Validity and Reliability Analysis of the Baldrige Excellence Framework Scale in the Electrical & Electronics Manufacturing Companies in Malaysia

OON Fok-Yew, Abdul Hamid Nor Aziati, Abdullah Nor Hazana

Abstract: This paper aims to examine the validity and reliability of the Baldrige Excellence Framework scale in the Electrical and Electronics (E&E) manufacturing companies in Malaysia. This study is using a survey questionnaire for collecting data. The survey instrument was designed according to the Baldrige Excellence Framework criteria. Stratified random sampling from four sub-sectors of E&E manufacturing companies has employed and follow by simple random sampling with estimated 325 sample size. The analysis of this scale validation was carried out by using PLS-SEM 3.2 to assess the validity and reliability of the survey questionnaire. The outcomes in this research further affirmed that the instrument used was met the acceptable range of validity and reliability. The sample framework and sample size are the E&E manufacturing industry which indicates that the result cannot be generalized to another industry due to potential differences. This study shall guide future business excellence research in the manufacturing setting by using the validated measures in the findings. It also offers the manufacturing managers measures to identify the level of their organization's business excellence in the E&E manufacturing companies. Hence, improvement programs can be designed to further improve their business results. This research probably the early study to examine the Baldrige Excellence Framework 2019-2020 deployment in manufacturing companies of Malaysia E&E. The study findings concluded that all instruments are valid and reliable, also suited to the context of Malaysia.

Keywords : Baldrige excellence framework, validity, reliability, E&E.

I. INTRODUCTION

Numerous organizations are applying Business Excellence (BE) initiatives to be more competing in respective sector. It was a big challenge for various companies to withstand the early success even through the initial achievements are very encouraging (Sony, 2019). They have molded a value-chain networked companies that circulating their processes or operations around the world. Every member in company is likely to involve to the chain of value according to their capabilities, areas of expertise and strengths in this and other collaborative excellence models (Ferdowsian 2016; Lee, Zuckweiler & Trimi, 2006; Sundharam, Sharma & Thangaiah, 2013). This move has brought a lot of benefits in particular speed, flexibility, supplemented resources, and responsiveness which required to face with unpredictable and turbulent business environment. Moreover, leadership also provides a new set of challenging issues which need integrated and responsible strategy for quality, planning and implementation (Matthews et al., 2014). For example, a visionary leader should set a vision for organization, demonstrate visible and clear organizational ethics and value, establish a customer-oriented, and place higher hopes to their staff (NIST, 2019).

Even through there was previous research of Business Excellence Models (BEMs) in manufacturing but the BEMs also contain several unexpected dimensions that required to address or needs research consideration. The first topic is that majority studies in BEMs vary of definition of "Business Excellence" which continue been enhanced to keep pace with the rapid changing business landscape (Dahlgaard-Park & Dahlgaard, 2010). For example, the Baldrige excellence framework constantly adjusting its criteria very two years since its inception in 1987. Indeed, there are many business excellences but there is one best model is much-needed. In present study, we adopted Baldrige model as Malaysia Business excellence framework is benchmarked from this model since in the past (Masrom et al., 2017a). Moreover, consideration of Baldrige in present study as it is the most comprehensive management framework and proven can work for all types and sizes of organizations for more than 30 years (NIST, 2019). It is also the most adopted and adapted excellence by many countries after the EFQM (Mann, Adebanjo & Tickle, 2011), particularly Asian countries in its tailored or entirely version such as India, China, Japan, Singapore, Thailand and Malaysia.

The second issue is the sustainability of gains from BE initiatives. The initial gain of BE initiatives is high and then the achievements are not sustainable. Besides, most of the BE initiatives only focus and assess the impact of economic dimension and ignored other dimensions (Sony, 2019). In contrast, the Triple Bottom Line approach suggests an organization if it performs on economic, environmental and social will be sustainable (Hubbard, 2009; Gimenez, Sierra, & Rodon, 2012).

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With the comprehensive of latest Baldrige model 2019, is interesting to explore which elements are not well take care by Malaysia E&E organizations. There is also a need to validate the instrument of latest Baldrige model in Malaysia context.

The third issue is we content that there is valid and real to fill the gaps in the absent of organizations when chasing BE that have not been entirely informed (Fok-Yew, 2016). Sreedharan et al. (2017) pointed out that too few researches have attempted to address the diverse factors of failure upsetting business excellence. Thus, this paper attempts to close this gap on E&E manufacturing companies towards the achievement of business excellence.

The present paper aims to fill the above discussed wide research gap based on the general principles of BEMs particularity on the Baldrige excellence framework which is most widely use globally (Mann, et al., 2011). This study purpose is to assess how well the Malaysia E&E manufacturing companies fare with Baldrige model and determine Baldrige model as the practices deployed and how it has significant impact on the business excellence of organizations. In addition, the leadership of E&E organizations will drive to attain superb results of business excellence through strategy planning, measurement, analysis, and knowledge management (MAKM), customer focus, operations, and workforce. The authors feel there is a need to excess this driver of BEM individually in Malaysia E&E organizations to enrich the holistic perspective.

II. MALAYSIA E&E MANUFACTURING INDUSTRY

Manufacturing is most important sector in Malaysia and was the second-largest contributor (after the service sector) to gross domestic product (GDP) of Malaysia and anticipated to increase 4.6% in 2019 (MIDA, 2019). Over the past four decades with the improved export competitiveness, the resilient E&E industry has been the support and strength of the Malaysia manufacturing sector and economy. However, it is currently facing challenging times in both on the domestic and external fronts (The Star, 2019). In 2000, Malaysia E&E exports share was recoded as high as 61.7% but has declined to 42.4% in 2010 and recent year 2018 of 38.2%. In the same year, E&E products still held the largest share of Malaysia's export composition (DOSM, 2019). As a developing country, Malaysia also confronts its major economic challenge which trapped in the middle of the cheaper manufacturing costs like Myanmar and Vietnam, and high innovation nations of the world (The Malaysia Reserve, 2016).

