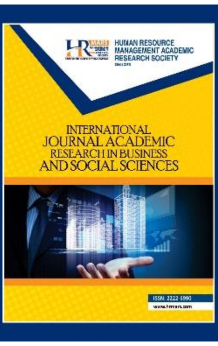

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Exploratory Factor Analysis of Management Accounting Tools (MATs) in Libyan Manufacturing Companies

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Abstract
The purpose of this paper is to develop a reliable instrument to measure management accounting tools (MATs) through Exploratory Factor Analysis (EFA), particularly in Libyan manufacturing companies. 100 financial managers /accountants in Libyan manufacturing companies. IBM SPSS 24.0 tool has been used for statistical analyses. The reliability of the subscales from Cronbach Alpha is ranging from 0.833 to 0.896. The results show that the Management accounting tools construct has three components or dimensions, i.e., adoption, (16 items), benefits (16 items), and the obstacles to the implementing of MATs (9 items). The factor loading for every item in each component is > 0.6. The researcher applied the Cronbach Alpha test to check the internal reliability of the current MATs instrument was higher than 0.7, which means that is reliable.
Keywords: Exploratory Factor Analysis (EFA), Management Accounting Tools (MATs).

Introduction

Management accounting tools promotes survival or organizations in the dynamic and competitive global markets by providing them with competitive advantage and guiding their managerial activities, motivating behaviours, supporting and creating cultural values needed for the strategic objectives realization (Hieu and Dung, 2018). Throughout the world, MATs have been garnering importance in practicing manager and policy maker circles in light of enhanced organizational performance (Ladislav, 2016). Evidently, the use of MATs have also increased through the years owing to factors effects in various phases of implementation based on the definition provided by IFAC of MA (Rufino, 2014).

Management Accounting Tools (MATs)

The International Management Accounting Practice Statement No 1 (IMAPS1), concerning Management Accounting Concepts established by the International Federations of Accounting in (IFAC, 2002) referred to management accounting as that portion of the process of management that is concerned with the use of organizational resource and of managerial processes and technologies that are concerned with contributing value to the organization through the achievement of effective resources use in the context of dynamism and competitiveness (IFAC, 2002). Moreover, the CIMA (2013) referred to a management accounting tool as a framework, model, technique or process enabling management accountants to enhance performance, facilitate decision-making, support strategic goals and objectives and contribute value.

Motivation of the Study

According to Sreekumar (2015), there is a considerable potential for developing nations to provide distinct opportunity for researchers to examine MATs evaluation in short-term. However, only a few empirical studies have been conducted in developing nations, particularly in the North African region. Tun Mat & Smith (2014) revealed that MATs generally differ from one set to the next and should thus be examined along with the political, cultural and economic issues. The manufacturing companies in Libya should keep themselves aware of the different accounting standards determinants in order to concentrate on the MA use in the present economy in the country following the revolution of 2011 (Abou-Alkheir, 2016). The Libyan market environment is ripe one to examine MA under an environment that is characterized by uncertainty and political change.

Objectives

The main objective is to develop a reliable instrument to measure management accounting tools through Exploratory Factor Analysis in Libyan manufacturing companies.

Literature Review

Management accounting tools, also known as management accounting practices (MAPs) refer to management tools or methods used to bring about decisions concerning operations/activities (Rufino, 2014). They are useful in every organization, whether or not they are profit-oriented. It is a must for every business organization to adoption management accounting tools notwithstanding their size, operation or market and among the three business operation types that should take advantage of such tools are service, merchandising and manufacturing.

Many studies developed the adoption, benefits, and the obstacles to the implementing of MATs (e.g. Angelakis et al., 2010; Albu & Albu, 2012; Yap et al., 2014; Sreekumar, 2015; Ladislav, 2016; Cuzdriorean, 2017; Hussein, 2017; Azudin & Mansor, 2017). Chenhall & Langfield-Smith (1998); Angelakis et al (2010); Hussein (2017) conducted examinations of the MATs adoption and the reaped benefits in Australia, Greece and Egypt respectively. They categorized the tools into five (long-term planning, budgeting systems, product costing, performance evaluation and decision support systems). In Malaysia Tun Mat and Smith, (2014); Azudin & Mansor (2017) lists sixteen MATs from four stages of the management accounting evolution. Besides that, In search for additional explanations of why the large majority of MATs addressed are not adopted and used, according to studies Yap et al (2014), Cuzdriorean (2017); Hussein, (2017), the respondents asked to indicate the extent to which a list of items obstacles the adoption of MATs.

