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Determinants of Competitive Advantage in the Textile and Apparel Industry in Tanzania: The Application of Porter's Diamond Model

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Authors' contributions

This whole work was carried out in collaboration by both authors.

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ABSTRACT

This study explores the magnitude of the key attributes underlying competitive advantages in the textile and apparel industry in Tanzania by using Porter's Diamond Model (PDM). The sampling design used in this study is non-probability and data were collected from 204 respondents in three regions; namely, Dar es salaam, Arusha and Mwanza. The estimated results from Factor Analysis, Principal Component Analysis and Structural Equation Modeling support strongly the relevancy of the Porter's Diamond model in enhancing firm competitive advantage in the textiles and apparel industry in Tanzania. The two most important factors on competitive advantage of the textiles and apparel industry are demand conditions and; related and supporting industries.

Keywords: Competitive advantage; porter's model; textile and apparel industry; Tanzania.

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1. INTRODUCTION

Although much has been written on the significance of Porter's Diamond Model (PDM) on firm's competitive advantage [1], relatively little is known on the relevancy of the diamond model to Tanzania's industries, and more so on the textiles and apparel. It is worth-noting that PDM was developed within the context of U.SA, Japan and EU (the triad), and therefore, a lot remains to be desired in showing its relevancy to small, open economies which are not part of the triad [2]). The motivation for testing such a model stems from the fact that, there is an increasing concern among academicians, researchers and policy makers alike on inadequate performance of textiles and apparel industry in terms of low quality products, poor technologies and inadequate penetration of products into the global market. A plethora of studies have been advanced to empirically show the causes of superior performance among the firms [3]; and these fall in the categories of traditional approach that emphasizes on the industry structure and market dominance [4]; firm's unique resources and core competencies [5,6]; and knowledge generation and its exploitation [7].

The textiles and apparel industry has a big potential to help Tanzania develop a strong industrial base and attain economic transformation, just like what it has done elsewhere. Notwithstanding this role, the growth of Tanzania's textile and clothing exports have been erratic over the years, partly exacerbated by economic reforms of the mid 1980s, 1990s and 2000s coupled with the effects of globalization. Prior to the economic reforms, the textiles and apparel sector was performing plausibly well. After 1990s, however, the challenges emerging from globalization and the market reforms characterized by withdrawal of government from production and market activities, forced most of the firms to shutdown [8]. Subsequently, manufacturing plants were sold off by the government to private investors since early 2000s. The Government's initiatives through privatization policy enabled most of the firms to revamp production but such a revamp could not sustain external competitive pressure.

A cursory glance at available statistics indicates that exports of textiles and apparel to major destination markets including United States of America (USA) and the European Union have not been impressive during the last ten years. In nominal terms, starting from a low level of USD 0.2 million in 2000, exports of textile in Tanzania grew to USD 3.3 million in 2004, and reached a peak in 2005 with a total value of USD 4.1 million but have since then dropped to USD 1.2 million before rebounding slightly to USD 2.0 million in 2009 and 2010 respectively, [8]. Although the European Union (EU) is the largest importer of textile and clothing worldwide, Tanzania's Textile and clothing exports to this most important market in 2010 were negligible amounting to Euros 6.8 million only. Of these exports, Euros 3.8 million consisted of cotton fibre and textiles, Euros 1.8 million consists of vegetable textile fibers and related products; Euros 1.3 million of garment [8]. This trend raises an important question as to what are the sustainable competitive elements to revamp the industry.

This study attempts to use PDM in exploring the competitive advantages of the apparel and textile industry in Tanzania; a study that to the best of our knowledge has never been hitherto carried out in Tanzania. The PDM comprises five attributes, namely; factor conditions, demand conditions, related and supported industries; firm strategy, structure and rivalry; and the role of government. In doing so, 204 questionnaires were distributed to the targeted population. Factor analysis, principal component analysis and structural equation modeling are employed as part of our empirical strategy. The estimated results support empirically the relevancy of the Porter's Diamond model in enhancing firm competitive advantage in the textiles and apparel industry in Tanzania. The two most important factors on competitive advantage of the textiles and apparel industry in Tanzania are demand conditions and; related and supporting industries. The remainder of this study is structured as follows. Section 2 reviews the literature. While section 3 gives the methodology, section 4 reports the empirical findings. Section 5 provides concluding remarks.

2. LITERATURE REVIEW

Porter's Diamond model is highly cited as one of the best models that help in benchmarking industry's competitive advantage and shows why some nations are successful in some industries while others are not, [9-15]. The model explains the new paradigm shift of competition among firms [16], and attempts to answer the question as to why some industries and nations gain competitive advantage in the international markets while others do not. The model comprises five determinants, namely; factor conditions, demand conditions, related and supporting industries; firm strategy, structure and

rivalry and the role of government. These determinates are shown in the Fig. 1 below:

In brevity, Porter extends the traditional international trade theory of comparative advantage that focus on endowments (i.e., factors of production) towards the processes by which these factors of production are created, and their relationship to firms' competitiveness in a comprehensive approach [10], though [17] argues that it is home based theory and does not take into account the offshore activities. According to [18], the Porter's work is an important one, but as a whole the analysis used is not empirically rigorous.

The *factor conditions* in the PDM are the inputs that are necessary to compete in any industry [8,19]. Analysis of factor conditions is an advancement of Heckscher-Ohlin theory of international trade which postulates that countries exports the goods that makes mostly use of the factors for which it is abundantly endowed; an economic theory that is obsolete and incorrect[1]. Further, in the contemporary world, nations do not inherit but instead create most important factors of production [9,19]. Consequently, there is paradigm shift in modern trade analysis as Porter's work remain at the heart of most business strategies today and provide a foundations on sources of competitive advantage in terms of developing linkages between generic strategies, five forces and value chain [13].

The demand conditions consists of the nature of home demand for the industry's products and services and sophistication of buyers, and it shapes the rate and character of innovation by the nations' firms [1,3,19]. The conditions provide the impetus and pressure for firms to upgrade the competitive advantage [10]. In general, a nation gains competitive advantage in industries where home forces firms to innovate and upgrade their products. In industries where buyers are sensitive to quality-price attributes, the manufacturers are forced to improve products qualities and strive for lower cost strategies, which in turn requires access to domestic buyers and open communication with them. The home demand is important for creating competitive advantage when there are significant economies of scale, and these forces firms to respect priorities of domestic buyers and increase the speed for innovation.

The *related and supporting industries* refer to the presence or absence in the nation of supplier industries and related industries that are internationally competitive [1,3,19]. One of the key elements is the concept of clustering; defined as "geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities [9]. In short, it is the case that competitive home based supplies can create advantage in downstream industries through providing cost effective inputs in an efficient, early and rapid means [19,20].[2]

The firm strategy, structure and rivalry refer to the context in which firms are created, organized and managed [4,19]. In as far as *firm strategy, structure* and rivalry is concerned, there are two sources of influence at the firm and national level: at the firm level, key characteristics includes strategies, structures, goals, managerial practices, individual attitudes, and intensity of rivalry within the business sector [10]. At the national level, the attributes includes attitudes towards authority and management, interpersonal relations, social norms of individuals and professional standards [3].