Hence, the E&E's companies have to pay attention on making the most effective use of resources in their operations to ensure sustainability of growth. Leaders or Managers in E&E companies have to improve their internal capabilities to deal with organization at changes, strategies, challenges in pursuing excellence in their daily operations. The authors willing to verify to what degree the Baldrige model can assist organization to attain excellence results. On the other hand, the authors also would like to examine to what extend the Leadership will drive organizations of E&E to achieve business excellence. In present study, we focus on examining validity and reliability of BE tools that we used before proceed with the structure model evaluation.

III. LITERATURE REVIEW

An important literature review was initiated and is organized as below:
1) This heading gives a brief review of BEMs evolution;
2) Present approaches and its deployment of BEMs;
3) Discuss the MBNQA/Baldrige model;
4) Figure out the practices of business excellence in Malaysia context

A. Evolution of Business Excellence

In 1951, first start-up of Deming Prize in Japan then come next by several other quality awards have been established with purpose to improve respective countries' competitiveness. The most popular awards are European Foundation for Quality Management (EFQM) and Malcom Baldrige National Quality Award (MBNQA) which were presented in Europe and US in Year 1991 and 1987 respectively. In USA the terms Business Excellence (BE) and Total Quality Management (TQM) are use interchangeable. However, BE is deemed to be beyond TQM on the European stage (Oakland & Tanner, 2008).

Many thoughts exist around the growth of BE and its certain connection with TQM. Adebanjo (2001) suggested that formally named "Total Quality Management (TQM) or Quality Models" was rebranded as "Business Excellence (BE) Models" in the mid-1990s. Dahlgaard-Park (2011) also with the same opinion by proposing that BE replaced TQM. Kanji (2001) argued that BE an evolution of TQM since it constructed on the similar values and has same meaning as TQM. Even through both TQM and BE have many similarities but have to consider them to be separate entities (Tickle, Mann & Adebanjo, 2014; Wang & Ahmed, 2001). The drive to BE in practice as in together with theory is initiated from the continued expansion of TQM. It is conclusive departure from TQM gradually (Lu, Betts & Croom, 2011). Sony (2019) stated that Total Quality Management was a very commonly employed practice in the 1980s and 1990s. Nevertheless, the influence of it reduced in the end 1990s as a result of introduction of BEMs, Lean and Six Sigma. According to Masrom et al. (2017a), BE is more than establish a quality system. BE also focuses on developing and enhancing the management in achieving excellence in all aspects that included leadership, strategy, customer, people, process and information management. Moreover, accomplishing greater business results is the final goal.

B. Approaches to BEMs Deployment

Companies that intent to deploy BE are usually confronted with the choice of whether simply applying business excellence solely for the purpose of practice or pursue for business excellence awards. Several studies have discussed the differences between organization that have decided not to apply for awards and who have won BE awards. Few studies discovered that BE awards winners attained better results of business on average compared with organizations who not do the BE awards application (Kumar et al., 2009, Tickle, et al., 2014; Jacob, Madu & Tang, 2004;

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Hendricks & Singhal, 1997). Conversely, Oakland and Tanner (2008) claimed that award standards fulfilment activities can diminish organization from other business objectives. Furthermore, it arguable that not all organizations that without apply awards is lag awards winners with regard to performance. The possibility of some organizations not willing to apply award maybe due to the timing, struggle, and the award flow can encompass distraction (Tickle et al., 2014; Lee, 2002). It was proven that a winner of National Quality Award may not be an assurance for a long-time success (Evans, 2012; Dahlgaard, et al., 2013).

The application of BEMs with main elements inherent can assist as a tool to figure out organization weaknesses and strengths. Both the EPQM and Baldrige models are the most established excellence models for self-assessment and quality awards by globally used (Sampaio, Saraiva & Monteiro, 2011; Masrom et al., 2017b). Indeed, BEMs are deployed as a crucial strategic approach by global nations to enhance the products and services standard, improve fulfilment of customers' needs and nationwide competitiveness. However, there has been little understanding about success and use of business excellence into perception of Asian companies (Mann et al., 2011). For example, expected more than 4,100 organizations have adopted the MBEF in Malaysia but total participation in Industry Excellence Award 2018 from both manufacturing sector and services were reported as low as 40 organizations (less than 1% participant rate) if compared with 63 total organization in 2016 (MITI, 2019). Therefore, it will be worth and important to understand the success rate of BEM deployment in Malaysia industry.

C. The Baldrige Model

The greatest influential and famous model in the western countries is the one introduced by the US government in 1987 called the Malcom Baldrige National Quality Award (MBNQA). It also generally recognized as the Baldrige criteria, the Baldrige model or the Baldrige criteria for performance excellence. Baldrige model offered a significant path forward in achieving quality management. It represented the award was based on Performance Excellence and the first obviously defined worldwide recognized TQM model. Baldrige model was developed to support quality awareness, information sharing on successful quality benefits and strategies, and enhance excellence (Talwar, 2011). Baldrige model also aided US business in re-energize its competitive capability and gradually earned appreciation as a genuine global standard on customer-focused management practices and systems (Talwar, 2011). More than sixty countries and state or regional awards are in reference to the principles of Baldrige model upon the criteria (Ionica, et al., 2010; Zdrilic & Dulcic, 2016). During the 1990s, several countries in Asia have established their own BE models with refer to Baldrige and EFQM model, such as Malaysia in 1990, India in 1994, Japan as well as Singapore in 1995, Philippines and Thailand in 1987 and 2001 respectively.

The Baldrige model offers a systems perspective for an organization can measure itself. The criteria inside Baldrige model depicts a common language for organizations to communicate and sharing good practices (Ionica, et al., 2010). The general approach of Baldrige model is stress on

