Factors determining uncertainty in capital budgeting decision making: Perspectives on Sri Lankan Listed Companies

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Abstract

*Allocating resources among competing investment projects is one of the most critical decisions made by the top management and is of **strategic** importance, and it invariably involve large sums of money and have a long-term economic life cycle. These decisions are critical to managing strategic change and sustaining long term corporate performance. Current investment markets are evolving within an increasingly volatile and intertwined global network and investments are strongly exposed to uncertainties .Uncertainties could lead to failure of a good investment decision and thus integration of uncertainty with capital budgeting techniques is overarching, nonetheless, often complex . Over the last two decades, corporate practices regarding capital budgeting have not been static and have diverged from theories. Therefore, aim of this study was to identify the factors indicating uncertainty in capital budgeting decision making which focused on Sri Lankan listed companies .The data for this study were garnered from 186 CFOs working in companies listed on the Colombo Stock Exchange using self-administered questionnaires. The questionnaire was piloted with a sample of five CFOs. After the data were collected, they were analysed using multivariate analysis such as factor analysis and confirmatory factor analysis. This study identified four major types of specific uncertainty factors: market uncertainty (uncertainties on competitive, output market and input market), social uncertainty (uncertainties on policy, political and social), operational uncertainty (uncertainties on input, labour and production) and financial uncertainty (uncertainties on interest rate, inflation rate and exchange rates). Overall, this study has made parametric contributions as identified four uncertainty factors ,beyond its valuable contribution, this study serves as a springboard for future research.*

***Key Words** : Market Uncertainty, Social Uncertainty, Operational Uncertainty, Financial Uncertainty*

1.1 Introduction

The survival and vitality of a company is determined by its ability to regenerate itself through the allocation of capital into productive use (Arnold and Hatzopoulos, 2000). Allocating resources among competing investment projects is one of the most critical decisions made by the top management and is of strategic importance, and it invariably involve large sums of money and have a long-term economic life cycle. These decisions are critical to managing strategic change and sustaining

long term corporate performance. Therefore, one of the most important strategic decisions for an organisation is how much to invest in assets, when to invest and which assets should be invested in. This is evaluated by systematic capital budgeting decisions. Nonetheless, current investment markets are evolving within an increasingly volatile and intertwined global network and investments are strongly exposed to uncertainties (Bock and Truck, 2011). Uncertainties could lead to failure of a good investment decision and thus integration of uncertainty with capital budgeting techniques is overarching, nonetheless, often complex (Ghahremani, Aghare and Abedzadeh, 2012). Over the last two decades, corporate practices regarding capital budgeting have not been static and have diverged from theories (Slagmulder, Bruggeman and Wassenhove, 1995; Arnold and Hatzopoulos, 2000). Empirical evidence shows that the theoretical application of sophisticated capital budgeting involves the use of multiple tools and procedures (e.g., Monte Carlo simulation, certainty equivalents, game theory decision rules and real options reasoning, Verbeeten, 2006). Therefore, capital budgeting theories are not applicable in all situations in contemporary borderless global business, leading to a research gap between theory and practices.

Capital budgeting investment of firms involved large sums of money over the long periods are crucial for the sustaining, surviving and flourishing in markets (Emmanuel, Harris and Komakech, 2010; Ghahremani, Aghaie and Abedzadeh, 2012), decisions on capital budgeting investments are critical owing to the influence of uncertainty factors (e.g., Peterson and Fabozzi, 2002, Cooper et al., 2002; Dayananda et al., 2002; Ghahremani, Aghaie and Abedzadeh, 2012). The global financial crisis epitomised this truth. The sources of uncertainty range *from* the mundane (such as cash flow estimation, number and sources of estimation error) to themore esoteric (such as complementarities among investments, options presented by investment opportunities, opportunity cost of investments) (Haka, 2006). One of the most intractable issues confronted by researchers is how to identify, capture, and evaluate uncertainties associated with long term investment projects (Haka, 2006).

Considering the importance of investment decisions nowadays, complex methods are used for making capital budgeting decisions rather than purely depending on theories of capital budgeting to *mitigate* the effect of uncertainty and other contingency factors (Arnold and Hatzopoulos, 2000; Cooper et al., 2002; Byrne and Davis, 2005; Verbeeten,2006; Zhang, Huang and Tang, 2011; Kersyte, 2011; Bock and Truck, 2011; Singh, Jain and Yadav, 2012). Thus, the process of change requires a re-examination of the fundamental assumption that cut through traditional boundaries of the financial management (Hill, 2008). Therefore, identifying factors indicating uncertainty in investment decision would provide a significant parametric contribution into extant investment decision literature. Thus, *the main aim of this study was to identify the*

factors indicating uncertainty in capital budgeting decision making in Sri Lankan emerging market.