The *government* has a direct role to influence all the determinants of the PDM. The elements that constitute this role are the subsidies; education policies; actions toward capital markets; the establishment of local product standards and regulations; the purchase of goods and services; tax laws; and antitrust regulation [9,13]. Of all these, the government's major role is that of being a catalyst and challenger [11], encouraging or even pushing companies to raise their aspirations and move to higher levels of competitive performance.

The chance events also determine competitive advantages, and are the occurrences that have little to do with circumstances in the nation and are outside the firms and national government to control [4,8). According to [20], "The chance events constitutes new inventions; political decisions by foreign governments; wars; significant shifts in world financial markets or

[1]*According to [19])….."Contrary to conventional wisdom, simply having a general work force that is high school or even college educated represents no competitive advantage in modern international competition". Countries such as Japan and Switzerland have been able to turn the disadvantages with scarce resources to sophisticated economies in the world*

[2]*The related and supporting industries are key to competitive advantage, as for example, Italian gold and silver jewelry companies are successful because Italian companies produce two-third of world's jewelry making and precious stones recycling.*

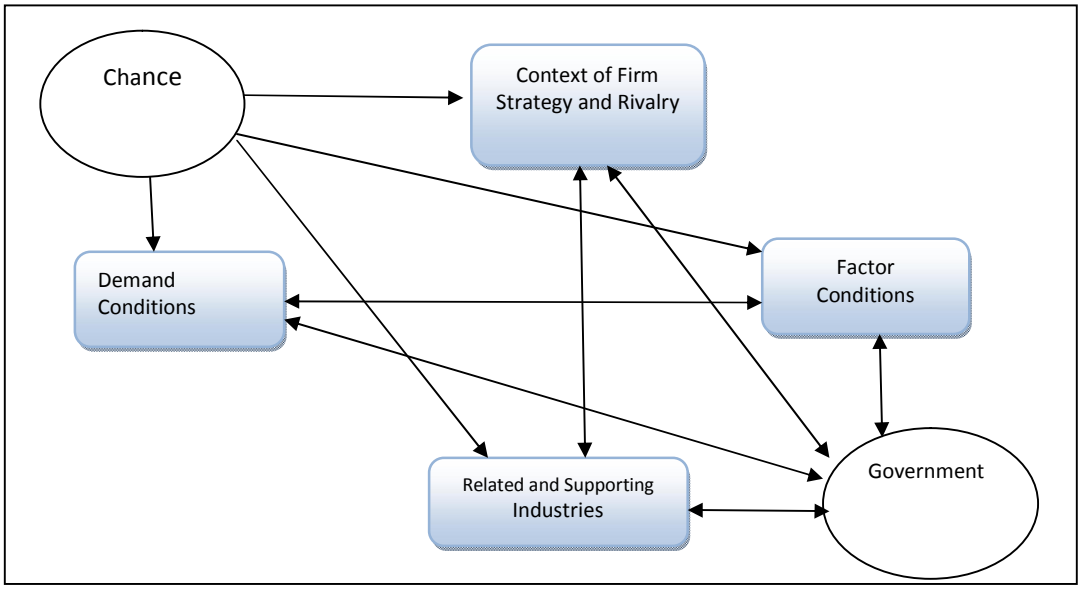

Fig. 1. Porter's diamond model of competitive advantage
Source: [3]

exchange rates; discontinuities in input costs such as oil shocks; surges in world or regional demand; and major technological breakthrough". These elements constitute the risk component that firms need to consider in corporate strategies and in turn develop appropriate mitigation mechanisms.

On the empirical front, competitive advantage has been a subject of much investigation, and there has been a growing interest among researchers, academics and policy makers to study the determinants of competitive advantage [10,12,[21,22,23,24]. For instance, [21] developed an integrated conceptual model of competitive advantage and found that the Porter's diamond, five forces and generic strategies and Information Communication Technology (ICT) are significant in determining competitive advantage of SMEs working in processing natural stones in Italy, Jordan and Turkey. [22] made an empirical survey to examine the relationship between core competence, competitive advantage, and Competitiveness and found that core competence at the level of technology and differentiations and time advantage are key factors for the firm to achieve sustainable competitive advantage, which in turn leads to corporate success.

A study by [23] examined the impact of core competencies on competitive advantages and success in Istanbul tourist companies and found that core competencies, competitive advantages and company success have significant relationship implying that firms should invest in efforts to upgrade the competencies of their personnel. Another study done by [24] empirically tested the Porter's diamond modal for the firms in the city of Kahramanmaras and found the determinants of the model have a significant relationship with competitive advantage of the firms. In the context of textiles industry in Korea, [12] modified the PDM by including Multinational Corporations and found the PDM exerts significant influence on competitiveness of textile industry[3]. Further, [10] establishes that PDM is relevant in explaining sources of competitive advantage for German's textiles and apparel industry. As argued before, there is a dearth of research on this important topic in Tanzania; and it is the intention of the current study to bridge this gap.

3. METHODOLOGY

3.1 The Conceptual Model and Hypothesis

The conceptual model is developed at firm level consists of macro variables of diamond constructs. These constructs are: demand conditions, factor conditions, related and

[3]*Most empirical research has found that the Porter's diamond model excludes the role of multinational corporations which are important determinant of competitive advantage.*

supporting industries; firm strategy, structure and rivalry; and the role of government.[4] Consequently, the five null hypotheses to be tested are:

(a) Factor conditions are not statistically significant determinants of competitive advantage of the textiles and apparel industry in Tanzania;
(b) Demand conditions are not statistically significant determinants of competitive advantage;
(c) Related and supporting industries are not statistically significant determinants of competitive advantage;
(d) Firm strategy, structure and rivalry are not statistically significant determinants of competitive advantage; and
(e) The role of Government is not statistically significant in determining the competitive advantage

3.2 Data Collection and Estimation Techniques

The data were collected from questionnaires which were distributed and collected from 204 respondents.[5] The target population comprised of employees of textile and apparel manufacturing firms, private sector organizations and public institutions providing the oversight role. As would be expected, the choice of respondents was dictated by the constructs of PDM framework.

The sampling design used in this study is non-probability sampling. Analysis of the sample shows that majority of the respondents are in the age group 31-40 years old, followed by under 30 years old, and then 41-50 years old. Analysis of the level of education shows that 46.5 percent of the respondents had a Bachelor Degree, followed by Graduate Diploma 22.6 percent, Diploma 21. 9 percent, Masters' Degree (8.4 percent), and lastly, high school graduates comprising of 6 percent.

With regard to employment career, majority of respondents in the sampled firms are employed as sales or marketing manager/officer constituting 27.1 percent, followed by production managers (17.4 percent), human resources managers /officers (14.2 percent) and finance/ accounting officers or managers (12.9 percent). The remaining percent are employees employed in the government or private sector umbrella organizations. Lastly, as far as category of institutions is concerned, 82 percent come from private sector enterprises, which is reasonable percentage given that the study mainly targeted the private sector firms. Eleven percent (11%) comes from the government and 6.5 percent comes from private sector umbrella organizations.