fulfilment of customer needs to achieve competitive capacity. The leadership drives strategic planning, people, information and analysis, and process activities towards excellence in customer satisfaction and business results is the underlying principle of award requirements. As those results required to be measurable, quantified and benchmarked (Talwar, 2011). Baldrige model have gone through several changes from 1987 to 2019. As shown in Figure 1, the business excellence is accomplished of Baldrige Excellence Framework 2019-2020 by addressing seven categories. Assessment of current systems and processes is required at each of these categories for the purpose of identify the strengths and areas for improvement. These criteria categories included (i) leadership, (ii) strategy, (iii) customers, (iv) MAKM (v) operations (vi) workforce, and (vii) results. We will list details of each criterion in the following section.
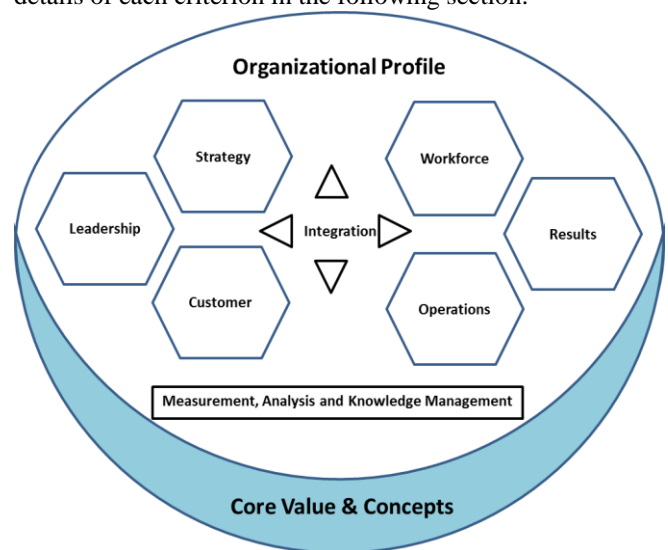

Figure 1: Baldrige Excellence Framework 2019-2020 (Adopted from NIST, 2019)

The Baldrige model self-assessment questionnaire was provided in both NIST's book and website. Appendix A presented the criteria, description and sub-section of Baldrige Excellence Framework 2019-2010 whereby Appendix B showed this criteria, description and sub-section assesses business results that are the more crucial to the organization's achievement.

D. Business Excellence in Malaysia Context

In Malaysia, the BE model was first introduced in 1990 and business excellence awards serve as significant role in promoting excellence in organizational performance. The first introduction of quality award was Quality Management Excellence Award (QMEA) by Malaysia Productivity Cooperation (MPC), then follow by the Productivity Award (PA) was launched later that same year. The Prime Minister Industry Excellence Award (PMIEA) was added as another award that recognizing business excellence in Malaysia. Malaysia companies commenced their own business journey using TQM principles. The criterial for business excellence is based on Baldrige criteria was used as a guide to the QMWA and PMQA participants (MPC, 2019).

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In 2010, a Business Excellence (BE) Department was set-up by MPC. They aim to expand its outreach and getting Business Excellence Framework (BEF) as a tool to assist organizations review and manage their business excellence matters and connecting that to business performance. Since 2011, the award programmes have been followed on the Malaysia Business Excellence Framework (MBEF) which integrates the essential elements to assess the business excellence companies from time to time. As to date, estimated more than 4,100 organizations in Malaysia have adopted the MBEF (MITI, 2019).

The objective of MBEF is to ensure quality, productivity and sustainability for any organization adhere to a comprehensive plan. The MBEF is assisting an organization assess how well it performing besides more important is helping them to identify improvement opportunities. Indeed, the MBEF is quite similar to Baldrige excellence framework which address the seven criteria consists of leadership, planning, customer, MAKM, people, process and composite results (Masrom et al., 2017b), if compared with EFQM in which their results are presented individually. This BEF defines the seven criteria is essential to sustain organizational performance (MPC, 2019). Furthermore, the criteria will guide the organizations of Malaysian to plan, execute and measure areas that related to the excellence dimensions. Thus, this study attempts to adopt the current Baldrige model 2019 as the basis for the research model in the Malaysia context.

IV. RESEARCH FRAMEWORK AND HYPOTHESES

A research framework is utilized in study provide a suitable approach to an opinion or idea to outline possible courses of action. Based on literature review, the present study adapted the general theory in the relationship of the Baldrige criteria (Masrom et al., 2017b; Flynn & Saladin, 2001). The connection between the elements addressed in this literature review is portrayed in a research framework as presented in Figure 2. Table 3 is outlining the general theory with the elements in the relationship of Baldrige model.
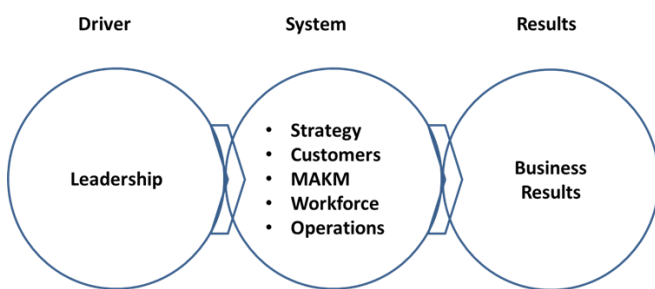

Figure 2: Research Framework (Adapted from Flynn & Saladin, 2001; Masrom et al., 2017b)

Table 3: The General Theory with the Elements in the Relationship of Baldrige Model

Baldrige model criteria	Category
Leadership	Driver
Strategy	System
Customers	
MAKM	
Workforce	
Operations	
Business results	Results

This research is to examine the causal relationship between driver, system and results of business. Thus, the study aims to address the following research hypotheses revealed in Table 4.

Table 4: Research Hypotheses Summary

H1: Driver criterial influences the system criteria	
H1a	Leadership has a positive impact on strategy
H1b	Leadership has a positive impact on customers
H1c	Leadership has a positive impact on MAKM
H1d	Leadership has a positive impact on workforce
H1e	Leadership has a positive impact on operations
H2: Inter-relationship within system criteria	
H2a	Strategy has a positive impact on customer
H2b	Workforce has a positive impact on operations
H3: Driver criterial influences the business results	
H3	Leadership has a positive impact on business results
H4: System criteria influences the business results	
H4a	Strategy has a positive impact on business results
H4b	Customers has a positive impact on business results
H4c	MAKM has a positive impact on business results
H4d	Workforce has a positive impact on business results
H4e	Operations has a positive impact on business results

V. RESEARCH METHODOLOGY

A. Research Instrument and Sample Design

In this context, the population are extract from the Federation of Malaysian Manufacturers (FMM) Directory of Malaysian Industries (49th edition) and sample were chosen from latest FMM directory. It is appropriate that managers or executive involved in operations or manufacturing were considered as respondents whereas the study is about business excellence in E&E manufacturing companies of Malaysia.