In the globalisation era, stand-alone application of capital budgeting theory is challenging and some theories do not hold water today, accounting for the influence of uncertainty factors. *Nonetheless*, uncertainty factors and their influence vary across countries. Thus, identifying uncertainty factors makes a *parametric* contribution in this study. Therefore, problem statement of the current study is '*What factors make up uncertainty in capital budgeting decision making in Sri Lanka?'*

1.2 Uncertainty on capital budgeting practices

In an economic context, uncertainty can be seen as being composed of two main elements: low-uncertainty and upturned uncertainty (Knight, 1921). Low uncertainties are events that have an adverse effect on outcomes compared with expectations. In contrast, upturned uncertainties are events that have a surprisingly better result than expected. In financial management, uncertainties are sometimes called risks. Anderson et al. (1981) states that uncertainty is a situation in which one has no knowledge about which of several states of nature has occurred or will occur. Verbeeten (2006) defines uncertainty as "the gap between the information currently available and the information required to make the decision' (p. 289). However, Al-Harthy (2010) states that 'uncertainty is defined as the range of an outcome, and risk is the probability of gain or loss associated with a particular outcome' (p.331). In the management literature, the terms uncertainty and risk are used interchangeably (Miller, 1992).

Many research scholars concur that uncertainty exists in capital budgeting and that this might have far reaching consequences for the survival of a company (e.g., Zhu and Weyant, 2003; Simerly and Li, 2000; Smit and Ankum, 1993; McGrath, 1997; Bulan, 2005; Emmanuel, Harris and Komakech, 2010; Bock and Truck, 2011; Ghahremani, Aghaie and Abedzadeh, 2012). Over time, many measures have been developed to assess uncertainties (e.g., Lawrence and Lorsch, 1967; Miles and Snow, 1978; Wernerfelt and Karnani, 1987) and many studies have been conducted to investigate the effect of uncertainty on investment practices across many countries (e.g., Govindarajan, 1984; Chen, 1995; Ho and Pike, 1998; Bulan, 2005; Byrne and Davis, 2005; Verbeeten, 2006; Bock and Truck, 2011). Miller (2000) states that 'in the real world, virtually all numbers are estimates' and 'the problem with estimates, of course, is that they are frequently wrong' (p.128). Therefore, a capital budgeting decision requires systematic and careful analysis in the current uncertain global environment. Pike (1996) conducted a study on the application of tools for uncertainty analysis in capital budgeting practices. He suggested that capital budgeting decisions were taken under uncertainty.

Several studies have attempted to identify

the nature of the relationship between uncertainty and the capital budgeting practices of organisations. The results of this relationship are often clashing. For example, Kim (1981) and Schall and Sundem (1980) found that all uncertainty seems to be related to the application of a criterion for payback in capital budgeting practices. Besides that, most studies found that the use of discounted cash flow (DCF) techniques appears to decrease in highly uncertain environments. This result is contrary to the findings of Schall and Sundem (1980), who stated that firms in uncertain environments use sophisticated capital budgeting practices (i.e., DCF-techniques). Haka (1987) found that predictable environments led to increased use of DCF techniques and higher performance. However, Haka's results have been contradicted by the results of Chen (1995), who found that most environmental uncertainty resulted in higher application rates for DCF-techniques. Verbeeten (2006) revealed that increasing financial uncertainty is associated with the use and importance of sophisticated capital budgeting practices in terms of Real Option Theory and Game Theory.

Uncertainty takes different forms: business uncertainty and project uncertainty (Townsend, 1969); market uncertainty and company uncertainty (Seidler and Carmichael, 1981); static and dynamic uncertainty (Fanning, 1983); strategic, operational and financial uncertainty (Vojta, 1992); general, industry and firm uncertainty (Miller, 1992); direct and indirect uncertainty (Pringle and Cannolly, 1993); aggregate uncertainty and firm-specific or idiosyncratic uncertainty (Dixit and Pindyck,1994); business and financial uncertainty (Baril, Benke and Buetow, 1996); *endogenous* and *exogenous uncertainty* (Folta, 1998); market, industry and firm specific uncertainty (Bulan, 2005); input uncertainty, financial uncertainty, social uncertainty and market uncertainty (Verbeeten, 2006).

Of these different types of uncertainty, Miller's (1992) uncertainty framework has been selected for the current study on identifying uncertainty in line with Verbeeten, (2006) as other models of uncertainty demonstrate a lack of knowledge with regard to the factors that determine measures of uncertainty. This framework provides an opportunity to identify factors indicating uncertainty on capital budgeting practices and this framework covers a wide range of uncertainties: external environment (competition, exchange rates, etc.) and internal environment (behaviour, research and development, etc.), and it also provides the opportunity to cover general, industry related and firm specific uncertainty factors. The details are presented in Table 1.

Table 1: Uncertainty and its components

Uncertainty	Description	Miller's (1992) model	Verbeeten's (2006) model
Political	Terrorism, War, Changes in Government, Political instability	A three level model	A four level model
Government policy	Fiscal and monetary policies, Trade restrictions, regulations affecting the business sector, Tax policy	**General environment uncertainties include** Political Government policy Macro Economic Social	**Input uncertainties include** Raw material Input market Production Labour Liability
Macro Economic	Exchange rate, Interest rate, Inflation, Terms of trade		**Financial uncertainties include** Inflation Interest Exchange rate
Social	Social unrest, Shift in social concerns, (beliefs, values and attitudes reflected in current government policy or business practice)	**Industry specific uncertainties include** Input market Product market Competition	**Social uncertainties include** Political Society Policy
Natural	Variations in weather, Natural disaster		**Market uncertainties include** Competition Output market
Input market	Quality of inputs, Supply relative to industry demand		
Product market	Consumer preferences, Market demand, Availability of substitutes and complements	**Firm specific uncertainties includes** Operations Liability R & D Credit & fraud Cultural Behavioural	
Competition	Pricing and other forms of rivalry, New entrants, Product and process innovation, technological uncertainty		
Operations	Labour relations, Availability of inputs, Production variability and downtime		
Liability	Product liability, emission of pollutants		
R & D	R & D activities, regulatory approval of new product		
Credit & fraud	Problems with collectibles, Fraudulent behaviour of employees		
Cultural	Cultural friction		
Behavioural	Agency problems, Emotions, Overconfidence		