Factor Analysis as an estimation technique was used to identify the underlying factors that are responsible for covariation among the variables. An Exploratory Factor Analysis using Principal Component Analysis was used to investigate the underlying factors representing the interrelated items among the data set to determine the new dimensions that can be applicable in measuring the competitive advantage as determined by the PDM. The SPSS-16 software was used for factor analysis: the extraction method used was Principal Component Analysis and the rotation method used was Varimax with Kaiser Normalization. Finally, based on the extracted pattern matrix, structural equation modeling techniques was employed using AMOS-21 software to compute the fit indices of both measurement and structural models. In testing the hypothesis, therefore, mixed techniques were employed: ANOVA Statistics of the variables, and the model fit indices for both measurement and structural model. We used the same software to compute the regression weights of the variables used under confirmatory factor analysis.

4. DATA ANALYSIS AND INTERPRETATION OF THE FINDINGS

4.1 Descriptive statistics

The skewness and kurtosis presented in Table 1 confirm that our variables are normally distributed-most of the variables have values close to 0; [25] shows that the skewness and Kurtosis of Normally Distributed variables do not exceed the value of 2 and 7 respectively. There is marginal difference in mean and median indicating little or insignificant effect of extreme values. The standard deviation of all the variables suggests that there is least spread around the mean.

[4] *The conceptual model is shown in appendix 1*
[5] *The questionnaires were structured around the items listed in Table 1*

4.2 Results of Factor Analysis

Next, we use Factor Analysis to examine key variables that need to be considered in measuring competitiveness of the textiles and apparel industry. The initial step in factor analysis entails conducting Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy in order to assess the adequacy of the sample. Table 2 shows that the KMO value is 0.739, which suggests that our sample is adequate for factor analysis. In general, the KMO value above 0.5 is acceptable and below 0.5 is not acceptable [26].

The second step involves an assessment of whether Factor Analysis can be used to test the model. The null hypotheses for this purpose states that factor analysis cannot be used to analyze competitiveness diamond variables of the textiles and apparel industry in Tanzania. The alternative hypothesis states that factor analysis can be used in analyzing determinants of competitiveness in the industry at 5 percent significance level. As usual, we can safely reject the null hypothesis if the p-value is less than the significance level. Given that the p-value 0.00 is less than significance value 0.05 as is also shown in Table 2, we reject the null hypothesis and therefore safely proceed with the estimation of Factor Analysis.

4.3 Factor Extraction Based on Eigen Values

Factor extraction was done to determine the factors using Eigen values greater than 1. Factors with Eigen values less than 1.00 were not used because they account for less than the variation explained by a single variable. The 42 variables used in the analysis were reduced into five principal components accounting for 56.5% of the total variation as noted in Table 3 below.

The next step involves a rotation of factors in order to interpret them. In short, factor rotation entails the rotation of factor axis such that variables are loaded optimally to only one factor [26]. Table 4 below shows the Rotated Component Matrix.

4.4 Factor Interpretation

Based on Rotated Component Matrix shown in Table 4 above, factor equations were written based on the loadings of the principal components. Consequently, factor equation for factor one is summarized in the following equation.

4.4.1 Factor one: demand conditions

$$F_1 = 0.639M_{14} + 0.645M_{17} + 0.658M_{18} + 0.543M_{20} + 0.644M_{23} + 0.644M_{24} + 0.750\ M_{25} + 0.684\ M_{26} + 0.829\ M_{30} + 0.732\ M_{31} + 0.785\ M_{32} + 0.707\ M_{35} \quad (1)$$

Factor One (see equation 1) comprises inadequate accessibility to buyers, low income of consumers, lack of sophisticated and demanding local buyers; lack of efficient, early, rapid preferential access; low development of value chains; lack of business strategy, non-existence of strong domestic competitors, attitudes of workers towards textiles and apparel management, the quality of human resources, type of education, process and products upgrading, ability of firms to position in domestic and foreign markets and the government to have minimum intervention, and leave market forces work. This factor represents *Demand Conditions***.**

4.4.2 Factor two: factor conditions

$$F_2 = 0.619M_1 + 0.645M_3 + 0.615M_4 + 0.513M_5 + 0.526M_7 + 0.775M_9 + 0.585\ M_{10} \quad (2)$$

Factor Two (see equation 2) is made up skilled number of employees, labour costs, cost and accessibility of capital resources, latest technology for production of quality textiles, infrastructure (roads, railways, ports etc), and absence of strong local demand, desire and ability of Tanzania's to buy local textiles and apparel products. Together these variables represent the *Factor Conditions.*

4.4.3 Factor three: firm strategy, structure and rivalry

$$F_3 = 0.730M_{11} + 0.751M_{12} + 0.735M_{13} + 0.649M_{15} + 0.581M_{16} \quad (3)$$

Factor three (see equation 3) consists of inability to understand customer needs, inability to produce quality clothes compared to imported ones, inability to produce varieties needed by Tanzanians, low growth of Tanzania's textile market and low income of consumers. This factor represents *Firm Strategy, Structure and Rivalry.*

4.4.4 Factor four: related and supporting industries

$$F_4 = 0.526_{19} + 0.695M_{21} + 0.610M_{22} + 0.617M_{36} + 0.581M_{16} \quad (4)$$

Factor four (see equation 4) constitutes poor linkages, poor information flow among companies, inadequate cluster programmes and forbidding imports of second hand clothes. This factor represents *Related and Supporting Industries*.

4.4.5 Factor five: the role of government

$$F_5 = 0.540M_{27} + 0.545M_{28} + 0.518M_{29} + 0.694M_{34} \quad (5)$$

Factor five (see equation 5) is made up of government regulatory framework, social norms of workers and managerial attitudes, limited Foreign Direct Investments, and the role of the government to regulate the industry. This factor represents the *Role of Government.*

4.5 Model Fit Indices

The model parameters were analyzed using AMOS 21 software to assess the extent to which the Diamond constructs reproduces the variance-covariance matrix among the indicator variables. Each construct was analyzed based on both absolute fit indices and relative (incremental fit index). The absolute fit indices measures the overall fit of the model [27], and shows how well the model specified by the researcher reproduces the observed data [25]. There are several absolute fit indices that can be used, but the most important indices are the Chi-square (χ2) statistic, the Goodness-of-Fit Index (GFI), the Root Means Square Residual (RMSR), the Root Mean Square Error of Approximation (RMSEA) and Normed Chi-square.

A brief discussion of the meaning of these indices is worth-noting. Two categories of indices are mostly used to assess the model fit, the *Absolute Fit indices* and *Incremental Fit Indices*. The Incremental Fit Indices are also known as comparative [2829] or relative fit indices [30]; and compares the fitness of the model under consideration to the baseline model [25]. Examples of these are the Normed Fit Index (NFI) and Comparative Fit Index (CFI). On the hand, Absolute Fit indices determine how well the model fits the sample data and demonstrates which model has the superior fit [28]; and provides the overall assessment of how the proposed theory fits the data. Examples are the Chi-Square Test and Root Mean Square Error of Approximation (RMSEA), Goodness of Fit Statistics (GFI).