Therefore, data were collected from managerial level which identified as responsible in running operations of organizations or/and in continuous improvement (CI) activities such as General Managers, Factory Managers, Plant Managers, Operations Managers, Business/Operational Manager, Lean Manager, Lean Coordinator/Specialist, CI Manager/Coach, and company's Advisor/Consultant.

The authors applied quantitative research approach used a survey method in this study. A set of questions was adapted and adopted from Baldrige excellence framework. All selected respondents were questioned to specify their degree of agreement on BE criterions and results by assigning point on a Likert scale from "1" (strongly disagree) to "7" (strongly agree). Respondent assigned rating is founded on their experience and knowledge in the manufacturing industry.

Initial test was carried out to check the response rate, missing values, outliers, normality, reliability and validity of this research construct after completing the task of data collection. The factor analysis and goodness of measure were carried out to examine the reliability and validity of the scale utilised in our analysis. Then follow by the test of structural

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relationship. As compared to other SEM techniques such as CB-SEM, PLS-SEM is more appropriate for this study because sample sizes are small, the complex nature of the model with many indicators and model relationship are estimated (Hair et al., 2017).

Questionnaires were sent via postal mails and e-mails to 488 companies from E&E industry who registered under FMM Edition 49th (FMM, 2018). The sending of postal mails and e-mails message containing the questionnaire and permission letter for data collection from the university began in October 2019. Then three follow-ups emails were sent in each week to remind non-respondents. A total of 159 respondents companies returned the questionnaires but 3 have discarded as a result of data incompletion. The final sample was comprised of 156 valid responses representing 31.9 percent response rate.

VI. DATA ANALYSIS

In current research, we used SPSS 23.0 to process the descriptive statistics to make sure no suspicious response pattern, zero missing value, and no outliers from the data collected. Follow by assessing the demographic profile of the collected sample whereby the demographic information contained profile of the respondent companies and respondents. In PLS-SEM analysis, we used Smart PLS 3.2 to analyse each individual item of the instruments for internal consistency reliability, convergent validity, and discriminant validity. Each subscale was checked by the Composite Reliability (CR) and Cronbach's alpha coefficient for internal consistency reliability. In contrast, the convergent validity of the instrument was evaluated by using Average Variance Extracted (AVE). Then follow by discriminant validity evaluation through cross-loadings criterion, Fornell-Larker criterion, and Heterotrait-Monotrait ratio (HTMT) to assess each item in the instrument.

A. Profile of the Respondents

1) Respondent companies' profile

The E&E manufacturing companies is categorized into 4 sub-sectors that comprised of (1) electronic components (2) consumer electronics (3) industrial electronics and (4) electrical products (MIDA, 2019). The most of the manufacturing companies replied to the survey came from electronic component sector that composed 46.3 percent of the total respondents. The remaining respondents continued by those in electrical products (21.9%), industrial electronics (17.2%) and consumer electronics (14.6%) as presented in Table 2.

Table 2. Respondents by E&E Sub-sector

E&E Sub-sector	Frequency	Percent	Valid Percent	Cumulative Percent
Electronic components	70	46.3	46.3	46.3
Electrical products	33	21.9	21.9	68.2
Industrial electronics	26	17.2	17.2	85.4
Consumer electronics	22	14.6	14.6	100.0
Total	151	100.0	100.0	

2) Profile of the respondents

For facilitate understanding, table 3 tabulating the profiles of the respondents. With regard to gender, the larger part of the questionnaires was answered by male which made-up of 71.5 percent as over to female at 28.5 percent. Moreover, the age between 36 and 45 of the respondents contributed highest of 43.7 percent. Then followed by 35.1 percent from the age above 46, and 21.2 percent responded from age between 18 and 35. Majority respondents was recorded at 33.8 percent with less than 5 year's term employment to their existing companies. Conversely, respondents replied that they have more than 16 years servicing to their existing organizations at 28.4 percent. The remaining respondents were 21.2 percent from between 6 to 10 years group and 16.6 percent from between 11 to 15 years group respectively. Less than half or 42.4 percent of the surveys are replied by the mid-level managers. Other groups respondents included lower management represented 19.2 percent, 32.4 percent of senior or top management and 6.0 percent answered by the group of professional. The group of professionals consisted of Advisors and Consultants. This survey portrays that most of the survey questionnaire were responded by the mid-level and higher-level managers from E&E manufacturing organizations. The results also indicated that majority of the target respondents have followed the criteria as specified in the front cover letter that attached to the survey questionnaire.

Table 3. Respondents Profile

Demographics		Frequency (n = 151)	Percent (Total 100%)
Gender:	Male	108	71.5
	Female	43	28.5
Age:	Between 18 to 35 years	32	21.2
	Between 36 to 45 years	66	43.7
	Above 46 years	53	35.1
Number of years working in this company:	Less than 5 years	51	33.8
	Between 6 to 10 years	32	21.2
	Between 11 to 15 years	25	16.6
	More than 16 years	43	28.4
Position held:	Lower management	29	19.2
	Middle management	64	42.4
	Top management	49	32.4
	Professionals	9	6.0

B. Measurement Model Analysis

A reflective measurement model is used in present study. The reflective measurement model has showed in Figure 1.2. The model consists of seven BE elements or criterion which included leadership, strategy, customer, MAKM, workforce, operations and results. They are total 88 items or indicators were connected to respective element.
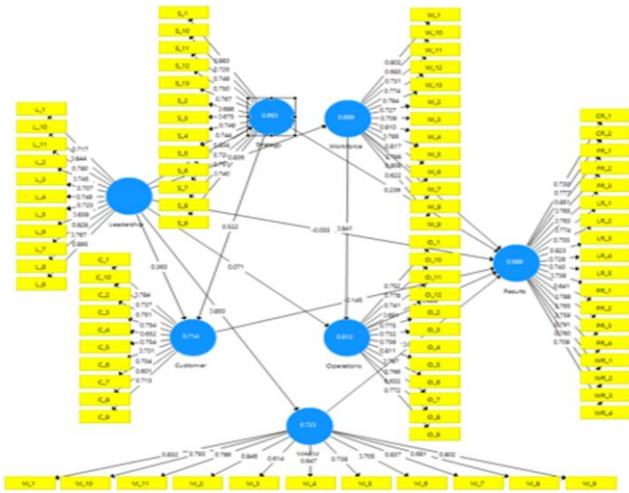
Figure 1.2: The Reflective Measurement Model