Miller's (1992) framework was applied by Verbeeten (2006), which offered the opportunity to investigate the role of specific uncertainties that have an impact on capital budgeting practices. As can be seen in Table 1, although they used similar variables to investigate uncertainty, the model and the variables composing uncertainty are different. This might be attributed to country-culture specific factors. Therefore, this study raises a research question:

RQ_1: *What factors make up uncertainty in capital budgeting decision making in Sri Lanka*

And thus, it can be hypothesised that:

H_1: *Miller's (1992) three-level model is applicable in the Sri Lankan context.*

1.3 Research methodology

1.3.1 Research approach

This study is anchored in the theory of capital budgeting theory and contingency

theory and ipso facto, a deductive approach is the most appropriate choice. Following a robust review of capital budgeting theory and contingency theory, the hypotheses was proposed. Then, the questionnaire to identify the factors indicating uncertainty was adapted and modified. Therefore, it is fair to say that this research is quite consistent with a deductive approach, which emphasises that the researcher may know how the world operates and examine these ideas with "hard data" (Neuman and Kreuger, 2003).

1.3.2 Research strategy

This study chose a "survey" strategy to answer the research question. This strategy provided a framework for the data collection and analysis (Bryman and Bell, 2007). The survey strategy permits the researcher to garner requisite data using the questionnaire.

1.3.3 Research site

The data for this study were collected from all companies listed on the Colombo stock exchange, Sri Lanka. Sri Lanka is an island located at the southern tip of India and geographically it is extremely important. Recently, driving forces of enhanced economic performance: the growth of GDP, peace, freedom from terrorism and stability have led the IMF to change the state of Sri Lanka from 'Poverty Reduction and Growth Trust' to an 'emerging middle income market'. This is an important milestone as the island nation makes its way down the path of development and reaps the benefits of peace. Sri Lanka has shown robust growth since the end of the 30-year civil war in May 2009 and it has begun to show more sustainable growth. According to the Central Bank of Sri Lanka (2011), all key sectors of the economy demonstrated a commendable performance in 2010 and 2011, supported by the peaceful domestic environment, the improved investor confidence, favourable conditions of macroeconomic factors, and the gradual recovery of the global economy from one of the deepest recessions in history. In the post war recovery phase, the on-going reform of the financial market has become essential to accelerate its economic growth more than ever before.

As well as local demand for business investment, heightened foreign interest in investment has also escalated due to the strategic location of Sri Lanka: close to India and the east-west international sea route. For instance, the central bank of Sri Lanka reported that Foreign Direct Investment (FDI) reached a peak of USD 1.07 billion in December 2011, this was USD 1.38 billion in 2012 and USD 1.42 billion in 2013. FDI has steadily been increasing towards Sri Lanka. This improvement in status is expected to open up further international capital markets for the country and bring attention from investors targeting emerging markets with strong projected growth. Therefore, nowadays, investment decisions play a more vital role than ever before in Sri Lanka. Even though, in Sri Lanka ,political uncertainty is

especially detrimental for attracting foreign direct investment that is vital for the country's economic growth. Foreign investors prefer a stable political environment, with less policy uncertainty and assurance of property rights. A high degree of political uncertainty created by possibilities of changes of government that may bring drastic economic policy changes is detrimental to investment. Therefore, to the researcher's knowledge, no studies have been conducted to identify the uncertainty factors in investment decision making in Sri Lanka over the course of the last four decades.

1.3.4 Population and Sampling framework

As this is the first study conducted in Sri Lanka, as a caveat, meticulous attention was given to the selection of sampling.

Shinoda (2010) considered the whole population for his study. However some researchers have covered different sizes of companies (e.g., Arnold and Hatzopoulos, 2000), and others have focused on industry groups (e.g., Singh, Jain and Yadav, 2012). Furthermore, the majority of the studies reported a low response rate (e.g.,Andres, Fuente and Martin, 2015). Since only 287 companies are listed on the Colombo stock exchange in Sri Lanka and hypothesis testing is based on multivariate analysis techniques that require a large sample size, this study decided to consider the whole population. Moreover, selecting the whole population means representing Sri Lanka as a whole and thus the findings will be robust for generalisation.

Although the people who make capital budgeting decisions in Sri Lanka are named chief financial officers, chief executive officers, financial controllers, finance managers, management accountants and financial directors, this research commonly refers to them chief financial officers. The self-report questionnaire was designed, then emailed and posted to all CFOs and some were directly distributed to CFOs. Web link was also provided on the questionnaire to fill the questions.

