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# Corporate Social Responsibility in Higher Education: A PLS-SEM Neural Network Approach

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**ABSTRACT** Corporate social responsibility (CSR) has become vital to the competitiveness of organizations. However, there is very limited research on CSR in the context of higher education. Therefore, this study investigates the impact of CSR factors on the university competitiveness with other universities. The contribution of this study includes applying a multi-analytical methodology by applying Partial Least Squares- Structural Equation Modelling (PLS-SEM) and Artificial Neural Network (ANN). First, PLS-SEM analysis was applied to measure which CSR factor has the most significant influence on the increased competitiveness of Saudi Arabian universities. Then, an ANN model analysis was applied to rank the relative influence of the significant CSR factors attained from the PLS-SEM analysis. The findings show that the CSR factors such as market-oriented CSR activities, society-oriented CSR activities and workforce-oriented CSR activities have a significant positive impact on increased competitiveness of Saudi Arabian universities. However, based on the ANN findings, society-oriented CSR is the most significant predictor of a university's increased competitiveness, followed by workforce-oriented CSR and finally by market-oriented CSR. The practical implications of this study provide Saudi universities to focus on society-oriented CSR to maintain and sustain their competitive advantage over other universities.

**INDEX TERMS** ANN, corporate social responsibility, education, PLS SEM, Saudi Arabia.

## I. INTRODUCTION

Understanding and addressing corporate social responsibility (CSR) is advised for any kind of business or organization [1]. It is suggested that CSR can be of great assistance in invigorating the competitiveness and operations of an organization, given that global competitiveness keeps following remarkable trends [2]. CSR has not only been accepted and become prominent as a business tool; it is also thought to elevate social development [3]. In order to maintain competitiveness, managers should come up with ways their organizations can develop economic competitiveness, ecological sustainability and social responsibility [2], [3]. If an organization makes efforts towards social responsibility, there are benefits for both the organization and society [3].

The CSR principles also apply to universities. Universities are not limited to only teaching and research.

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University competitiveness refers to the ability of a university to create and sustain competitive advantages over other universities domestically and also internationally. Such as the university ability to maintain its long-term performance better than its competitors, as shown by teaching, income, research output and graduates' employability. Universities continue to educate the modern-day generation and provide a community service [4]. According to Parson [5], there is a need to recognize CSR as a core component of the function of universities rather than as a separate consideration. As stated by Vallaey [6], social responsibility is not a philanthropic activity but an orientation that exists in the universities' functioning. Hayter and Cahoy [7] consider CSR at universities to be a strategic move that should exist within the depths of the infrastructure of the university. Because of this, CSR-based infrastructure aligns strategy and resources for maximizing the social impact of universities.

Universities strengthen relationships between humans and society [8]. However, although research has been conducted

on CSR in universities (such as [7], [12], [13]), there is a lack of studies dealing with CSR in developing countries [10], [11]. According to Pisani and Kourula [14], less than 10% of CSR research deals with developing nations. There is a lot of current research that explores whether universities should have CSR as one of their main concerns [4]–[6]. According to Kantanen [15], a university should strive to provide benefits to society, since universities greatly contribute to the knowledge-based economy [16] and social progress. According to Vasilescu *et al.* [17], universities are one of the main components of society. Therefore, it is considered that universities can develop social responsibility for societies, communities and stakeholders if they adopt CSR practices [18].

CSR is highly complicated and involves multiple dimensions [19]. However, previous research on CSR has been conducted using a single step SEM analysis. SEM is capable of finding the linear relationships between variables. ANN is helpful in non-linear and linear relationships with higher predictive accuracy.

The two objectives of this research are as follows. First, to investigate the use of CSR factors in Saudi university and their likely influence on competitiveness with other universities in the region. Second, to enhance CSR based research with the help of a multi-analytical two step approach, using the PLS-SEM and ANN method. This research applied Turyakira *et al.*'s [20] CSR factors, which includes a workforce-oriented CSR factor, society-oriented CSR factor and market-oriented CSR factor in the context of Saudi Arabian university competitiveness with other universities.