The Chi-Square Value evaluates the overall model fit and assess the difference between what the actual relationship in the sample are and fitted covariance matrix [28,31]. The Normed Chi-square assesses the model by comparing the X^2 value of the model to the X^2 value of a null model, or a baselines model [26]. The Goodness of Fit Index (GFI) estimates the proportion of the variance that is accounted for by the estimated population covariance [32]. On the other hand, the Root Mean Square Error of Approximation (RMSEA) tell us how well the model fits the covariance matrix and is related to the difference in the sample data and what would be expected if the model were assumed to be right [28,33]. The acceptable levels of threshold for a good model fit are provided in Appendix 3.

For the *factor conditions*, the p-value of 0.308[6] suggests that the model is significant. The value for Goodness of Fit Index (GFI) stands at 0.973, which is reasonably strong. The value of incremental fit index CFI is 0.993 and the RMSEA (badness of fit) carries a value of 0.04. All these indices supports factor conditions embedded in the Porter's model. Therefore, the null hypothesis that factor conditions are not statistically significant determinants of competitive advantage of the textiles and apparel industry in Tanzania is rejected and the alternative hypothesis that factor conditions are statistically significant is supported. The Path diagram of this construct and the correlations among the error terms is shown in Fig. 2 below[7].

[6] *The p value should be greater than 0.05 for a good model fit (See Appendix 2).*

[7] *Throughout the text, note that the relationship between the latent constructs and indicators (M_1, M_2…M_n) denotes the reflective measurement, where the latent constructs are considered to have influence on the indicators [27]. Further, as elaborated by [34], the theoretical implication is that the latent constructs (independent variables) drive the degree of agreement with the statements representing the indicators (dependent variables). The indicators, in rectangles, are predicted by the latent variables. Given that measurement of indicators may be affected by inaccuracies in measurement, it follows that the factor does not predict the indicators perfectly: this is taken into account by the error terms, e_s [34]. The numbers attached in each row are the correlation coefficients between the constructs and the indicators: the positive (or negative) signs indicate positive (negative) correlation between the latent constructs and the indicators, or among the error terms.*

Table 1. Descriptive analysis of the data

S/No	Variable	Mean		Std Dev	Variance	Skewness		Kurtosis	
		Statistic	Std Error	Statistic	Statistic	Statistic	Std Error	Statistic	Std Error
1	Skilled number of employees	1.74	.068	.705	.497	1.242	.234	2.785	.463
2	Scientific, technical and market knowledge	1.67	.059	.611	.373	.319	.234	-.629	.463
3	Labour costs	1.98	.087	.901	.811	.985	.234	.487	.463
4	Cost and accessibility of capital resources	1.70	.063	.647	.419	1.230	.234	5.030	.463
5	Latest technology for production of quality textiles	1.66	.070	.726	.527	1.519	.234	4.314	.463
6	Lack of research and training centers	1.61	.054	.562	.316	.213	.234	-.824	.463
7	Infrastructure (roads, railways, ports etc)	1.86	.060	.621	.386	1.063	.234	5.296	.463
8	National and industry efforts for research and development investment	1.92	.069	.715	.512	1.228	.234	3.639	.463
9	Absence of strong local demand	2.02	.097	1.000	1.000	1.116	.234	.761	.463
10	Desire and ability of Tanzanians to buy local textiles and apparel products	2.22	.108	1.119	1.251	.780	.234	-.511	.463
11	Inability to understand customer needs	2.15	.096	.989	.977	1.245	.234	1.356	.463
12	Inability to produce quality clothes compared to imported ones	2.15	.092	.950	.902	.839	.234	-.087	.463
13	Inability to produce varieties needed by Tanzanians	2.30	.096	.993	.985	.722	.234	-.317	.463
14	Inadequate accessibility to buyers	2.29	.087	.901	.811	.732	.234	-.200	.463
15	Low size and growth of Tanzania's textile market	2.13	.083	.859	.737	.927	.234	.511	.463
16	Low income of consumers	2.55	.107	1.109	1.231	.417	.234	-.949	.463
17	Lack of sophisticated and demanding local buyers	2.37	.089	.917	.840	.606	.234	-.503	.463
18	Lack of efficient, early, rapid preferential access	2.20	.102	1.050	1.103	.792	.234	-.369	.463
19	Poor linkages	2.15	.084	.867	.751	1.033	.234	.620	.463
20	Low development of value chains	2.00	.073	.752	.566	.813	.234	1.026	.463
21	Poor information flow	2.16	.083	.859	.739	.867	.234	.366	.463
22	Inadequate cluster programme	2.00	.075	.777	.604	.861	.234	.966	.463
23	Lack of business strategy	1.72	.071	.737	.543	1.075	.234	1.527	.463
24	Non-existence of strong domestic competitors	2.29	.091	.942	.887	.767	.234	-.021	.463
25	Attitudes of workers towards textiles and apparel management	2.23	.094	.977	.954	.626	.234	-.272	.463
26	The quality of human resources	1.97	.082	.852	.726	.801	.234	.751	.463
27	Government regulatory framework	1.95	.076	.782	.611	1.049	.234	2.098	.463
28	Social norms of workers and managerial attitudes	2.06	.074	.763	.582	.945	.234	1.959	.463

S/No	Variable	Mean		Std Dev	Variance	Skewness		Kurtosis	
		Statistic	Std Error	Statistic	Statistic	Statistic	Std Error	Statistic	Std Error
29	Limited FDI	1.96	.068	.699	.489	.894	.234	1.767	.463
30	Type of education	2.05	.085	.884	.781	.995	.234	.984	.463
31	Process and products upgrading	2.01	.072	.746	.557	.957	.234	1.472	.463
32	Ability of firms to position in domestic and foreign markets	2.08	.091	.943	.889	.931	.234	.446	.463
33	To design policies for industry competitiveness	1.46	.052	.537	.288	.543	.234	-.945	.463
34	To regulate the industry	1.65	.058	.600	.360	.580	.234	.919	.463
35	To have minimum intervention, and leave market forces work	2.06	.089	.920	.846	.851	.234	.106	.463
36	To forbid imports of second hand clothes	1.97	.088	.906	.820	.910	.234	.276	.463
37	The government to deal with corrupt practices in the industry	1.46	.052	.537	.288	.543	.234	-.945	.463
38	To invest directly in building textiles and apparel factories	1.99	.085	.874	.764	1.400	.234	2.874	.463
39	To provide subsidies and other assistances	1.80	.049	.504	.254	-.329	.234	.205	.463
40	To negotiate for good market access conditions	1.79	.065	.669	.448	1.226	.234	3.442	.463
41	To provide subsidies to enable local firms to compete	1.72	.054	.563	.317	.356	.234	1.378	.463
42	To build capacities for local firms to innovate	1.70	.058	.602	.363	.764	.234	2.326	.463