1) Validity and Reliability

First and foremost, the measurement model was verified for internal consistency reliability through Cronbach's alpha and Composite Reliability (CR), meanwhile the outer loadings number was used to access the indicator reliability. Prior to that, the descriptive values for all the constructs are presented in Table 3. Table 4 revealed that all items loadings surpassed the suggested value of 0.6 (Ali, Kim & Ryu, 2016; Chin, Peterson, & Brown, 2008). Both the Cronbach's alpha and CR values that signify the level to which the construct indicators showed the latent construct were above the suggested value of 0.7. So, this was demonstrated that internal consistency reliability among seven reflective latent variables were at high levels. On the other hand, convergent validity stipulates that tests having the similar or same constructs should be highly correlated. This was evaluated through Average Variance Extracted (AVE). Refer to Table 5, the AVE that indicated the total amount of variance in the indicators accounted for the latent variable also surpassed the proposed value of 0.5 (Hair et al., 2017).

Table 3: Descriptive Values

Construct	N	Missing	Mean	Std. Deviation	Minimum	Maximum
Leadership	156	0	5.5624	0.89982	2.27	7
Strategy	156	0	5.5636	0.86236	2.69	7
Customer	156	0	5.6679	0.89486	2.4	7
MAKM	156	0	5.3974	0.95994	1.73	7
Workforce	156	0	5.5754	0.88453	1.62	7
Operations	156	0	5.706	0.66511	3.62	6.97
Results	156	0	5.5905	0.75047	2.37	7

Table 5: Reliability and Validity for Constructs

Constructs	Indicators	Outer Loading	Cronbach Alpha	CR	AVE
Leadership	L_1	0.717	0.946	0.95	0.61
	L_2	0.745			
	L_3	0.707			
	L_4	0.749			
	L_5	0.723			
	L_6	0.838			
	L_7	0.829			
	L_8	0.767			
	L_9	0.895			
	L_10	0.717			
	L_11	0.844			
Strategy	S_1	0.883	0.945	0.95	0.57
	S_2	0.686			
	S_3	0.675			
	S_4	0.749			
	S_5	0.744			
	S_6	0.834			
	S_7	0.726			
	S_8	0.751			
	S_9	0.74			
	S_10	0.883			
	S_11	0.725			
	S_12	0.749			
	S_13	0.75			
Customer	C_1	0.737	0.914	0.92	0.52
	C_2	0.784			
	C_3	0.751			
	C_4	0.754			
	C_5	0.652			
	C_6	0.754			
	C_7	0.731			
	C_8	0.704			
	C_9	0.601			
	C_10	0.713			
MAKM	M_1	0.832	0.937	0.94	0.57
	M_2	0.846			
	M_3	0.614			
	M_4	0.647			
	M_5	0.738			
	M_6	0.705			
	M_7	0.837			
	M_8	0.681			
	M_9	0.802			
	M_10	0.832			
	M_11	0.793			
Workforce	W_1	0.802	0.946	0.95	0.58
	W_2	0.727			
	W_3	0.709			
	W_4	0.81			
	W_5	0.785			
	W_6	0.817			
	W_7	0.798			
	W_8	0.808			
	W_9	0.622			
	W_10	0.802			
	W_11	0.683			
	W_12	0.731			
	W_13	0.774			
Operations	O_1	0.752	0.94	0.94	0.56
	O_2	0.775			
	O_3	0.732			
	O_4	0.756			
	O_5	0.811			
	O_6	0.797			
	O_7	0.766			
	O_8	0.632			
	O_9	0.772			
	O_10	0.752			
	O_11	0.778			
	O_12	0.741			

Constructs	Indicators	Outer Loading	Cronbach Alpha	CR	AVE
Results	PR_1	0.739	0.961	0.96	0.58
	PR_2	0.641			
	PR_3	0.788			
	PR_4	0.765			
	CR_1	0.73			
	CR_2	0.777			
	WR_1	0.759			
	WR_2	0.791			
	WR_3	0.76			
	WR_4	0.709			
	LR_1	0.774			
	LR_2	0.755			
	LR_3	0.823			
	LR_4	0.726			
	LR_5	0.743			
	FR_1	0.851			
	FR_2	0.765			
	FR_3	0.763			

The second stage was to evaluate the discriminant validity. This test is to examine whether a low correlation occur among the measure of interest and the measures of different construct. The square root of AVE in each latent variable can be utilized to develop discriminant validity provided this value is greater than other correlations values within the latent constructs (Fornell & Larker, 1981). The square root of the AVE results appeared in diagonal values is presented in Table 6 with each construct square root of the AVE has showed larger than the correlation of the particular construct with any of the other constructs. This outcome shown that discriminant validity is well-established.

Table 6: Fornell-Larcker Criterion Analysis for Evaluating Discriminant Validity

Constructs	1	2	3	4	5	6	7
Leadership	**0.82**						
Strategy	0.789	**0.883**					
Customers	0.693	0.75	**0.857**				
MAKM	0.817	0.774	0.82	**0.851**			
Workforce	0.684	0.672	0.738	0.609	**0.86**		
Operations	0.718	0.714	0.704	0.829	0.76	**0.854**	
Results	0.755	0.636	0.801	0.7	0.787	0.761	**0.761**

*The diagonal values (bolded) are the square roof of the AVE of the latent construct and indicators the highest in any column or row.

Some criticised the Fornell-Larcker criterion (Fornel & Larker, 1981) unreliable to discover the absence of discriminant validity in normal research conditions (Henseler, Ringle & Sarstedt, 2015). Hence, the new heterotrait-monotrait ratio of correlation measure (HTMT) was developed by Henseler et al. (2015) as substitute method in accordance with the multitrait-multimethod matrix to evaluate the discriminant validity. Thus, Table 6 presented the outcomes of discriminant validity that verified with this new approach. If HTMT value is greater than maximum threshold value of .85 or $HTMT_{.85}$ then can consider that there is inadequacy of discriminant validity (Kline, 2011). Table 7 demonstrated that total items fall lower compared with the threshold of 0.85 or $HTMT_{.85}$.