The paper is organized as follows. The next section 2 presents theoretical background and hypotheses development. Then the section 3 presents the research methodology followed by data analysis and results in section 4. Finally, section 5 presents discussion, implications and concludes the study.

## II. THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

For the purpose of this research and on the basis of prior studies [20], [21], CSR contains the following factors: workforce-oriented CSR, society-oriented CSR and market-oriented CSR. Regardless of whether the influence of these factors is individual or collective, organizations can become more competitive in profitability, market share, growth rate and increased sales volume because of them. According to Carroll [22], the successful implementation of CSR policies can contribute to an organization's competitiveness. According to Vaaland *et al.* [23], stakeholder theory is important to implementing CSR, such that the workers, customers, community and environment are the key stakeholders. For CSR, it is necessary to work with local communities collaboratively, make investments that benefit society, have a good understanding of customers, workers and their households, and take part in the promotion of environmental sustainability and conservation [24].

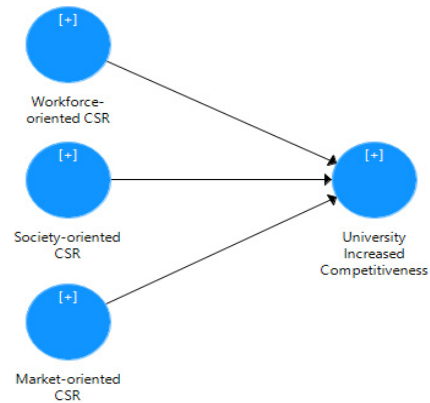


FIGURE 1. Research model.

Similar to any other organization, social responsibility also exists in the universities' functioning [8]. CSR at universities to be a strategic move that should exist within the depths of the infrastructure of the university [7]. Therefore, universities can develop corporate social responsibility for societies, communities and stakeholders if they adopt CSR practices [18].

University competitiveness refers to the ability of a university to create and sustain competitive advantages over other universities domestically and also internationally. Such as the university ability to maintain its long-term performance better than its competitors by focusing on students, staff and service to the community. Therefore, CSR factors [20] such as workforce-oriented CSR, society-oriented CSR and market-oriented CSR are applicable to university. Figure 1 shows the research model.

### A. WORKFORCE-ORIENTED CSR ACTIVITIES

Workforce-oriented CSR activities refer to the activities that help workers to keep a work-life balance, create diversity and equal opportunities and provide staff development and training so that workers can have better working conditions [20]. Fiori *et al.* [25] suggest that job creation and security systems, good employee relations systems, equal opportunity and policy systems, staff training and development systems, and systems for safety and health provide the basis for these workforce-oriented CSR activities. Considering this, the CSR measures of a university similar to any organizations are aimed at motivating and keeping workers [26]. For example, 86–95% of Austrian businesses consider workforce-oriented CSR functions as a role model for employees by providing equal treatment to employees, a fair salary structure and honest contracts [21]. Similar to any business organization, university workforce-oriented CSR activities leads to increase increased competitiveness [20]. This leads to the following hypothesis:

H1: CSR workforce-oriented activities have a positive impact on university's increased competitiveness with other universities.

## B. SOCIETY-ORIENTED CSR ACTIVITIES

Society-oriented CSR activities deal with community involvement, providing help to people with low wages, education, health and well-being, sports, and the community [20]. These kinds of activities are considered to revolve around supporting community development as well as cultural and social community activities and other such concerns [27]. In addition to that, a university that demonstrates social responsibility can increase their revenues and become more competitive due to the fact that the public and business community consider the enterprise to be reputable [28]. Universities are one of the main components of society. If a university makes efforts towards social responsibility, it is more likely to contribute to the knowledge-based economy [16], [17]. This leads to the following hypothesis:

H2: CSR society-oriented activities have a positive impact on university's increased competitiveness with other universities.