Exploratory Factor Analysis (EFA)

This type of analysis was described by Awang (2012), and Shkeer & Awang (2019) as a strategy employed to determine the development of a group of factors gathering. It is a measurable method used to achieve data summarizing and data reduction (Tabachnick & Fidell, 2013). In other words, EFA is a method used for the recognition, minimization and organization of a large number of survey items into a specific construct for the examination of the independent construct.

Scientists are of the consensus as the use of EFA process on each variable to detect the objects dimensionality from the previous studies, where the measurements originated. In this regard, the items dimensionality may transform when the examination that is current carried out is different from those that were carried out in the past based on the study field, country and monetary situation of the population (Awang, 2012; Noor et al., 2015; Hoque et al., 2018). Another added factor is the period between the current investigation and the past ones in literature – the outcomes in the past may not be relevant owing to the referenced distinctions mentioned above (Awang, 2012; 2014). The respondents number for the pilot test N this study is 100, and they were randomly chosen from the manufacturing firms in Libya.

The Exploratory Factor Analysis Procedure

The EFA procedure is initiated with a Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity in order to confirm that the gathered data is appropriate to be exposed to factor analysis. The two tests basically gauge the sampling adequacy to determine the factorability of the data index (Hair et al., 2014). In cases where the Bartlett's Test of Sphericity is significant and substantial, the KMO measure exceeds 0.50, and has a tendency to accept the existence of the factorability of dataset (Pallant, 2016). The next step involves the use of Principal Component Analysis (PCA) extraction method with Varimax Rotation to differentiate the basic factors. The PCA is used to determine the number of factors to be included, while the Varimax Rotation is employed as a suitable orthogonal factor rotation method that sheds light in the elements examination (Hair et al., 2014).

Added to the above, Varimax Orthogonal technique has been evidenced to be effective in dealing with and getting the orthogonal rotation of factors. EFA is used to determine the underlying items scopes and eradicate those that remain under 0.60 cut-off of the factor loading, implying that factor loading that is less than 0.60 is unacceptable (Awang, 2014; 2015). A higher factor loading was brought forward by Bahkia et al. (2019), who stated that loadings under 0.30 should not be interpreted, and based on the general rule of thumb, 0.32 loadings are poor, 0.45 loadings are fair, 0.55 loadings are good, 0.63 loadings are very good, while 0.71 loadings are considered as excellent.

Research Methodology

This study randomly selected 100 financial managers / accountants in Libyan manufacturing companies from the total of 492 companies to be used as simple random sampling. The number of samples is adequate for the purpose of doing an Exploratory Factor Analysis (EFA) study (Hair, et al., 2016). According to Chenhall & Langfield-Smith (1998); Angelakis et al (2010); Yap et al (2014); Hussein (2017), the MATs construct measured by three sub-constructs (Adoption, benefits, and the obstacles to the use of MATs). The researcher adapted all the three sub-constructs to measure the MATs construct to conform to the study in the Libyan context.

The adoption, and benefits sub-constructs, using the same instrument applied by Laitinen (2006); Angelakis et al (2010); Mat & Smith (2014); Azudin & Mansor (2017), used the list of sixteen MATs. A list of sixteen MATs and developed survey questions to determine the adoption rate and the degree of importance for each tool. All sixteen of the Adoption, benefits sub construct showed sufficient reliability; which is greater than 0.7 and exhibited construct

and discriminant validity Angelakis et al (2010). The researcher adapted all sixteen tools to the Adoption, benefits sub construct to conform to the study in Libyan context.
In addition, for the obstacles to the use of MATs sub-construct, using the same instrument applied by Hussein (2017) the obstacles to the use of MATs sub-construct has nine items, all items showed sufficient reliability; which is greater than 0.7 and exhibited construct and discriminant validity Hussein (2017). The researcher adapted all times to conform to the study in the Libyan context. The respondents were asked to indicate the Adoption sub construct by using sixteen items (1-16) in the questionnaire. Respondents were asked on a five-point Likert scale of 1 (never used) to 5 (very often) to measure the adoption sub construct. And Benefits sub construct was measured by using sixteen items (1-16) in the questionnaire a five-point Likert scale of 1 (None) to 5 (Very high) to measure the benefits sub construct.
Under this part, also, the respondents were asked to indicate the obstacles to the use of MATs in Libyan manufacturing firms (especially those who answer never use) by using ten items (1-9) in the questionnaire. Respondents were asked on a five-point Likert scale of ''1''(Do not impede at all) to ''5''(Considerably impede) to measure the obstacles to the use of MATs in Libyan manufacturing firms. The questionnaire was then piloted on a small sample size before the actual survey – this involved 10 Libyan employees working in the manufacturing firms, after which eight questionnaires from the ten distributed ones were retrieved and scrutinized for resolution of issues, if any. No issues were found and thus, the questionnaire was deemed to be ready for the pilot study.