Table 2. Kaiser-Meyer-Olkin measure (kmo) and Bartlett's test

Bartlett's Test of Sphericity	Approx. Chi-Square	3.615E3
	df	861
	Sig.	0.000

Table 3. Principal component analysis based on five factors

Component		Initial Eigenvalues			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Raw	1	8.100	28.822	28.822	5.966	21.228	21.228
	2	2.487	8.849	37.671	2.831	10.075	31.303
	3	2.074	7.381	45.052	3.274	11.648	42.951
	4	1.875	6.672	51.725	2.189	7.788	50.738
	5	1.347	4.791	56.516	1.624	5.777	56.516

Extraction Method: Principal Component Analysis

Table 4. Rotated component matrix[8]

		Components				
M1	Skilled number of employees	1	2	3	4	5
M2	Scientific, technical and market knowledge		.619			
M3	High labour costs					
M4	Cost and accessibility of capital resources		.645			
M5	Latest technology for production of quality textiles		.615			
M6	Lack of research and training centers		.513			
M7	Infrastructure (roads, railways, ports etc)					
M8	National and industry efforts for research and development investment		.526			
M9	Absence of strong local demand					
M10	Desire and ability of Tanzania's to buy local textiles and apparel products		.775			
M11	Inability to understand customer needs		.585			
M12	Inability to produce quality clothes			.730		
M13	Inability to produce varieties needed by Tanzanians			.751		
M14	Inadequate accebility to buyers			.735		
M15	Low size and growth of Tanzania's textile market	.639				
M16	Low income of consumers			.649		
M17	Lack of sophisticated and demanding local buyers			.581		
M18	Lack of efficient, early, rapid preferential access	.645				
M19	Poor linkages	.658				
M20	Low development of value chains				.526	
M21	Poor information flow	.543				
M22	Inadequate cluster programme				.695	
M23	Lack of business strategy				.610	
M24	Non-existence of strong domestic competitors	.644				
M25	Attitudes of workers towards textiles and apparel management	.644				
M26	The quality of human resources	.750				
M27	Government regulatory framework	.684				
M28	Social norms of workers and managerial attitudes					.540
M29	Limited FDI					.545
M30	Type of education					.518
M31	Process and products upgrading	.829				
M32	Ability of firms to position in domestic and foreign markets	.732				
M33	To design policies for industry competitiveness	.785				
M34	To regulate the industry					
M35	To have minimum intervention, and leave market forces work					.698
M36	To forbid imports of second hand clothes	.707				
M37	The government to deal with corrupt practices in the industry				.617	
M38	To invest directly in building textiles and apparel factories					
M39	To provide subsidies and other assistances					
M40	To negotiate for good market access conditions					
M41	To provide subsidies to enable local firms to compete			.511		
M42	To build capacities for local firms to innovate					

1Extraction Method: Principal Component Analysis. 2 Rotation Method: Varimax with Kaiser Normalization

[8]*The Matrix based on five principal components corresponding to the number of constructs of the model*

In the case of *firm strategy, structure and rivalry*, the chi-square p-value is 0.992 suggesting that the model is significant. The value for Goodness of Fit Index (GFI), an absolute fit index, was found to be perfect with a value of 1.00 which is an excellent fit; the value of CFI, the incremental fit index CFI was also excellent at 1.00; and the RMSEA (badness of fit) value was also excellent at 0.00. All these indices supports that the model of firm strategy, structure and rivalry supports the construct embedded in the Porter's model. In other words, the null hypothesis that firm strategy, structure and rivalry is not statistically significant determinant of competitive advantage of the textiles and apparel industry in Tanzania is rejected and the alternative hypothesis that firm strategy, structure and rivalry are statistically significant is accepted. The Path diagram of this construct and the correlations among the error terms is shown in Fig. 3 below:

For the *demand conditions,* the chi-square p-value is 0.22 suggesting that the model is significant. The value for Goodness of Fit Index (GFI), an absolute fit index, is 0.947 which is a good fit; the value of CFI, the incremental fit index CFI is 0.991 which is also a good fit, and the RMSEA value is 0.049. All these indices supports that the measurement model of firm demand conditions supports this construct embedded in the Diamond model. The null hypothesis that demand conditions are not statistically significant determinants of competitive advantage of the textiles and apparel industry in Tanzania is rejected and the alternative hypothesis that demand conditions are statistically significant is not rejected. The Path diagram of this construct and the correlations among the error terms is shown in Fig. 4 below.

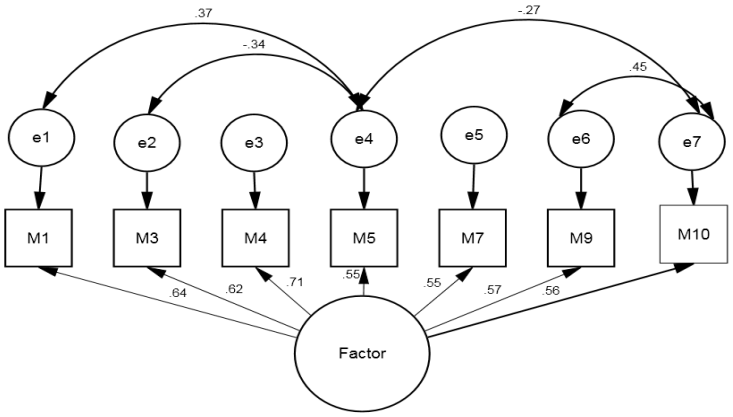

Fig. 2. Model fit for demand conditions
Normed Chi-Square =1.167; p-Value=0.308; CFI=0.993; GFI=0.973; RMSEA=0.04

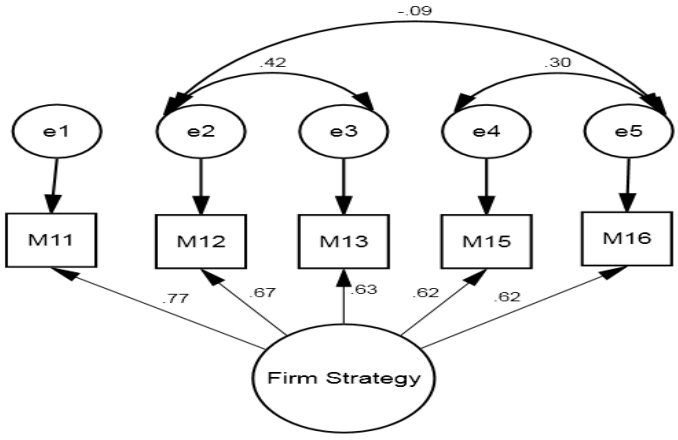

Fig. 3. Model fit for firm strategy, structure and rivalry
Normed Chi-Square =0.08; p-Value=0.992; CFI=1.00; GFI=1.00; RMSEA=0.00

With regard to *related and supporting industries*, the chi-square p-value is 0.615 suggesting that the model is significant. The value for Goodness of Fit Index (GFI), an absolute fit index, is 0.999 which is an excellent fit; the value of CFI, the incremental fit index CFI is 1.00 which is also excellent fit, and the RMSEA (badness of fit) value was 0.00. All these indices supports the measurement model of related and supporting industries construct embedded in the Diamond model. The null hypothesis that related and supporting industries are not statistically significant determinants of competitive advantage of the textiles and apparel industry in Tanzania is rejected and the alternative hypothesis is approved. The Path diagram of this construct and the correlations among the error terms is shown in Fig. 5 below.