## C. MARKET-ORIENTED CSR ACTIVITIES

Market-oriented CSR activities include ensuring the business is open at suitable times, producing revenue, being loyal to customers, charging fair costs, treating customers in a healthy manner, providing useful information to the customers, and responding quickly to customer feedback [20]. In order for organizations to achieve long-lasting success, the sales networks of an organization's products have to be high quality and durable [29]. According to Ali *et al.* [30], organizations can become more competitive if they have informative sound market-oriented CSR activities that influence customers to be loyal. Similarly, market-oriented CSR activities in universities which include responsible student relations and attracting potential students lead to increase increased competitiveness [20], [21]. This leads to the following hypothesis:

H3: CSR market-oriented activities have a positive impact on university's increased competitiveness with other universities.

## III. RESEARCH METHODOLOGY

The survey method was used to collect data. Data were collected from university staff from Saudi universities from November 2018 to February 2019. A previously validated questionnaire scale was modified and adopted [20]. Data were analysed using a multi-analytical methodology by incorporating Partial Least Squares Structural Equation Modelling (PLS-ESM) and Artificial Neural Network (ANN) [31]. The analysis is carried out in two stages. In the first stage, PLS-SEM is examined. This stage is further separated into two steps, known as the measurement model validation and structural model hypothesis testing [32].

However, SEM is capable of only finding the linear relationships between latent constructs. But, ANN is helpful in findings both and non-linear relationships with higher predictive accuracy [31]. According to Henseler *et al.* [33], "artificial neural networks (ANN) may be valuable in those research

settings that have a predictive scope, weak theory and which do not call for comprehending the underlying associations." Hence, employing the PLS-SEM and ANN methods are complementary to one another [31], [33]. Therefore, the second stage involves the use of ANN to analyse the complement and validate the PLS-SEM analysis, and to determine how the independent factors affect the dependent factor.

## IV. DATA ANALYSIS AND RESULT

Data were collected in King Abdulaziz University (KAU), Jeddah. It is a large public university with affiliated institutions in Saudi Arabia. According to the times higher education – world university ranking 2020, KAU is at 201-250<sup>th</sup> in world ranking. KAU consists of management departments, faculties and deanships (such as Deanships of community services and continuing education). Staff were invited via university webmail to participate in survey. A total of 325 participants responded to the survey. After removing incomplete responses, 205 (63%) were used for analysis. 68% were males and 32% were females. 70% of respondents have more than seven years of experience at the university. 65% of participants consists of professional staff such as from the HR department and the deanships faculty staff. 35% of participants were academic staff. 60% of participants had a master's degree. 30% of participants had a PhD and 10% had bachelor's degrees.

### A. PLS-SEM

PLS-SEM is a variance-based statistical analytical model that is used for testing hypotheses by employing SmartPLS V3.2 [34]. Reinartz *et al.* [35] offer an effective outlook on variance as well as covariance-based SEM (CB-SEM). The method that is preferred for analysis in studies on business information systems is PLS-SEM due to reasons such as the small size of the sample, lack of normality, and the potential to work in the absence of distributional presumptions with ordinal, nominal and interval-scaled factors [36].

Henseler *et al.* [37] found that a better performance is exhibited by PLS-SEM in comparison to CB-SEM to determine the true model. In addition to this, it was highlighted by Hair *et al.* [38] that PLS-SEM is also more effective in justifying variance in the indicators of dependent factors than CB-SEM. Finally, PLS-SEM has been applied in various business and information systems studies [16], [32], [34], [39]–[41].

The validity and reliability are included in the measurement model and these are determined by assessing internal consistencies and convergent and discriminant validities [32], [33]. It has been found that Cronbach's reliability and internal consistencies with composite reliability for every latent factor was more than the suggested value of 0.70. Additionally, for every variable, the correlations were lower than the square root of the average variance extracted (AVE), which suggests that there was suitable discriminant validity. All variable values have AVE of more than the suggested value of 0.50. Table 1 shows the measurement model results.

TABLE 1. Reliability and validity assessment.

