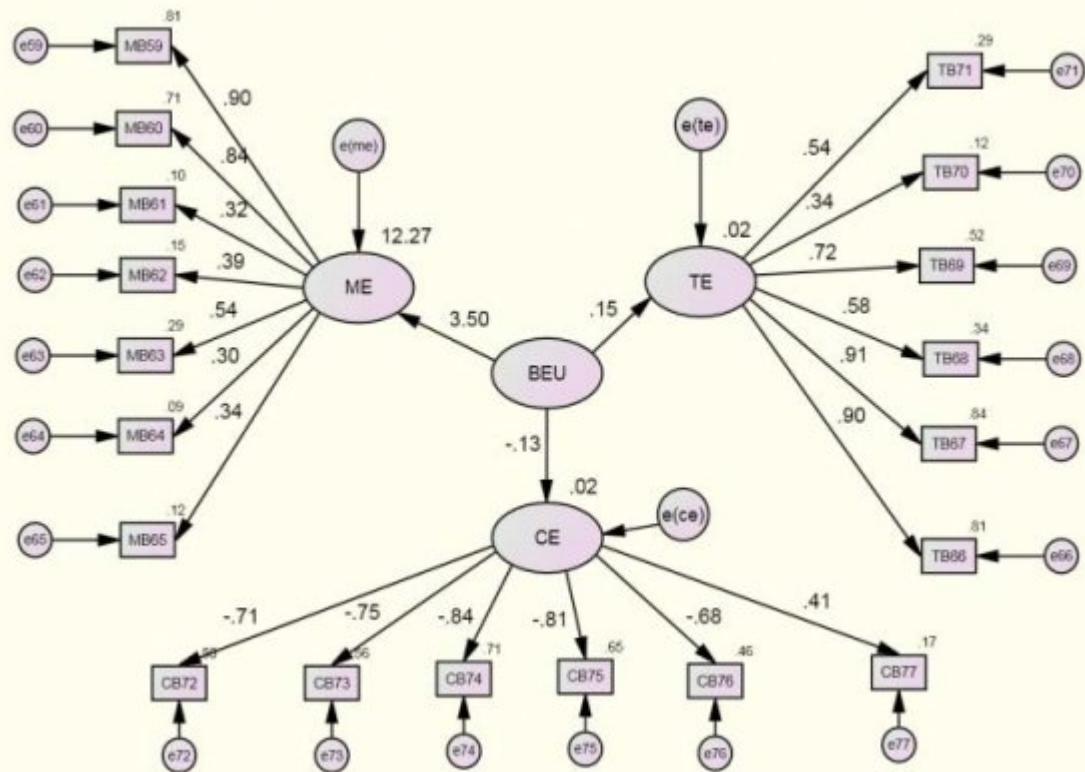
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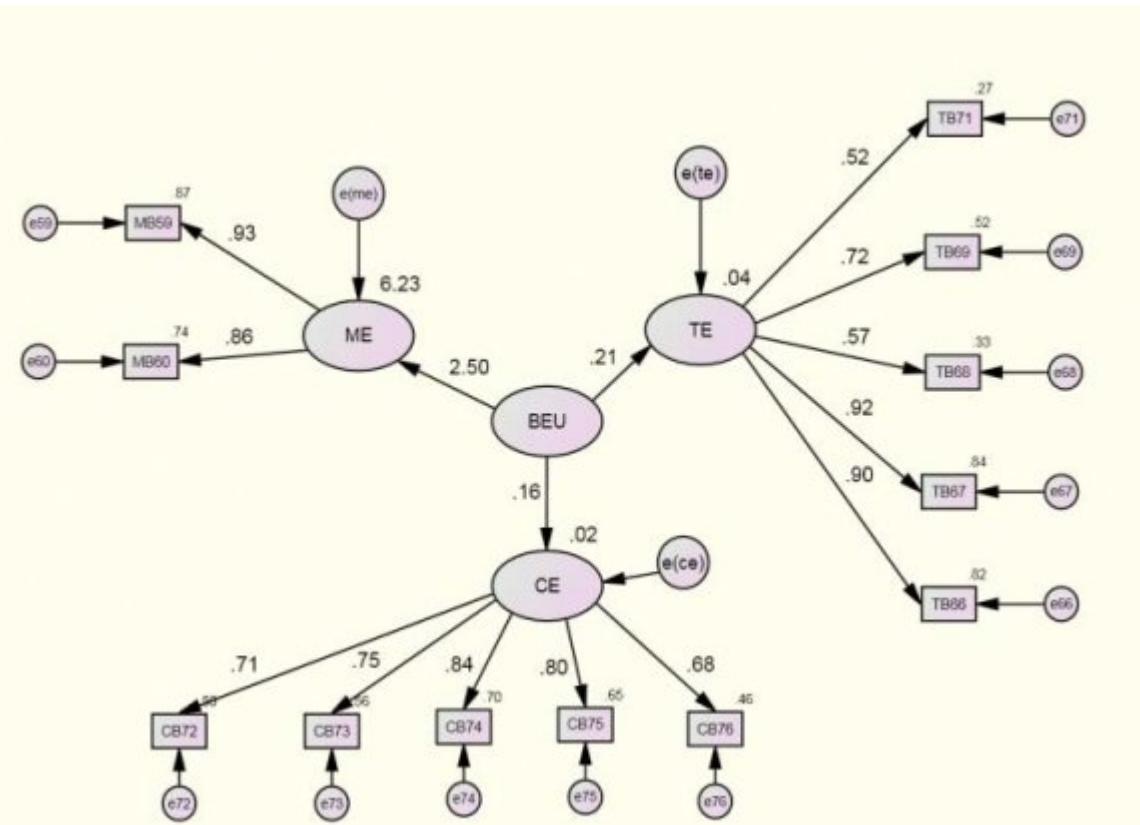
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Figure 2: Figure 1 . 2 :