With regard to *the role of Government*, the chi-square p-value is 0.281 suggesting that the model is significant. The value for Goodness of Fit Index (GFI) is 0.988 which is an excellent fit; the value of CFI, the incremental fit index CFI is 0.994 which is also an excellent fit, and the RMSEA (badness of fit) value was 0.05. All these indices supports the measurement model of the role of government as embedded in the Diamond model. The null hypothesis that the role of government is not statistically significant determinants of competitive advantage of the textiles and apparel industry in Tanzania is rejected and the alternative hypothesis that the government has a significant role is approved. The Path diagram of this construct is shown in Fig. 6 below:

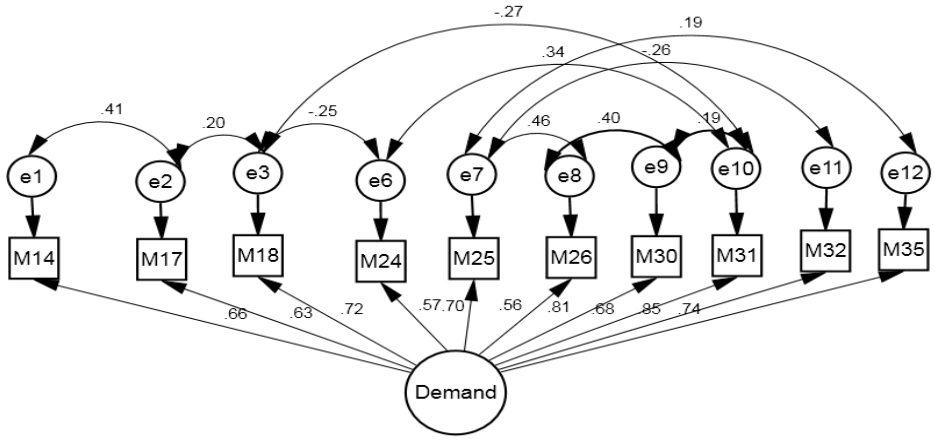

Fig. 4. Model fit for the demand conditions
Normed Chi-Square =1.205; p-Value=0.220; CFI=0.991; GFI=0.947; RMSEA=0.049

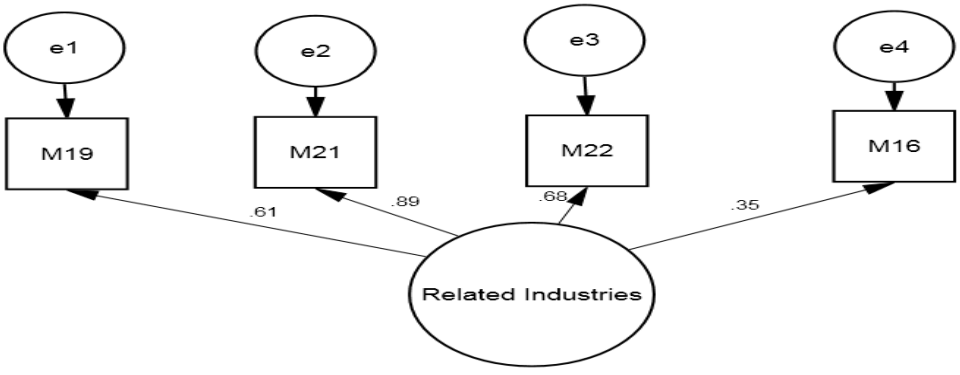

Fig. 5. Model fit indices for related industries
Normed Chi-Square = 0.254; p-Value=0.615; CFI=1.00; GFI=0.999; RMSEA=0.00

4.6 The Structural Equation Model (SEM)

The Structural Equation Model for the five constructs of the diamond model was empirically estimated in order to gauge the relationships among the constructs and relationships among the variables. The value of Normed Chi-Square was 1.3, the absolute fit index (GCI) was 0.9; the value of incremental fit index-CFI was 0.912, and the badness of fit (RMSEA) value was 0.04, also an acceptable value. All these indices support the Structural Model when benchmarked as illustrated in Appendix 3. Based on the structural model, all null hypotheses of no statistical significance relationship between the diamond determinants and the competitive advantage were also rejected and hence the alternative hypotheses were accepted. Appendix 2 depicts these relationships embodied in the structural model.

4.7 The Linear Regression Equations and Assessments of Significance

In an effort to assess the significance of constructs under the PDM, the ANOVA was employed. In general, the Analysis of Variance on the Porter's Diamond Model rejects strongly the null hypothesis stated under section 3.1. We briefly describe the results in the following sub-sections.

4.7.1 Factor conditions

The linear model that shows the relationship the relationship between the dependent variable and independent variables of this latent construct is represented by the following equation:

$$F_p = 0.759 + 0.107M_8 + 0.042M_4 + 0.215M_6 + 0.013M_3 + 0.112M_1 + 0.105M_7 + 0.163\,M_2 - 0.121\,M_5 \quad (6)$$

Where the dependent variable is proxied by factor conditions denoted as F_p; and independent variables are constant (β), National and industry efforts for research and development (M_8);, Cost and accessibility of capital resources (M_4), Lack of research and training centers (M_6), labour costs (M_3), Skilled number of employees (M_1), Infrastructure (roads, railways, ports etc) (M_7), scientific, technical and market knowledge (M_2) and latest technology for production of quality textiles (M_5). The above equation shows that all variables are positively correlated with factor conditions except the technology for production of quality textiles which is negatively correlated. Further, the ANOVA statistic of the variables confirms that the model is statistically significant at 5 percent level of significance as shown in Table 5 below.