Table 7: Heterotrait-Monotrait (HTMT)

Constructs	1	2	3	4	5	6	7
Leadership							
Strategy	0.788						
Customers	0.69	0.841					
MAKM	0.713	0.772	0.812				
Workforce	0.68	0.668	0.729	0.807			
Operations	0.713	0.808	0.699	0.628	0.756		
Results	0.655	0.834	0.797	0.799	0.689	0.858	

*Shaded boxes inside table are the HTMT standard reporting format

VII. DISCUSSION AND CONCLUSION

The aim of present study is to examine the validity and reliability of research instruments by applying the PLS-SEM modelling approach. Prior to drawing conclusion regarding the interrelation of the constructs, it is vital to make sure the instruments have reached reliable and valid measures of constructs. In accordance with the suggested model measurement analysis results, it can be concluded that the seven constructs are all valid measures of their individual constructs in regard to their statistical significance and factor estimations. All seven constructs of the Baldrige excellence framework which included leadership, strategy, customers, MAKM, operations, workforce, and results. Thus, the measurement model has established acceptable validity and reliability criteria that can be proceed the structure model analysis. As now, this paper delivers the constructs understanding on the relationship of driver, system and results on business excellence. It will determine an effect of each criteria of Baldrige model by end of this study.

This study has successfully evaluated the reliability and validity of the Baldrige excellence framework scale in E&E manufacturing companies' context. This study perhaps the first study to explore the Baldrige Excellence Framework 2019-2020 deployment in manufacturing companies of Malaysia E&E. The study findings also concluded that all instruments are valid and reliable, also suited to the context of Malaysia. Is has provide a new path to researchers to deploy Baldrige excellence concept in their future research. The present study intents to measure how well the Malaysian E&E manufacturing companies fare with business excellence and to define Baldrige excellence framework as the practices applied and how it has impact on the business performance of organizations. Therefore, it is strongly believed that Baldrige excellence framework is able to assess the E&E organization performance in Malaysia and use it to enhance their performance towards excellence.

Validity and Reliability Analysis of the Baldrige Excellence Framework Scale in the Electrical & Electronics Manufacturing Companies in Malaysia

APPENDIX

Appendix A: Criteria, description and sub-criteria of Baldrige Excellence Framework 2019-2020

Criteria	Description	Sub-criteria
Leadership	Assesses how leaders guide and sustain their organization, how organizations view their governance system, and how organizations fulfil their legal and ethical responsibilities, and societal contributions (NIST, 2019).	(1) Our senior leaders set organization's vision and values. (2) Our senior leaders' personal actions demonstrate their commitment to legal and ethical behaviour. (3) Our senior leaders communicate with and engage the entire workforce, key partners, and key customers. (4) Our senior leaders create an environment for success now and in the future. (5) Our senior leaders create a focus on action that will achieve the organization's mission. (6) Our organization ensure responsible governance. (7) Our organization evaluate the performance of senior leaders and governance board. (8) Our organization address current and anticipate future legal, regulatory, and community concerns products and operations. (9) Our organization promote and ensure ethical behaviour in all interactions. (10) Our organization consider societal well-being and benefit as part of strategy and daily operations. (11) Our organization actively support and strengthen key communities.
Strategic	Determines how organization develop strategic objectives and implement action plans, how organization change strategy if circumstances require, and measures its progress (NIST, 2019).	(1) Our organization conduct strategic planning. (2) Our organization's strategy development process stimulates and incorporate innovation. (3) Our organization collect and analyse relevant data and develop information for use in our strategic planning process. (4) Our organization decide which key process will be accomplished by our workforce and which by external suppliers, partners, and collaborators. (5) Our organization have key strategic objectives and timetable for achieving them. (6) Our organization's strategic objectives achieve appropriate balance among varying and potentially competing organizational needs. (7) Our organization have key short- and longer-term action plan. (8) Our organization deploy the action plans. (9) Our organization ensure that financial and other resources are available to support the achievement of our action plan while we meet current obligations. (10) Our organization key workforce plans to support our short- and longer-term strategic objectives and action plans. (11) Our organization use key performance measures or indicators to track the achievement and effectiveness our action plan. (12) Our organization have performance projections for key performance measures or indicators in short- and longer-term planning horizons. (13) Our organization recognize and respond when circumstances require a shift in actions plan and rapid execution of new plans.
Customers	Examine how organization engages its customers for ongoing market space success, how organization listens to the voice of customer, serve and exceeds customers' expectations and builds long-term customer relationships (NIST, 2019).	(1) Our organization listen to, interact with, and observe customers to obtain actionable information. (2) Our organization listen to potential customers to obtain actionable information. (3) Our organization determine customer groups and market segments. (4) Our organization determine product offerings. (5) Our organization build and manage customer relationships. (6) Our organization enable customers to seek information and support. (7) Our organization manage customer complaints. (8) Our organization determine customer satisfaction, dissatisfaction, and engagement. (9) Our organization obtain information on customers' satisfaction with our organization relative to other organizations. (10) Our organization use voice-of-the-customer and market data and information.
Measurement, analysis, and knowledge management (MAKM)	Understand how organization selects, gathers, analyses, manages, and improve its data, information, and knowledge assets. And also find out how organization uses reviews finding to improve its performance and learning (NIST, 2019).	(1) Our organization track data and information on daily operations and overall organizational performance. (2) Our organization select comparative data and information to support fact-based decision making. (3) Our organization ensure that our performance measurement system can respond to rapid or unexpected organizational or external changes and provide timely data. (4) Our organization review our organization's performance and capabilities. (5) Our organization project our organization's future performance. (6) Our organization use findings from performance reviews to develop priorities for continuous improvement and opportunities for innovation. (7) Our organization verify and ensure the quality of organizational data and information. (8) Our organization ensure the availability of organizational data and information. (9) Our organization build and manage organizational knowledge. (10) Our organization share best practices within organization. (11) Our organization use knowledge and resources to embed learning in the way our organization operates.
Workforce	Figure out how organization assesses workforce capability and capacity needs and builds workforce environment that is conducive to high performance. And also, to discover how organization engages, manages, and develops workforce to utilize its full potential in alignment with overall business needs (NIST, 2019).	(1) Our organization assess our workforce capability and capacity needs. (2) Our organization do you recruit, hire, and onboard new workforce members. (3) Our organization prepare our workforce for changing capability and capacity needs. (4) Our organization organize and manage our workforce. (5) Our organization ensure workplace health, security, and accessibility for the workforce. (6) Our organization support our workforce via services, benefits, and policies. (7) Our organization determine the key drivers of workforce engagement. (8) Our organization assess workforce engagement. (9) Our organization foster a culture that is characterized by open communication, high performance, and an engaged workforce. (10) Our organization workforce performance management system supports high performance. (11) Our organization learning and development system support the personal development of our workforce members and our organization's needs (12) Our organization evaluate the effectiveness and efficiency of our learning and development system. (13) Our organization manage career development for our workforce and future leaders.
Operations	Uncover how organization design, manages, improves, and innovates its products and work, process and improves operational effectiveness to deliver customer value and achieve ongoing organizational success (NIST, 2019).	(1) Our organization determine key product and work process requirements. (2) Our organization have key work process. (3) Our organization design our products and work processes to meet requirements. (4) Our organization day-to-day operation of work processes ensure that we meet key process requirements. (5) Our organization determine our key support processes. (6) Our organization improve our work processes and support processes to improve products and process performance, enhance our core competencies, and reduce variability. (7) Our organization manage our supply network. (8) Our organization pursue opportunities for innovation. (9) Our organization manage the cost, efficiency, and effectiveness of our operations. (10) Our organization ensure the security and cybersecurity of sensitive or privileged data and information and of key assets. (11) Our organization provide a safe operating environment. (12) Our organization ensure that we are prepared for disasters or emergencies.