13

Figure 3: Figure 1 . 3 :

Figure 4:

1

Business Activity	No of Firms	Percent (%)
Agriculture Products	7	3
Manufacturing Products*	126	50
Electronic and Electrical Products	60	24
Chemical and Petroleum Products	11	4
Infrastructure Products	19	7
Medical Products	28	11
Other Products	2	1
Total	253	100

[Note: *Includes Food and Mineral, Furniture, Iron & Steel Products, Paper, Rubber, Souvenirs, Sport, Textile, Toys, Wood Products.]

Figure 5: Table 1 .

2 : BEU Standardized Regression Weight Business Environment Uncertainty	Factor Loading
Market Environment	
Product preferences change quite often (MB1)	0.901
Customer look for new products (MB2)	0.844
Price-sensitive (MB3)	0.322
Price is relatively unimportant on some occasions (MB4)	0.391
Product-related needs (MB5)	0.494
Service existing loyal customers continuously (MB6)	0.299
Difficult to predict product changes/customer preference (MB7)	0.343
Technological Environment	
Technology rapidly changing (TB 8)	0.898
Technological changes provide opportunities (TB9)	0.914
Difficult to forecast future technology (TB10)	0.583
Technological breakthrough (TB11)	0.722
Technological development minor (TB12)	0.342
Technology becomes obsolete quickly (TB13)	0.539
Competitive Environment	
Price competition (CP14)	-0.705
Overall competition (CP15)	-0.746
Competitor offers (CP16)	-0.841
Promotion war (CP17)	-0.805
Competitive Move (CP18)	-0.678
Competitors are relatively weak (CP19)	0.408
Total Variance Explained	43%
Cronbach' Alpha	0.83

Figure 6: Table 1 .

3 : BEU Manifest Variables Purged Manifest Variable	Loading Factor
Market Environment	
Price-sensitive (MB3)	0.322
Price is relatively unimportant on some occasions (MB4)	0.391
Product-related needs (MB5)	0.494
Service existing loyal customers continuously (MB6)	0.299
Difficult to predict product changes/customer preference (MB7)	0.343
Technological Environment	
Technological development minor (TB12)	0.342
Competitive Environment	
Competitors are relatively weak (CP19)	0.408

Figure 7: Table 1 .

1

4 : BEU Standardized Regression Weight-After Modification Business Environment Uncertainty	Factor Loading
Market Environment	
Product preferences change quite often(MB59)	0.932
Customer look for new products (MB60)	0.707
Technological Environment	
Technology rapidly changing (TB 66)	0.904
Technological changes provide opportunities (TB67)	0.917
Difficult to forecast future technology (TB68)	0.570
Technological breakthrough (TB69)	0.720
Technology becomes obsolete quickly (TB71)	0.521
Competitive Environment	
Price competition (CP72)	0.707
Overall competition (CP73)	0.750
Competitor offers (CP74)	0.836
Promotion war (CP75)	0.805

Figure 8: Table 1 .

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