1.3.5 Data sources

The relevant data for the purpose of this study was garnered from primary sources. The questionnaire survey was carried during the period from June to December 2013.

The primary source of data collection- The questionnaire

A questionnaire was administered to collect the primary data. The questionnaire consisted of two parts: Part I of the questionnaire elicited information regarding the company's demographic information (including the respondent's qualifications and experiences)

Part II of the questionnaire was used to identify the general, industry and organisational uncertainty factors. The questions in part II were originally developed and validated by Miller (1992) and Verbeeten (2006), and were adapted for this study. The participants were asked to indicate on a five-point Likert scale (ranging from 1= not at all important, to 5 = very important) the extent to which they considered a number of uncertainties

relevant for their company within the time frame of an investment decision.

Data collection procedure

In the initial stage, the designed questionnaire was given to two experts with a covering letter explaining the purpose of the study. The letter made a humble plea for them to elicit their suggestions on it. Feedback was received from most relevant academic and one of the practitioners of capital budgeting practices and investment decision making in Sri Lanka. No major problem was reported in the pilot test and the questionnaire was ultimately finalized. The details of pilot test are reported in the following section.

Pilot testing

In this study the questionnaire survey was conducted using a paper-based self-administered questionnaire with a sample of five CFOs. Of these, only one of the CFOs agreed to fill in the questionnaire in front of the researcher. What was observed was how the respondent understood the questions in the questionnaire, how long it took to complete the questionnaire and if anything important was missing. The respondent understood all of the questions in the way that the researcher intended and the respondent spent 15 minutes completing the questionnaire. The CFO did not express any concerns about the questionnaire. The results and the nature of the pilot study were successful and this paved the way for implementing it among a large group of potential respondents.

Testing the reliability

A reliability analysis of the item-scales was performed using SPSS. Cronbach's alpha (α) values were assessed for each variable with item-scales. The reliability of the measures was well above the minimum threshold of 0.60 in every case (Gliner and Morgan, 2000). Thus, it can be concluded that all of the measures were generally reliable.

1.4 Descriptive analysis of the survey responses

Of the total of 287 companies listed on the CSE in Sri Lanka, 64% of the CFOs responded to the survey. The descriptive analyses of the survey responses are discussed under the following sub-headings.

1.4.1 Educational qualification of the CFOs

Classification of the educational qualification of the CFOs was grouped into: bachelor degree, MBA, non-MBA Master's, above Master's degree and professional qualification (e.g.,CIMA, ACCA). Above master degree qualification (e.g., MPhil/PhD or master degree with professional qualification) was held by 52.2% of CFOs, followed by MBA qualification (29%), non-MBA Master's (13.4%), Bachelor degree (3.8%) and professional qualification (1.6%), as per table 2.

Table 2: Educational qualification of the CFOs

Educational qualification	No. of CFOs (*N*)	Percentage (%)
Bachelor degree	7	3.8%
MBA	54	29.0%
Non-MBA Master's	25	13.4%
Above Master's degree	97	52.2%
Professional qualification only	3	1.6%
Total	186	100.0%

1.4.2 Experience of the CFOs

Experience of the CFOs was classified into four groups in terms of number of years they had been in the profession: less than 5 years, 5-9 years, 10-19 years and 20 years and more. The higher number of CFOs had 10 to 19 years' experience (*N*=81), followed by 20 years' and more experience (*N*=77), 5 to 9 years' (*N*=21) and a small number of CFOs had less than 5 years' experience (*N*=7).

Table 3 shows experience of the CFOs.

Experience in years	No. of CFOs (*N*)	Percentage (%)
Less than 5 years	7	3.8%
5-9 years	21	11.3%
10-19 years	81	43.5%
20 years and more	77	41.4%
Total	**186**	**100.0%**

1.5 Exploratory factor analysis

Gorsuch (2013) pointed out that the "prime use of factor analysis has been in the development of both the operational constructs for an area and the operational representatives for the theoretical constructs" (p. 350) and Dess and Davis (1984) connoted that factor analysis aids in detecting the presence of meaningful patterns among a set of variables. Unfortunately, there is no consistent nature of uncertainty and the variables composition of uncertainty to invoke previous studies (Miller, 1992; Verbeeten, 2006). For example, as discussed earlier, Miller (1992) identified three types of uncertainty: general environment uncertainty, firm specific uncertainty and industry specific uncertainty. In contrast, for the same types of variable, Verbeeten (2006) identified four types uncertainty: finance uncertainty, input uncertainty, social uncertainty and market uncertainty. Their findings might be attributed to the country and cultural specific uncertainty. Thus, it is overarchingly important to conduct factor analysis to identify what variables compose of uncertainty and the prevailing specific uncertainty (Hurley et al., 1997; Hair et al., 2010; Field, 2013). Uncertainty is a latent variable measured by 17 indicators each using a 5-point Likert scale, 1 indicating "not at all important" to 5 indicating "very important" .