Exploratory Factor Analysis for Management Accounting Tools

In the questionnaire, there are 41 measurement items measuring MATs. Three sub-constructs initially measured the MATs constructs: (1)(Adoption, (2)benefits, and (3) the obstacles to the implementing of MATs. The Adoption and benefits dimensions have sixteen items each, obstacles to the implementing of MATs has nine items.
The descriptive statistics of each item are tabulated in Table 1 and they are measured using a five-point Likert scale of 1 (never used) to 5 (very often), (None) to (Very high), and (Do not impede at all) to (Considerably impede) respectively adopted from Awang et al (2016) and Hoque et al (2018). Table 1 contains the statements of items and their mean and standard deviation scores.

Table 1: The Mean and Standard Deviation for Items Measuring Management Accounting Tools

Descriptive Statistics			
	Item Statement	**Mean**	**Standard Deviation**
1	Budgetary Control	4.090	.697
2	Full/ Absorption Costing	4.000	.828
3	Cost-volume-profit (CVP) analysis	3.930	.781
4	Marginal/ Variable Costing	4.040	.777
5	Standard Costing	4.010	.771
6	Total Quality Management (TQM)	4.040	.777
7	Target Costing	3.980	.765
8	Activity Based Costing (ABC)	3.960	.827
9	Activity Based Management (ABM)	3.890	.827
10	Value Chain Analysis	3.970	.744
11	Product Life Cycle Analysis	4.090	.697
12	Benchmarking	4.010	.731
13	Product Profitability Analysis	3.960	.803
14	Customer Profitability Analysis	4.030	.784
15	Shareholder Value Analysis/ EVA	4.020	.828
16	Balanced Scorecard	3.960	.827
17	Budgetary Control	3.820	.716
18	Full/ Absorption Costing	3.590	.865
19	Cost-volume-profit (CVP) analysis	3.600	.864
20	Marginal/ Variable Costing	3.620	.788
21	Standard Costing	3.840	.761
22	Total Quality Management (TQM)	3.870	.719
23	Target Costing	3.660	.699
24	Activity Based Costing (ABC)	3.860	.765
25	Activity Based Management (ABM)	3.940	.776
26	Value Chain Analysis	3.860	.738
27	Product Life Cycle Analysis	3.630	.895
28	Benchmarking	3.730	.750
29	Product Profitability Analysis	3.900	.771
30	Customer Profitability Analysis	3.930	.794
31	Shareholder Value Analysis/ EVA	3.850	.770
32	Balanced Scorecard	3.890	.750
33	Headquarters and government regulations	3.930	.843
34	Cadres that implement the of management accounting tools are not qualified	4.040	.839
35	Costs of the application of management accounting tools are relatively high	4.060	.814
36	Senior management is not convinced by the of management accounting tools	4.050	.783
37	Software required by the application of management accounting is not available	3.970	.869

38	The information system is not developed enough to the optimal application of management accounting tools	4.050	.821
39	Lack of relevant courses on such advanced techniques in academic institutions	4.000	.791
40	Lack of up-to-date publications about advanced management accounting tools	3.950	.880
41	Company ownership type	4.050	.821

The present study employed EFA, Principal Component Analysis, with Varimax Rotation on the 41 measurement items of MATs and the results from the test are tabulated in Table 2. From the table, it is clear that Bartlett's Sphericity Test is significant (p-value < 0.05), sampling adequacy by KMO (0.748) is excellence, because it is higher than 0.6 (Awang, 2012; Hoque et al., 2015; Noor et al., 2015). Both results are indicative of the adequacy of data for further data reduction analysis (Awang, 2012; Noor et al., 2015; Hoque & Awang, 2016; Hoque et al., 2017, 2018; Yahaya et al., 2018).