Appendix B: Criteria, description and sub-section of business results.

Criteria	Description	Sub-criteria
Business results	Examines organization's performance and improvement in all key areas including product and process results, customer results, workforce results, leadership and governance results, and financial, market and strategy results (NIST, 2019).	(1) Results for products and customer service processes. (2) Process effectiveness and efficiency results. (3) Safety and emergency preparedness results. (4) Supply-network management results. (5) Customer satisfaction and dissatisfaction results. (6) Customer engagement results. (7) Workforce capability and capacity results. (8) Workplace climate results/ (9) Workplace engagement results. (10) Workforce and leader development results. (11) Results for senior leaders' communication and engagement with the workforce, partners, and customers. (12) Results for governance accountability. (13) Legal and regulatory results. (14) Results for ethical behaviour. (15) Results for societal well-being and support of key communities. (16) Financial performance results. (17) Marketplace performance results. (18) Results for the achievement of strategy and action plans.

REFERENCES

1. Adebanjo, D. (2001). TQM and business excellence: is there really a conflict? Measuring Business Excellence, 5 (3), 37-40.
2. Ali, F., Kim, W. G., & Ryu, K. (2016). The effect of physical environment on passenger delight and satisfaction: Moderating effect of national identity. Tourism Management, 57, 213-224.
3. Chin, W. W., Peterson, R. A., & Brown, P. S. (2008). Structural equation modelling in marketing: Some practical reminders. Journal of Marketing Theory and Practice, 16(4), 287-298.
4. Dahlgaard-Park, S. M. (2011). The quality movement: Where are you going?, Total Quality Management & Business Excellence, 22(5), 493-516.
5. Dahlgaard-Park, S.M. and Dahlgaard, J.J. (2010), 'Organizational learnability and innovability: A system for assessing, diagnosing and improving innovations,' International Journal of Quality and Service Science, 2(2), 153–175.
6. Dahlgaard, J. J., Chen, C.K., Jang, J.Y., Banegasb, L. A. & Dahlgaard-Park, S. M. (2013). Business excellence models: limitations, reflections and further development. Total Quality Management, 24(5), 519–538.
7. DOSM. (Department of Statistics Malaysia) (2019). https://www.dosm.gov.my/v1/ (Accessed December 15, 2019).
8. Ferdowsian, M. C. (2016). Total business excellence – a new management model for operationalizing excellence. International Journal of Quality & Reliability Management, 33(7), 942-984.
9. Evans, J.R. (2012). Beyond performance excellence: Research insights from Baldrige recipient feedback. Total Quality Management & Business Excellence, 23(5), 489–506.
10. Fok-Yew, O. (2016). The Mediating Role of Lean Engagement on Lean Practices and Business Excellence in Malaysia Electrical and Electronics Companies. International Journal of Academic Research in Economics and Management Sciences, 5(2), 2226-3624.
11. FMM. (Federation of Malaysian Manufacturers. (2018). FMM-MATRADE industry directory electrical and electronics Malaysia Edition 49th. Kuala Lumpur: Federal of Malaysian Manufacturers (FMM).
12. Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39-50.
13. Flynn, B. B. and Saladin, B. (2001). Further evidence on the validity of the theoretical models underlying the Baldrige criteria. Journal of Operations Management, 19, 617–652.
14. Gimenez, C., Sierra, V., & Rodon, J. (2012). Sustainable operations: Their impact on the triple bottom line. International Journal of Production Economics, 140(1), 149–159.
15. Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). A Primer on Partial Least Squares Structural Equation Modeling. 2nd Ed. Thousand Oaks: Sage.
16. Hendricks, K.B. and Singhal, V.R. (1997). Does implementing an effective TQM program actually improve operating performance? Empirical evidence from organisations that have won quality awards. Management Science, 43(9), 1258-1274.
17. Henseler, J., & Fassott, G. (2010). Testing moderating effects in PLS path models: An illustration of available procedures. In V. Esposito Vinzi, W. W. Chin, J. Henseler, & H. Wang (Eds.), Handbook of partial least Squares: Concepts, methods and applications. Heidelberg, Dordrecht, London, New York: Springer.
18. Hubbard, G. (2009). Managing Organizational Performance: Beyond the Triple Bottom Line. Business Strategy and the Environment, 19, 177-191.

19. Ionica, A., Baleanu, V. Edelhauser, E. and Irimie, S. (2010). TQM and Business Excellence. Annals of the University of Petroşani, Economics, 10(4), 125-134.

20. Jacob, R., Madu, C.N. and Tang, C. (2004). An empirical assessment of the financial performance of Malcolm Baldrige Award winners. International Journal of Quality & Reliability Management. 21(8), 897-914.