There are two most commonly used factor extraction methods: principal components analysis (PCA) and common factors analysis (e.g., principal-axis factoring, maximum-likelihood factoring, image factoring, alpha factoring, unweighted and generalised least squares). PCA is used to reduce the number of items retaining as much of the original item variance as possible whereas factors analysis is used to understand constructs that account for the shared variance among items (Worthington and Whittaker, 2006; Hair et al., 2010; Field, 2013). Factor analysis is more appropriate with the development of measurement scales (Worthington and Whittaker, 2006), of which the principal axis factoring method is the most widely used technique (e.g., Velicer and Jackson, 1990; Worthington and Whittaker, 2006). Velicer and Jackson (1990) connote that "component analysis can be viewed as a computational efficient approximation to factor analysis" (p. 23) and "...the principle of parsimony, applied to parsimony procedures, provides the strongest argument

for preferring component analysis over factor analysis" (p. 24). Moreover, in a similar study, *Verbeeten (2006) also used PCA.* Thus, this study employed PCA in line with *Verbeeten (2006) and* Velicer and Jackson (1990).

1.5.1 Analysis and results

The suitability of the data for factor analysis was measured by the Kaiser-Meyer–Olkin (KMO) measures of sampling adequacy and Bartlett's test of sphericity and the inspection of correlation coefficients (e.g., Hair et al., 2010; Pallant, 2010; Field, 2013). As a caveat, KMO of each individual variable should satisfy a minimum of 0.5, otherwise they should be excluded from the factor analysis: one at a time, smaller taken first (e.g., Hair et al., 2010; Field, 2013). Initially, the diagonal elements of the anti-image correlation matrix have four variables below the minimum level of 0.5: natural uncertainties, fluctuating results under research projects (research uncertainties) and uncertainties on payment behavior of customers (credit uncertainties) and behavioral uncertainties. They were all removed: one at a time. Once the individual KMO conforms above the minimum of 0.5.In the first stage of factor analysis, a variable called "Liability uncertainties (environment/product)" was discarded owing to a very low factor loading in line with Stevens (2002), Hair et al. (2010) and (Field 2013). The value of the determinant of the correlation matrix is 0.002 which is higher than the minimum value of 0.00001 indicating no existence of multicollinearity (e.g., Hair et al., 2010; Field, 2013).

The results of the KMO and Bartlett's test are shown in table 4.

Table 4: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.714
Bartlett's Test of Sphericity	Approx. Chi-Square	1145.743
	df	66
	Sig.	.000

A measure of sampling adequacy, the KMO is .714 exceeding the minimum recommended value of .60 (Tabachnick and Fidell, 2007) and Bartlett's test of sphericity is significant (χ^2 (66) = 1145.743, p<.001) indicating factorability of the correlation matrix. That is the *R*-matrix is not an identity matrix explaining relationship between variables and thus, the data set is said to be appropriate for factor analysis.

The Kaiser's criterion (eigenvalue rule) is most commonly used technique for retaining number of factors and the components with an eigenvalue greater than 1 is retained (Hair et al., 2010; Pallant, 2010; Field, 2013). The Kaiser's criterion is presented in table 5

Table 5: Kaiser's criterion for factor extraction

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.953	24.605	24.605	2.953	24.605	24.605	2.610	21.747	21.747
2	2.445	20.374	44.979	2.445	20.374	44.979	2.420	20.165	41.912
3	2.080	17.335	62.313	2.080	17.335	62.313	2.241	18.671	60.583
4	1.993	16.609	78.922	1.993	16.609	78.922	2.201	18.339	78.922
5	.503	4.192	83.114						
6	.442	3.687	86.801						
7	.368	3.063	89.864						
8	.323	2.693	92.557						
9	.291	2.422	94.979						
10	.248	2.070	97.049						
11	.209	1.746	98.795						
12	.145	1.205	100.000						

As shown in table 5, only four components had eigen values greater than 1.0. The eigen value for the fifth component is .503 that is neither 1.00 nor closer to 1.0 and thus the component was excluded. The first component accounted for 24.61% of variance, the second for 20.37% of variance, the third for 17.34% of variance and the fourth for 16.61% of variance. All in all, all four components accounted for 78.92% of variance which is well above a minimum of 60% as recommended in social sciences (Hair et al., 2010).

Table 6: Principal Components Analysis with Varimax rotation

Variables	Component			
	Market Uncertainty	Social Uncertainty	Operational Uncertainty	Financial Uncertainty
Competitive uncertainties (intensifying competition, competitor attitudes and low entry barriers)	.932			
Output market (strong fluctuations in the demand for products in general and sector level, changes in consumer preferences, availability of substitutes and complements)	.930			
Input market (strong variations in quality and/or quantity of inputs such as raw materials and staff /supply relative to the industry demand)	.904			

Policy uncertainties (changes in Government policy, company policies, accounting policies, fiscal & monetary policies, tax policy, trade restrictions and regulations affecting business sector)		.918		
Political uncertainties (terrorism, war and changes in political regime)		.896		
Social uncertainties (changes in beliefs, values and attitudes reflected in business practice)		.871		
Input uncertainties (Availability of inputs)			.866	
Labour uncertainties (changes in labour productivity, strikes)			.868	
Production uncertainties (production variability and downtime, Manufacturing faults)			.839	
Interest rate uncertainties				.872
Inflation uncertainties				.865
Exchange rate uncertainties				.824
Eigenvalue	2.953	2.445	2.080	1.993
Proportion of variance explained (%)	24.61%	20.37%	17.34%	16.61%
Cumulative percentage explained	24.61%	44.98%	62.32%	78.93%
Cronbach's Alpha – Reliability of the factors	0.915	0.876	0.825	0.816