4.7.2 Demand conditions

The linear model that shows the relationship between the dependent variable and independent variables of this latent construct is shown in the following equation:

$$D_C = 1.142 + 0.131M_{17} - 0.122M_{12} + 0.201M_{15} + 0.105M_{11} - 0.09M_{14} + 0.017M_{10} + 0.097\,M_{13} - 0.130M_{16} \quad (7)$$

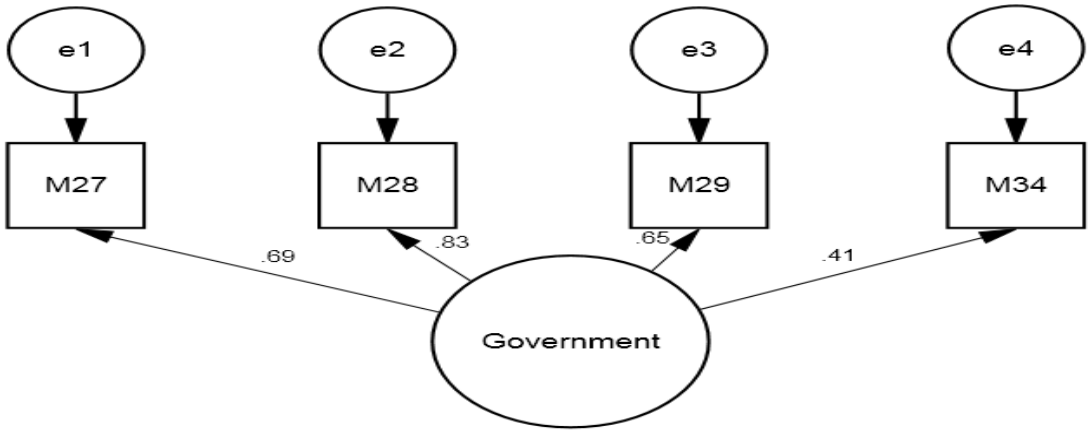

Fig. 6. Model fit indices for the role of government
Normed Chi-Square =1.269; p-Value=0.281; CFI=0.994; GFI=0.988; RMSEA=0.05

Table 5. ANOVA statistics of factor conditions

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	11.705	8	1.463	3.941	0.000
	Residual	54.204	146	.371		
	Total	65.910	154			

Where the dependent variable is proxied by demand conditions denoted as D_C; and independent variables are constant (β), lack of sophisticated and demanding local buyers (M_{17}), inability to produce quality clothes compared to imported ones (M_{12}), absence of strong local demand (M_9), low size and growth of Tanzania's textile market (M_{15}), inability to understand customer needs (M_{11}), inadequate accessibility to buyers (M_{14}), desire and ability of Tanzanians to buy local textiles and apparel products (M_{10}), inability to produce varieties needed by Tanzanians (M_{13}) and low income of consumers (M_{16}). The ANOVA statistics confirms the model is statistically significant at 5 percent level of significance as shown in Table 6 below.

4.7.3 The related industries construct

The linear model showing the relationship between the dependent variable and independent variables of this latent construct is shown in the following equation:

$$\boldsymbol{R_{IN}} = \beta + 0.576 + 0.131M_{18} + 0.114M_{19} + 0.280M_{20} + 0.246M_{21} \quad (8)$$

Where the dependent variable is proxied by demand conditions denoted as D_C; and independent variables are constant (β), lack of efficient, early, rapid preferential access (M_{18}), poor linkages (M_{19}), low development of value chains (M_{20}), Poor information flow (M_{21}) and inadequate cluster programme (M_{22}). Further, the ANOVA statistics of the variables confirms that the model is statistically significant at 5 percent level of significance as shown in Table 7 below.

4.7.4 Firm strategy, structure and rivalry construct

Once again, the linear equation model showing the relationship between the dependent variable and independent variables of this latent construct is shown in the following equation:

$$\boldsymbol{R_{FS}} = \beta + 0.855 + 0.208M_{23} + 0.096M_{24} + 0.036M_{25} - 0.128M_{26} + 0.246M_{27} + 0.162M_{28} + 0.064M_{29} + 0.188M_{30} + 0.134M_{31} - 0.142M_{32} \quad (9)$$

Where the dependent variable is proxied by firm strategy, structure and rivalry denoted as R_{FS}; and independent variables are constant (β), lack of business strategy (M_{23}), non-existence of domestic competitors (M_{24}), attitudes of workers (M_{25}), quality of human resources (M_{26}), government regulatory framework (M_{27}), social norms of workers (M_{28}), limited FDI (M_{29}), type of education (M_{30}), process and products upgrading (M_{31}) and ability of firms to position in domestic and foreign markets (M_{32}). Further, the ANOVA statistics of the variables confirms that the model is statistically significant at 5 percent level of significance as shown in Table 8 below:

4.7.5 The Role of Government

Lastly, the linear equation model showing the relationship between the dependent variable and independent variables is shown in the following equation:

$$\boldsymbol{F_G} = \beta + -0.256 + 0.298M_{33} + 0.157M_{34} + 0.112M_{35} - 0.060M_{36} + 0.213M_{37} - 0.069M_{38} + 0.188M_{39} + 0.061M_{40} + 0.118M_{41} + 0.164M_{42} \quad (10)$$

Where the dependent variable is proxied by the role of government denoted as F_G; and independent variables are constant (β), to design policies for industry competitiveness (M_{33}), to regulate the industry (M_{34}), to have minimum intervention, and leave market forces work (M_{35}), to forbid imports of second hand clothes (M_{36}), the government to deal with corrupt practices in the industry (M_{37}), to invest directly in building textiles and apparel factories (M_{38}), to provide subsidies and other assistances (M_{39}), to negotiate for good market access conditions (M_{40}), to provide subsidies to enable local firms to compete (M_{41}) and to build capacities for local firms to innovate (M_{42}). Further, the ANOVA statistics confirms the model is statistically significant at 5 percent level of significance as shown in Table 6 below:

Table 6. ANOVA statistics of demand conditions

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.883	9	1.765	4.736	0.000
	Residual	54.027	145	0.373		
	Total	69.910	154			

Table 7. ANOVA statistics of related and supporting industries construct

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	47.479	5	9.496	14.234	0.000
	Residual	99.399	149	0.667		
	Total	146.877	154			

Table 8. ANOVA statistics of firm strategy, structure and rivalry

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	32.158	10	3.216	12.053	0.000
	Residual	37.352	140	.267		
	Total	69.510	150			

Table 9. ANOVA statistics of the role of government

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.139	10	5.114	11.792	0.000
	Residual	62.448	144	.434		
	Total	113.587	154			