	AVE	CR	C-alpha	W-CSR	S-CSR	M-CSR	UIC
W-CSR	0.65	0.85	0.81	0.80			
S-CSR	0.68	0.83	0.80	0.52	0.82		
M-CSR	0.56	0.84	0.73	0.23	0.22	0.74	
UIC	0.64	0.81	0.72	0.25	0.34	0.64	0.80

Notes: AVE: Average Variance Extracted, CR: Composite Reliability, C- Alpha: Cronbach's Alpha, W-CSR: Workforce-oriented CSR; S-CSR: Society-oriented CSR; M-CSR: Market-oriented CSR; UIC: University Increased Competitiveness; Diagonal elements are the square root of AVE. All correlation coefficients are significant at the 0.05 level.

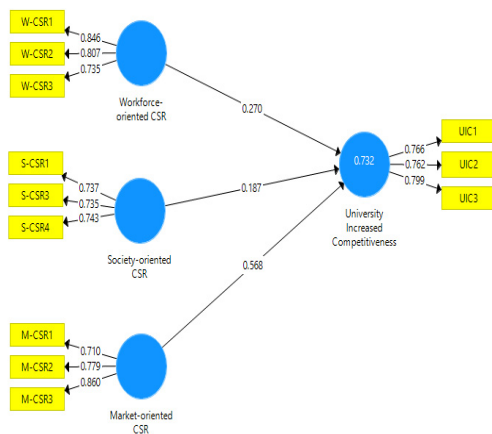


FIGURE 2. Path testing.

In addition, Variance Inflation Factor (VIFs) of all indicators were above the threshold value is 3.3 indicating full collinearity test and no bias.

The t-test was used to determine the significance of the path coefficients. The bootstrapping method was used for this, while the level of significance was 5%. Bootstrapping signifies a nonparametric technique for assessing the coefficients, i.e. the path coefficients and outer factor weights, by evaluating the standard error for estimation. To carry out the inner as well as outer model to determine the t-value for significance, SmartPLS V3.2 is used. The threshold values for significance levels of 10%, 5% and 1% are 1.65, 1.96 and 2.58 respectively. Figure 2 presents the structural model results. The results of the R<sup>2</sup> indicate that 73% of the variance is the increased competitiveness in Saudi universities. Table 2 presents the hypotheses tests. The findings show all hypotheses are accepted. The workforce-oriented CSR activities, society-oriented CSR activities and the market-oriented CSR activities have a significant positive impact on the increased competitiveness of Saudi Arabian universities.

**B. ARTIFICIAL NEURAL NETWORK (ANN) ANALYSIS**

As discussed in the methodology section, the second stage of analysis uses the ANN network. The inputs to ANN are significant hypothesized predictors that stress how crucial every predictor's variable is. ANN can also be used to assess

TABLE 2. Structural model testing.

	Path	Path Coefficient	Standard Deviation	t-value	p-value	Findings
H1	W-CSR → UIC	0.270	0.08	3.36	0.001*	Positive and significant
H2	S-CSR → UIC	0.187	0.07	2.36	0.019**	Positive and significant
H3	M-CSR → UIC	0.568	0.06	8.81	0.000*	Positive and significant

\*Significant at the 0.001 level, \*\* Significant at the 0.05 level.

how the predictor is related to the adoption decision variables (linear or non-linear relationship) [42]. Additionally, more accurate predictions are generated by ANN than by SEM techniques [42]. Through SEM analysis, the intricacies of the decision-making process could be over-simplified [31], [42]. In contrast, it is not recommended to use the ANN technique for testing hypotheses that comprise causal correlations [42], [43]. Nonetheless, a greater prediction precision is offered by ANN in comparison to SEM. Hence, employing the PLS-SEM and ANN methods in this study would be complementary to one another.

This research employs a Multilayer Perceptron (MLP) back propagation feedforward. The MLP is the most popular and widely employed ANN technique [31], [44]. There are three layers that form the ANN analysis: the input layer, hidden layer and the output layer. SPSS v22 is used in this study to model MLP-ANN. Recommendations are put forward by [31], [42], [44], who assert that there is autonomous creation of the hidden neurons (nodes) and the activation function (Sigmoid function) is used for hidden as well as output layers. In addition to this, ten-fold cross-validation is used to determine the prediction precision of the trained network, consistent with the recommendations presented by the earlier authors. The over-fitting issue is prevented by distributing the data into two parts, where 90% is assigned to training and 10% to testing [31], [44]–[45]. The root means square error for training (90%) and testing (10%) data sets (ten runs) was used to determine the prediction precision of the ANN model [44].