As can be seen in table 6, all factor loading were greater than .824 indicating a very significant loading as the minimum loadings for a sample of 200 is .364 (Stevens, 2002). Factor one is made up of three variables viz., Competitive uncertainties (intensifying competition, competitor attitudes and low entry barriers), Output market (Strong fluctuations in the demand for products in general and sector level, changes in consumer preferences, availability of substitutes and complements) and Input market (strong variations in quality and/or quantity of inputs such as raw materials and staff) with loadings of .932, .930 and .904, respectively. Factor two is made up of three variables viz., Policy uncertainties (changes in government policy, company policies and accounting policies), Political uncertainties (changes in political regime) and Social uncertainties (changes in beliefs, values and attitudes reflected in business practice) with loadings of .918, .896 and .871, respectively. Factor three is also made up of three variables viz., input uncertainties

(availability of inputs), labour uncertainties (changes in labour productivity, strikes) and production uncertainties (production variability and downtime) with loadings of .866, .868 and .839, respectively. In a similar vein, factor four consisted of three variables viz., Interest rate uncertainties, Inflation uncertainties and Exchange rate uncertainties with loadings of .872, .865 and .824 respectively. Having given meticulous attention to the composite of variables of factors, they were named as Market Uncertainty, Social Uncertainty, Operational Uncertainty and Financial Uncertainty, respectively, and the decision is further supported in line with Verbeeten (2006).

Once variables with factors have been decided, further robust checks for establishing explanatory power to the structure were carried out. Firstly, each factor consisted of three variables which satisfies the "rule of three" considered as "a rock bottom lower bound" (e.g., MacCallum, 1990; Bollen and Lennox, 1991; Velicer and Fava, 1998; Fabrigar et al., 1999; Costello and Osborne, 2005; Freeze and Raschke, 2007; Hair et al., 2010; Field, 2013). Secondly, reliability of each factor was examined using Cronbach's α, for which a value between 0.60 to .70 is the lower limit of acceptability (e.g., Robinson, Shaver and Wrightsman, 1991; Gliner and Morgan, 2000). The results revealed that all factors have excellent reliability, over .80. Thirdly, inter-item correlation was assessed, for which a minimum value should be at least .30 (Robinson, Shaver and Wrightsman, 1991; Pallant, 2010). The minimum inter-item correlation was .564 for the factor "financial uncertainty", which is well above the minimum requirement of .30.

In sum, four factors, namely, Market Uncertainty, Social Uncertainty, Operational Uncertainty and Financial Uncertainty, were extracted using the principal component analysis with Varimax rotation. All four factors accounted for 78.93% of variance and have good reliability with sufficient inter-item correlations. The factors are robust and theoretically meaningful and interpretable. In the next step, confirmatory factor analysis was performed to confirm the model fit and to establish psychometrics properties.

1.6 Confirmatory factor analysis

Confirmatory factor analysis is the most widely used technique following an exploratory factor analysis (Bagozzi and Foxall, 1996; Worthington and Whittaker, 2006) to see how fit the data to a preconceived model (Worthington, and Whittaker, 2006). The CFA was conducted by using AMOS (Analysis of Moment Structures). In AMOS, data analysis is in the form of a path diagram which is a pictorial presentation of the model. The CFA path diagram consists of latent constructs (unobserved variables), indicators (measured or manifest variables), error terms and their linkages using one-headed arrows or two-headed arrows. The latent variables are drawn by "ellipses" and measured variables by "rectangles". A one-headed arrow from a latent variable towards

an indicator is a factor loading (in AMOS, factor loadings are referred to as regression weights however, in LISREL they are called lambda). Each indicator in turn has an error term indicating how far the latent variable does not explain the measured variables (Hair et al., 2010). The validity of the model was established using both GOF (goodness-of-fit) indices and construct validity.

GOF indices generally fit the model by comparing estimated covariance matrix (theory) to the observed covariance matrix (reality) (Hair et al., 2010). Among the different types of GOF indices, this study reports the RMSEA, CFI, RMR and SRMR to see the model fit (e.g., Kline, 2005; Byrne, 2010). Of the number of fit indices, the fundamental fit index is the chi square (X^2) statistic which is the mathematical function of the sample size, and the difference between the observed and estimated covariance matrices and ipso facto, ceteris paribus, if sample size (*N*) increases value will also increase and in similar vein, adding indictors would also increase the X^2 value. Insignificant result of the X^2 test denotes the model's perfect fit where the model capably reproduces the covariance matrix of the observed variables.

The psychometric property of the model is the construct validity which primarily includes convergent validity and discriminant validity. Convergent validity is generally measured by factor loading, AVE (average variance extracted) and construct reliability. A factor loading of 0.7 is considered as good convergent validity as half the variance (.7 x .7) in the model is explained by indicators rather error variance (Hair et al., 2010). In a similar vein, AVE of .5 or greater is considered as an adequate level as it explains mean variance of the item loadings onto a factor. Construct reliability (CR), as a rule of thumb, over .60 is an indicator of convergent validity (Hair et al., 2010).