Table 2: KMO and Bartlett's Sphericity Test Results for MATs Construct

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.748
Bartlett's Test of Sphericity	Approx. Chi-Square	137.605
	Df	205
	Sig.	.000

Figure 1 presents a scree plot of the three dimension/components that EFA procedure obtained for the MATs construct. All 41 items were grouped into three dimensions, with each dimension having its own items set. The accurate determination of which items belong to which component is determined using the Rotated Component Matrix (Awang, 2012).

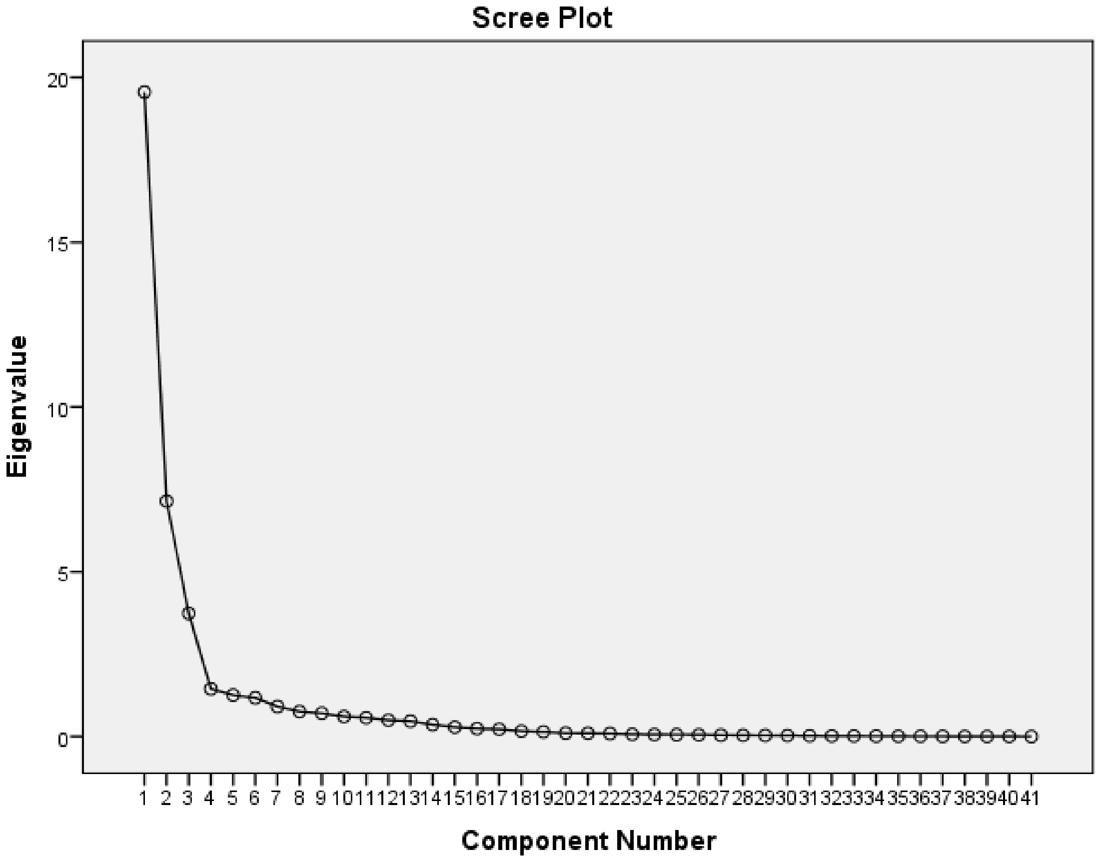

Figure 1 Scree Plot for MATs

Three dimensions were obtained from the EFA procedure of MATs based on the Eigen value higher than 1.0. Specifically, the Eigen values varied from 3.648 to 19.557. For component 1, the variance explained is 30.194%, for component 2, it is 56.636%, and lastly, for component 3, it is 76.031%. Moreover, the total variance explained for the construct measurement is 76.031%, and was deemed acceptable as it exceeded the minimum value of 60% (Awang, 2012; Noor et al., 2015; Hoque & Awang, 2016; Hoque et al., 2017, 2018; Yahaya et al., 2018).