The ANN was calculated by the training (90%) and testing (10%) data sets, as recommended by Zabukovšek *et al.* [44]. Root mean square error (RMSE) is used to predict the accuracy of the ANN model. The RMSE is computed using the below equation, using the sum of squared error (SSE) and the mean squared prediction error (MSE). Table 3 shows the ANN results.

$$RMSE = \sqrt{MSE} = [1 \div n) \times SEE$$

Furthermore, the normalized relative importance ranking (%) using a sensitivity analysis was also computed to find the relative importance of each input predictor [44], as presented in Figure 4 and Table 4. Based on the normalized predictor importance, society-oriented CSR is the most significant predictor of a university's increased competitiveness, followed by workforce-oriented CSR and finally market-oriented CSR.

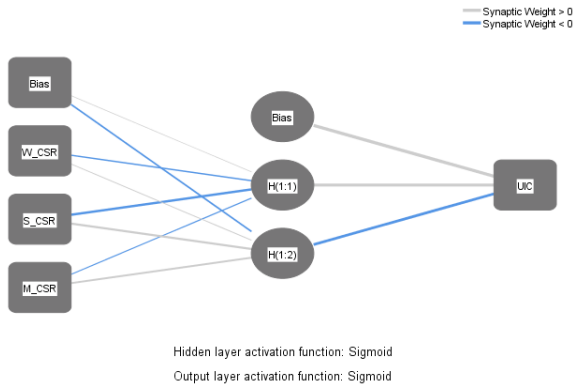


FIGURE 3. ANN model.

TABLE 3. ANN values.

Inputs: Workforce-oriented CSR; Society-oriented CSR; Market-oriented CSR				
Output: UIC: University Increased Competitiveness				
Neural Network	Training (90%)		Testing (10%)	
	SSE	RMSE	SSE	RMSE
ANN1	1.97	0.107	0.13	0.084
ANN2	1.98	0.107	0.13	0.085
ANN3	1.98	0.107	0.13	0.085
ANN4	1.95	0.107	0.13	0.084
ANN5	1.98	0.107	0.13	0.085
ANN6	1.99	0.107	0.14	0.085
ANN7	1.97	0.107	0.13	0.084
ANN8	1.96	0.107	0.13	0.084
ANN9	1.98	0.107	0.13	0.085
ANN10	1.98	0.107	0.13	0.085
	<b>Mean</b>	0.107	<b>Mean</b>	0.085

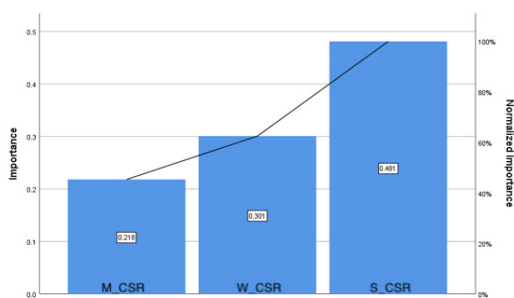


FIGURE 4. Normalized importance.

Table 5 shows a comparison of the PLS-SEM and ANN analyses. The comparison in terms of the predictor’s strength of influence shows that workforce-oriented CSR is ranked second in both PLS-SEM and ANN. However, society-oriented CSR is ranked one in ANN analysis but is ranked three in PLS-SEM analysis, while market-oriented CSR is ranked three in ANN analysis but ranked one in PLS-SEM analysis. The reason for this difference is because ANN computes both the linear and the complex

TABLE 4. Normalized variable relative importance.

Predictors	Average relative importance	Normalized relative importance (%)	Ranking
Workforce-oriented CSR	0.218	44	2
Society-oriented CSR	0.481	100	1
Market-oriented CSR	0.301	60	3

TABLE 5. PLS-SEM and ANN analysis comparison.