Discriminant validity is measured by comparing AVE with the square of the correlation. If AVE is above the square correlation, the constructs are said to be distinct (unique) (Hair et al., 2010).

1.6.2 Fitness of the model- analysis and results

As can be seen in figure 1, the model consisted of four latent constructs and each is represented by three indicators: market uncertainty (uncertainties on competitive, output market and input market), social uncertainty (uncertainties on policy, political and social), operational uncertainty (uncertainties on input, labour and production) and financial uncertainty (uncertainties on interest rate, inflation rate and exchange rates). Thus, in total, 12 observed variables (4 x 3 =12) composed the model and each observed variable has an error term marked by e1 to e12. As derived in the factor analysis, each variable was loaded onto a particular factor and as a fundamental, all four factors were connected by a double-headed arrow (covary). Further, it is important to confirm the model is an over identified model (Byrne, 2010). Elaborating, the number of data point is 78 [(P (P+1) / 2) where *P* stands for observed variable (12 (12+1) / 2)] with 30 unknown parameters and consequently, the model is over identified with 48 degrees of freedom. Table 7 presents the summary of the model parameters.

Table 7: The model summary statistics, variables and parameter

Computation of degrees of freedom	
Number of distinct sample moments:	78
Number of distinct parameters to be estimated:	30
Degrees of freedom (78 - 30):	48
Results	
Minimum was achieved	
Chi-square = 53.918	
Degrees of freedom = 48	
Probability level = .258	
Variables	
Number of variables in your model:	28
Number of observed variables:	12
Number of unobserved variables:	16
Number of exogenous variables:	16
Number of endogenous variables:	12

Parameter summary

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	16	0	0	0	0	16
Labeled	0	0	0	0	0	0
Unlabeled	8	6	16	0	0	30
Total	24	6	16	0	0	46

As shown in table 7, the model has 28 variables consisting of 12 observed variables and 16 unobserved variables. In other words, 16 are the exogenous variables and the remaining 16 are the endogenous variables. This model has 24 regression weights consisting of 16 fixed weights (12 error terms and 4 are the first each indicator loading-assigned value of 1). There are 6 covariances (double-headed arrow between factors) and 16 variances. All in all, the model has 46 parameters, of which 30 are estimated (8 regression weights, 6 covariances, and 16 variances).

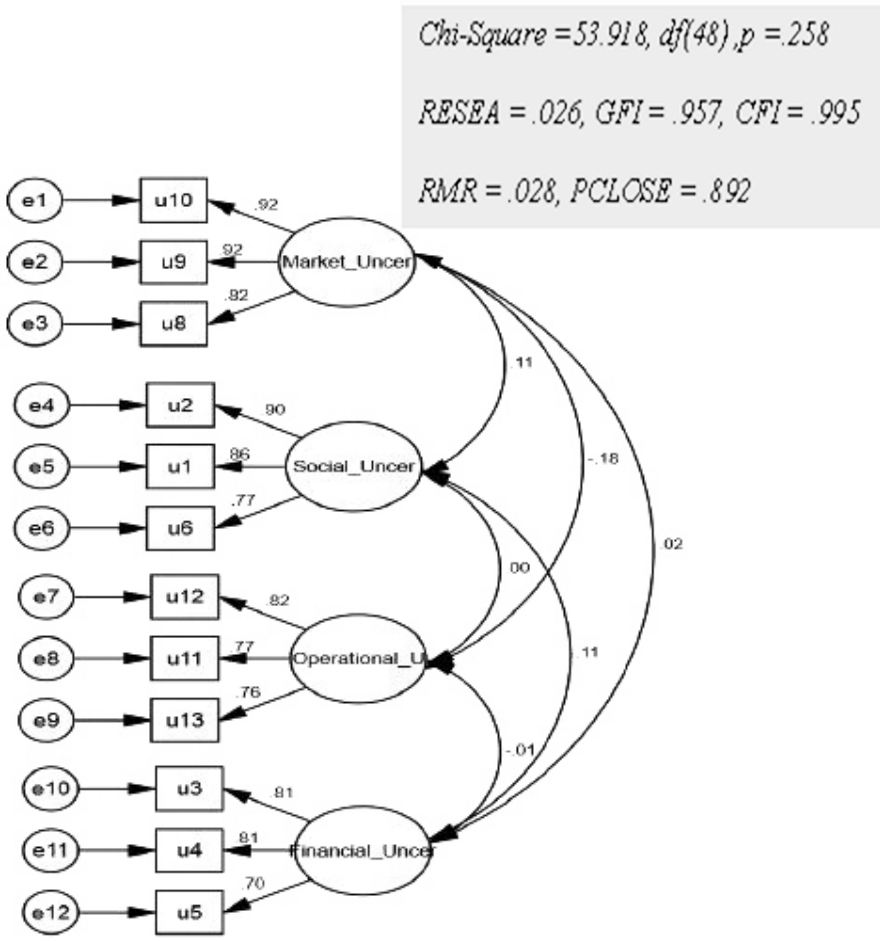
Table 8 shows the parameter estimate for both unstandardized solution and standardized solution.