Table 3: Total Variance Explained for MATs Construct

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	19.557	47.700	47.700	19.557	47.700	47.700	12.379	30.194	30.194
2	7.141	16.168	69.045	7.141	16.168	69.045	10.841	26.442	56.636
3	3.648	8.897	77.942	3.648	8.897	77.942	7.952	19.395	76.031
Extraction Method: Principal Component Analysis.									

One dimension emerged from the respective items of the EFA procedure in this construct (refer to Table 4), and every item should have a factor loading that is higher than 0.60 to remain in the analysis as proposed by Awang (2012) and Yahaya et al. (2018). Items that loaded lower than 0.60 should be discarded (Awang, 2012, 2014 & 2015; Noor et al., 2015; Hoque & Awang, 2016; Hoque et al., 2017, 2018; Yahaya et al., 2018). Table 4 tabulates the measurement items, their factor loadings and their respective components.

Table 4: Rotated Component Matrix for MATs Construct

Rotated Component Matrix[a]

	Component		
	1	2	3
MATs1	.889		
MATs2	.728		
MATs3	.785		
MATs4	.858		
MATs5	.858		
MATs6	.848		
MATs7	.830		
MATs8	.847		
MATs9	.739		
MATs10	.794		
MATs11	.889		
MATs12	.840		
MATs13	.760		
MATs14	.854		
MATs15	.802		
MATs16	.847		
Ben1		.726	
Ben2		.746	
Ben3		.724	
Ben4		.721	
Ben5		.951	
Ben6		.632	
Ben7		.743	
Ben8		.943	
Ben9		.868	
Ben10		.671	
Ben11		.703	
Ben12		.727	
Ben13		.871	
Ben14		.859	
Ben15		.938	
Ben16		.627	
Obst1			.835
Obst2			.813
Obst3			.816
Obst4			.782

Obst5	.847
Obst6	.846
Obst7	.829
Obst8	.856
Obst9	.844

Extraction Method: Principal Component Analysis.

Internal Reliability Analysis (Cronbach's Alpha)

Reliability test was the second test to be conducted after EFA. This test examines the inner consistency through the use of Cronbach's Alpha coefficient to ensure that the research instruments are devoid of random error and bias (Sekaran & Bougie, 2016). Cronbach's alpha coefficient has been extensively utilized for estimating internal consistency and it runs from 0 to 1 (De Vaus, 2013), and is identified by the normal associations among the measurement items. Cronbach's alpha is also used to assess the consistency level between different variable estimations (Hair et al., 2014).

Therefore, this study used Cronbach's alpha coefficient to examine the MATs construct internal consistency. Following the pilot test, Cronbach's alpha was used for the purpose mentioned above as it is one of the most extensively utilized techniques to ensure reliability, with value of 0.70 and over deemed to illustrate adequate internal consistency reliability (Awang, 2012, 2015; Hair et al., 2016; Awang et al., 2015; Awang et al., 2018). Cronbach's alpha needs to be processes to determine the internal reliability of the items estimating the MATs construct.

The Internal Reliability for Management Accounting Tools

Table 5: Cronbach' Alpha for Internal Reliability for Management Accounting Tools Construct

Components	Sub-construct	No. of Items	Cronbach's Alpha
1	Adoption MATs	16	.841
2	Perceived benefits	16	.833
3	Obstacles	9	.881
	Management Accounting Tools	41	.896

The three dimensions that were used to estimate MATs obtained an alpha that exceeded 0.70, and Cronbach's alpha coefficient for all 41 items within the three dimensions is 0.896, which also exceeded 0.70. Therefore, all the items measuring MATs were deemed to have sufficient internal reliability following prior studies (Awang, 2012, 2014, 2015; Hoque et al., 2018; Shkeer & Awang, 2019). Reliability estimates for the three dimensions of MATs were way above the cut-off alpha coefficient value and thus, they were considered to be reliable and are appropriate to be used for estimating MATs.

Conclusion

At this point of the study, EFA was independently conducted for the MATs construct. SPSS, version 24 was used for the analysis. The results show that the MATs construct has three components or dimensions: (1)(Adoption, (2)benefits, and (3) the obstacles to the implementing of MATs. The Adoption and benefits dimensions have sixteen items each, obstacles to the implementing of MATs have nine items. All reliability measures for the three dimensions or components of the MATs construct showed high Cronbach's Alpha value, met Bartlett Test achievements (significant) at $p < 0.001$ (Hair et al., 2016), KMO (> 0.6), and exceeded 0.60 of factor loadings.

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