5. CONCLUDING REMARKS

This study has examined the applicability of PDM in textile and apparel industries in Tanzania, using data from firms located in Dar es Salaam, Arusha and Mwanza. The motivation for this study stems from the fact that, to the best of our knowledge there has never been hitherto such studies carried out in Tanzania. In doing so, factor analysis, principle component analysis and structural equations have been used in the analysis. In general, the empirical analysis strongly supports the relevancy of the Porter's Diamond model in enhancing firm competitive advantage and it has been found that the model is relevant as a benchmark of firms and industry's efforts to attain competitive advantage. The study finds that, the determinants of the model have varying degree of importance in a given industry. The two most important factors that are envisaged to engender competitive advantage of the textiles and apparel industry in Tanzania are: related and supporting industries; and demand conditions. The related and supporting industries consists of poor linkages, poor information flow among companies, inadequate cluster programmes and the need to forbid imports of second hand clothes. The demand conditions comprises of enhancement of access to buyers, improvement in incomes, modernization and sophistication standards of local buyers; upgrading value chains, mobilization of firms in the development of business strategies in order to win competitive edge and improvement in the quality of human resources, type of education, and products upgrading.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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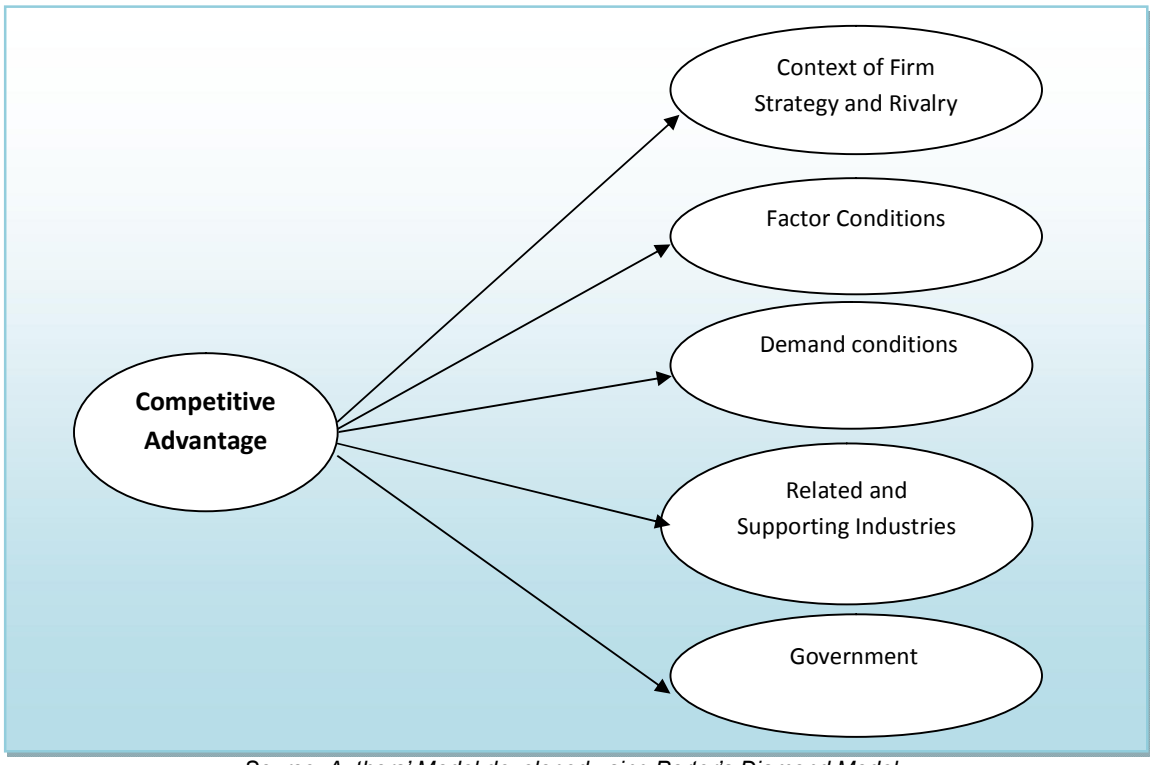
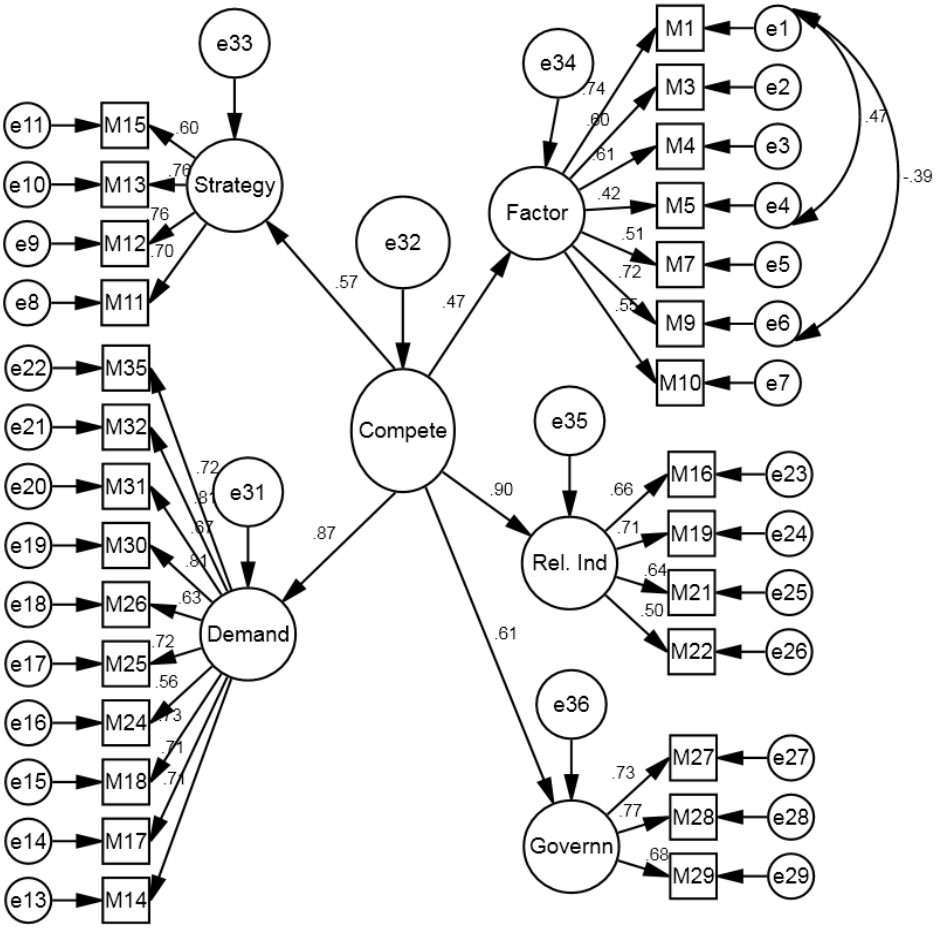
Appendix 1. The conceptual model



Source: Authors' Model developed using Porter's Diamond Model

Appendix 2. The Empirics of the Diamond Model: The Structural Model



CMIN/df =1.3; p-Value 0.45; CFI=0.192; GFI =0.9; RMSEA =0.04

Appendix 3. The acceptable fit indices of the structural model

Fit index	Abbreviation	Acceptable values and comments
Chi-square Statistic	χ 2	The *p* value should be greater than 0.05 for a good model fit. A non-significant value indicates that there is no difference between the sample variance-covariance matrix and the estimated variance-covariance matrix, implying the researcher's model is right. The value is sensitive to sample size and model complexity, and the values tends to be greater when sample size or the number of observed variables increases even if the difference between the observed and estimated covariance matrices are identical.
Goodness of fit index	GFI	Less sensitive to sample size. Ranges between 0-1, with values of 0 (poor fit) to 1 (perfect fit). Higher values indicate better fit. No absolute threshold level for acceptability
Root mean square error of approximation	RMSEA	The RMSEA is used to correct the impact of sample size or model complexity on χ2. Lower values indicate better fit (badness-of-fit measures), and values over 0.10 indicate poor fit.

Source: Nguyen (2010)

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The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=979&id=20&aid=8477