Table 8: Parameter estimate both unstandardized solution and standardized solution

			Unstandardised solution				Standardised solution
			Estimate	S.E.	C.R.	*p*	Estimate
U8	<---	Market Uncertainty	1.000				.819
U9	<---	Market Uncertainty	1.050	.068	15.347	***	.922
U10	<---	Market Uncertainty	.976	.064	15.363	***	.922
U6	<---	Social Uncertainty	1.000				.772
U1	<---	Social Uncertainty	1.339	.112	11.962	***	.859
U2	<---	Social Uncertainty	1.492	.122	12.224	***	.897
U13	<---	Operational Uncertainty	1.000				.762
U11	<---	Operational Uncertainty	1.008	.108	9.316	***	.767
U12	<---	Operational Uncertainty	1.053	.113	9.298	***	.816
U5	<---	Financial Uncertainty	1.000				.702
U4	<---	Financial Uncertainty	1.212	.138	8.784	***	.806
U3	<---	Financial Uncertainty	1.236	.140	8.810	***	.812

As can be seen in table 8, the results of the unstandardised solution all estimate statically significant. As discussed earlier, standardised factor loadings for each indicator to a factor should be at least .50 or most preferably .70. The factor loadings (standardised solution) were all above .70 demonstrating that all indicators are statically significant to their respective factor. Elaborating, U8, U9 and U10 to the factor of market uncertainty have the significant loadings of .819, .922 and .922, respectively. In a similar vein, U6, U1 and U2 to the factor of social uncertainty have the significant loadings of .772, .859 and .897, respectively. As to U13, U11 and U12 to the factor of operational uncertainty, these have the significant loadings of .762, .767 and .816, respectively. Finally, U5, U4and U3 to the factor of financial uncertainty have significant loadings of .702, .806 and .812, respectively. The model of uncertainty is depicted in figure 1.

Figure 1: The model of uncertainty



Once the basics of significant loadings are confirmed, it is of paramount important to assess the model fit. AMOS provides a number of diagnostic measures, called GOF indices. The crux of GOF is the chi square (X^2) and as discussed earlier the nonsignificant result is indicative of a well-fitting model. The is expressed as (48) = 53.918, p>.05 (p=.258). That is the value of is nonsignificant indicating a well-fitting model (e.g., Bagozzi and Foxall, 1996; Kline, 2005; Hair et al., 2010; Byrne, 2010). Moreover, CMIN/DF = 1.123, RMSEA =.026, CFI = .995, RMR = 0.028, and SRMR = .0428 are indicative of a well-fitting model.

Table 9: The results of the validity measures

	CR	AVE	MSV	ASV	SU	MU	FU	OU
Social Uncertainty (SU)	0.881	0.713	0.013	0.008	0.844			
Market Uncertainty (MU)	0.919	0.790	0.034	0.016	0.112	0.889		
Financial Uncertainty (FU)	0.818	0.601	0.012	0.004	0.109	0.021	0.775	
Operational Uncertainty (OU)	0.825	0.612	0.034	0.011	-0.002	-0.184	-0.008	0.782

CR: Construct Reliability; AVE: Average Variance Extracted; MSV: Maximum Shared Variance; ASV: Average Shared Variance

As reflected in table 9, AVE exceeded a minimum of .50 and the lowest AVE is .601 and CR is all well above a minimum threshold of .70; consequently, the model is said to have high convergent validity. Moreover, in all cases CR is greater than AVE which is another indicative of strong convergent validity. In sum, this model is a robust model having excellent convergent validity implying that all items of the model are statically well-fitting to each factor. Having established convergent validity, the discriminant validity deserves much importance to confirm that each factor is distinct/unique. As can be seen in table 5.12, the AVEs are greater than the corresponding squared intercorrelations and MSV and ASV are less than AVE (i.e., MSV < AVE and ASV < AVE) are indicative of high discriminant validity. In sum, results of the CFA confirm the four-factor uncertainty model is robust and has strong construct validity. Moreover, the model is theoretical meaningful and interpretable. Therefore, it can be concluded that four uncertainty factors (each represented by three variables) composed of total uncertainty, viz., *market uncertainty (uncertainties on competitive, output market and input market), social uncertainty (uncertainties on policy, political and social), operational uncertainty (uncertainties on input, labour and production) and financial uncertainty (uncertainties on interest rate, inflation rate and exchange rates). Therefore, the hypothesis* (H_1) that Miller's (1992) three-level model is applicable in the Sri Lankan context was not supported, instead, four- new factor model was devised.

1.7 Conclusion

This study identified four major types of specific uncertainty: *market uncertainty (uncertainties on competitive, output market and input market), social uncertainty (uncertainties on policy, political and social), operational uncertainty (uncertainties on input, labour and production) and financial uncertainty (uncertainties on interest rate, inflation rate and exchange rates). In CFA, the four-factor model of uncertainty was confirmed with its psychometric properties (convergent validity and discriminant validity). From this study,* practitioners can assess these

uncertainty factors before choosing their capital budgeting methods then they can investigate their impact on the application of capital budgeting practices. For example, practitioners can use this uncertainty model and examine the level of uncertainty and consequently they can use appropriate methods in order to make long-term investment decisions

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