21. Kanji, G. K. (2001), Measuring Business Excellence, London/New York: Routledge.

22. Kline, R. B. (2011). Principles and practice of structural equation modeling. New York: Guilford Press.

23. Kumar, V., Choisne, F., Grosbois, D.D. and Kumar, U. (2009). Impact of TQM on company's performance. International Journal of Quality & Reliability Management, 26(5), 23-37.

24. Lee, S.M., Zuckweiler, K.M. and Trimi, S. (2006). Modernization of the Malcom Baldrige national quality award. International Journal of Production Research, 44(23), 5089-5106.

25. Lee, P. (2002). Sustaining business excellence through a framework of best practices in TQM. The TQM Magazine, 14(3), 142-149.

26. Lu, D., Betts, A. & Croom, S. (2011). Re-investigating business excellence: Values, measures and framework. Total Quality Management & Business Excellence, 22(12), 1263-1276.

27. Mann, R., Adebanjo, D. and Tickle, M. (2011). Deployment of business excellence in Asia: an exploratory study. International Journal of Quality & Reliability Management, 28(6), 604-627.

28. Masrom, N. R., Rasi, R. Z. R. M. and Daut, B. A. T. (2017a). Evaluation of Business Excellence among Halal Certified Food Manufacturers in Malaysia. MATEC Web of Conferences, 135, 00035.

29. Masrom, N. R., Rasi, R. Z. R. M. and Daut, B. A. T. (2017b), 'The Impact of Business Excellence on Operational Performance among Halal Certified Food Manufacturers in Malaysia. MATEC Web of Conferences, 135, 00041.

30. Matthews, R. A., Maura, J. M., Rachel, C. T. and English, L. (2014), 'Family-Supportive Supervisor Behaviors, Work Engagement, and Subjective Well-Being: A Contextually Dependent Mediated Process,' Journal of Occupational Health Psychology, 19(2), 168-181.

31. MITI. (Ministry of International Trade and Industry). (2019). https://www.miti.gov.my/index.php/pages/view/industry4.0?mid=559 (Accessed April 10, 2019).

32. MPC. (Malaysia Productivity Corporation). (2019). http://www.mpc.gov.my/business-excellence/ (Accessed January 3, 2019).

33. NIST. (National Institute of Standards and Technology). (2019). Baldrige Excellence Framework 2019-2020 - Business/Nonprofit/Government, NIST.

34. Oakland, J. S. and Tanner, S. J. (2008), 'The relationship between Business Excellence and Performance - An empirical study using Kanji's Leadership Excellence Model,' Total Quality Management, 19(7-8), 733-749.

35. Sampaio, P., Saraiva, P. & Monteiro, A. (2011). A comparison and usage overview of business excellence models. The TQM Journal, 24(2), 181-200.

36. Sony, M. (2019). Implementing sustainable operational excellence in organizations: an integrative viewpoint. Production & Manufacturing Research, DOI:10.1080/21693277.2019.1581674 (Accessed April 2, 2019).

37. Sreedharan, V. R., Gopikumar V, Nair, S., Chakraborty, A. and Antony, J. (2017), 'Assessment of Critical Failure Factors (CFFs) of Lean Six Sigma in real life scenario: evidence from manufacturing and service industries,' Benchmarking: An International Journal. https://doi.org/10.1108/BIJ-10-2017-0281 (Accessed January 12, 2019).

38. Sundharam, V.N., Sharma, V. and Thangaiah, I.S.S. (2013). An integration of BSC and AHP for sustainable growth of manufacturing industries. International Journal of Business Excellence, 6(1), 77-92.

39. Talwar, B. (2011). Business excellence models and the path ahead …. The TQM Journal, 23(1), 21-35.

40. The Malaysia Reserve. (2016). Malaysia facing biggest economic challenge. https://themalaysianreserve.com/2017/04/03/malaysia-facing-biggest-economic-challenge/ (Accessed December 13, 2019).

41. The Star. (2019). https://www.thestar.com.my/business/business-news/2019/07/13/ee-industry--the----------golden-goose-of-malaysia (Accessed December 26, 2019).

42. Tickle, M., Mann, R., & Dotun Adebanjo, D. (2014). Deploying business excellence – success factors for high performance. International Journal of Quality & Reliability Management, 33(2), 197-230.

43. Wang, L.C. and Ahmed, K.P. (2001). Energizing the organization – a new agenda for business excellence. Measuring Business Excellence, 5(4), 22-27.

44. Zdrilic, I. and Dulcic, Z. (2016). Business Excellence as a Success Factor for the Performance of Large Croation Enterprises. Management, 21(1), 145-162.

45. G. O. Young, "Synthetic structure of industrial plastics (Book style with paper title and editor)," in Plastics, 2nd ed. vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15–64.

46. W.-K. Chen, Linear Networks and Systems (Book style). Belmont, CA: Wadsworth, 1993, pp. 123–135.

47. H. Poor, An Introduction to Signal Detection and Estimation. New York: Springer-Verlag, 1985, ch. 4.

48. B. Smith, "An approach to graphs of linear forms (Unpublished work style)," unpublished.

49. E. H. Miller, "A note on reflector arrays (Periodical style—Accepted for publication)," IEEE Trans. Antennas Propagat., to be published.

50. J. Wang, "Fundamentals of erbium-doped fiber amplifiers arrays (Periodical style—Submitted for publication)," IEEE J. Quantum Electron., submitted for publication.

51. C. J. Kaufman, Rocky Mountain Research Lab., Boulder, CO, private communication, May 1995.

52. Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interfaces(Translation Journals style)," IEEE Transl. J. Magn.Jpn., vol. 2, Aug. 1987, pp. 740–741 [Dig. 9th Annu. Conf. Magnetics Japan, 1982, p. 301].

53. M. Young, The Techincal Writers Handbook. Mill Valley, CA: University Science, 1989.

54. (Basic Book/Monograph Online Sources) J. K. Author. (year, month, day). Title (edition) [Type of medium]. Volume(issue). Available: http://www.(URL)

55. J. Jones. (1991, May 10). Networks (2nd ed.) [Online]. Available: http://www.atm.com

56. (Journal Online Sources style) K. Author. (year, month). Title. Journal [Type of medium]. Volume(issue), paging if given. Available: http://www.(URL)

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