	Path	Path Coefficient	Finding	PLS-SEM Ranking	ANN-normalized relative importance (%)	ANN Ranking	Matched?
H1	W-CSR → UIC	0.270	Positive and significant	2	44	2	Yes
H2	S-CSR → UIC	0.187	Positive and significant	3	100	1	No
H3	M-CSR → UIC	0.568	Positive and significant	1	60	3	No

Workforce-oriented CSR; S-CSR: Society-oriented CSR; M-CSR: Market-oriented CSR; UIC: University Increased Competitiveness

nonlinear relationships among predictors with high predictive accuracy [44].

V. DISCUSSIONS, IMPLICATONS AND CONCLUSION

The study shows that the two-step approach (PLS-SEM and ANN) offer in-depth findings compared to single step PLS-SEM method. The strength of each CSR factor effect on the university’s increased competitiveness is ranked using ANN sensitivity analysis to confirm the PLS-SEM findings. The results of the ANN analysis usually confirm the results obtained by SEM. However, there are some nominal differences, which are due to the non-linear nature and the high prediction accuracy of the ANN model. ANN analysis confirms the workforce-oriented CSR findings by ranking them second. However, the ANN model predicts that society-oriented CSR has a higher impact than market-oriented CSR. This means that out of the three CSR factors, society-oriented CSR activities can contribute more to making universities more competitive. This means that for a university to have a better chance at developing long-term competitiveness, it should give a portion of its revenue to the community, assist community projects, make donations to the community and volunteer in other similar local community activities. It is recommended that universities assist with development projects in the community (such as sports and health care), provide students who have good academic performance with rewards, and give funds in the form of community donations to contribute to the general well-being of the community so that good community relations can be established and maintained.

The results show that workforce-oriented activities are ranked second, which means that there are more chances of long-term competitiveness enhancement for enterprises that focus on staff development and provide job security to

their workers. It is recommended that universities work towards offering appropriate and responsible salaries, flexible working hours and a safe and conductive workplace to their workers and improving their skills via training and retraining. This means universities will more likely gain and retain competitiveness as the workforce will be more motivated.

In addition to this, market-oriented CSR is ranked third, however, it can still greatly contribute to making universities more competitive. For a university to have a better chance of improving its competitiveness, the university should provide fair treatment to its stakeholders, stay open at suitable times, and give quick responses to students' feedback. If they implement such measures, universities will become more competitive in the long run by establishing healthy relationships with all the stakeholders involved.

As stated in the theoretical background in section 3, stakeholder theory is important to implementing CSR, which includes workers, customers, and community as key stakeholders [23]. Universities are one of the main components of society [17]. The findings of the study confirm that CSR activities such as market-oriented CSR activities, society-oriented CSR activities and workforce-oriented CSR activities have a significant positive impact on the increased competitiveness of Saudi universities. Therefore, this study confirms that universities should develop social responsibility for stakeholders in adopting CSR practices in developing nations, which is consistent with [18].

Previous research has shown that the world top universities are committed to CSR [7], [12], [13], which aim to focus on the core areas of social responsibilities such as human rights, ethical business, labor practices, organization governance, customer and community engagement. Overall, the findings show that each CSR factor (market-oriented CSR activities, society-oriented CSR activities, and workforce-oriented CSR activities) help to make Saudi universities more competitive than other universities in the region. The results of this study also are aligned with [20], [27], [29].

In conclusion, the practical implications of this study provide Saudi universities to focus on society-oriented CSR, workforce-oriented followed by market-oriented CSR activities to maintain and sustain their competitive advantage over other universities.

Finally, this study has limitations. First, the data were collected only in one public university in Saudi, which could affect the generalization of the study. Second, this study only considers three CSR factors. Future work should investigate the impact of additional CSR activities on universities' competitiveness. Third, it is unknown if there is a non-response bias, as we did not conduct a comparison with the incomplete survey respondents. However, PLS-SEM has the benefit to assess data with no bias [46]. Fourth, qualitative methods would provide supplemental findings. CSR is a multi-criteria decision-making (MCDM) real-world problem, thus, a fuzzy MCDM method (such as [47]–[49]) would likely provide deeper understanding of CSR activities.

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