Assessing Digital Readiness of Small Medium Enterprises: Intelligent Dashboard Decision Support System

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***Abstract*—The implication of the Covid-19 global pandemic is driving the transition of SMEs' business towards digitalization. However, despite the use of the digital platform, many SMEs are unable to survive. Therefore, this study included a focus on Decision Support System (DSS)-based dashboard model as a new feature in assessing SMEs' digitalization readiness. The twenty-four criteria appraisals are regarded in this sense as two views of business and Information Technology (IT) dimensions which include the Fuzzy-Analytical Hierarchy Process Method (F-AHP) for the weighting measurement and Objective Matrix (OMAX) for the performance mapping analysis, and both are embedded in the Business Intelligent (BI) dashboard development. In Riau Province, Indonesia, a total of 118 SMEs were interested in this study and fact thus revealed the general performance of SMEs as rated at an "Average" level of index value 4.95 with comprehensive parameters for index contribution viz., 3.79, 3.84, 7.75, 4.68, 4.32, and 5.43 for Business Activity (BA), Transaction (TC), Marketing (MC), Management (MG), Micro Environment (MI) and Macro Environment (MA) respectively. Furthermore, the dashboard prepares a tracking and analysis system with the graphical diagram extracted from each criteria hierarchy's root cause to sub-criteria. The DSS dashboard's information and knowledge have been developed into a promotional framework for stakeholders relevant to a digital business's success and sustainability performance initiatives.**

Keywords*—Decision support system; digital readiness; fuzzy analytical hierarchy process; business intelligent dashboard; objective matrix

I. Introduction

Indonesia and other developing countries provide a historical and significant scale investment of SMEs that influenced the country's economy, both in numbers of companies, the gross value-added, and the absorption of employees. The transformation of the manufacturing industry in the digital age has led to the development of SMEs that are leading the way in integrating creative technology utilization and digital platforms for product marketing, business transactions, as well as a wide range of quality investment services from top to bottom business [1]. Furthermore, the leverage of the digital business model of performance in SMEs has been seen to have the effect of enhancing overall cross-industry equipment, lowering inventory, workers' productivity, reducing logistical costs, boosting productivity, reducing production times, and rising sales, and cutting costs [2]. The Ministry of Co-operatives, Small and Medium-sized Enterprises, and the Ministry of Communication, Information Technology, and e-commerce actors launched a program entitled Eight million SMEs Go Online, aiming to foster this digital transformation by creating social and community awareness [3]. Here, several marketplaces and e-commerce sites in Indonesia, such as Lazada, Shopee, MatahariMall.com, BliBli.com, Bukalapak, Tokopedia, and Blanja.com, the founders of successful online companies, are comprised in this program. However, due to the lack of engagement and interest from SMEs and the suffering for the very principle of information exchange by active leaders, the program did not live up to expectations, and therefore, the digital revolution struggles to work.

Previous studies indicated that SMEs' common obstacles and demand in the revolution stage include human resources and capitalization, competition, marketing strategy, innovation, government actions, preparedness for the state, market demand

potential, innovation and creativity, exports, companies' resistance, and survival, knowledge of local business, women empowerment, internet and digitalization, currency conversion, manufacturing, trade, and infrastructure [4]. Despite the negative impacts on SMEs' growth globally, especially in Indonesia, it still offers attractive prospects. Furthermore, the Covid-19 virus outbreak has devastated countries' economies and has forced the digital revolution to accelerate fully. The number of SMEs influenced by this has attempted to make flexible and digitalize their market growth model to survive. However, digitalization's success requires full reinforcement from external and internal parties due to the high risk of investment. Peillon and Dubruc (2019) have identified various stumbling blocks to SMEs' digitalization, including technological hurdles to the accessible entrance of technology and artificial intelligence in promoting the quality and delivery of their business practices and services [5]. Besides this, technological capital and infrastructure adoption are difficult to enforce due to a lack of fund.

Furthermore, it affects essential changes in operational areas such as core business practices, commodities, procedures, organizational structures, managerial concepts, emerging capabilities and skills in management innovation, cultural shock, and analysis of company performance [5] and [6]. More importantly, customers revisiting and stored information becomes a huge burden to reach due to their protection and privacy breaches [7]. In a nutshell, this failure detection encourages further analysis of SMEs' readiness towards the digital business's success and sustenance.

Therefore, this study aims at analyzing SMEs' readiness in the vicinity of digitalization by incorporating ideas and perspective from governments, investors, the marketplace, and SMEs industries through the opportunities for creating a model-driven DSS dashboard. The application of F-AHP and OMAX enriched the DSS dashboard analysis as an information tracking system to assess the degree and parameters of the performance index. Furthermore, this intelligent business tool struggles with the new situation in Indonesia with current challenges and digital transformation issues in the future. The increasing sense of complexity and confusion in decision-making encourages the need for a forecasting process to assist decision-making, planning, analysis, and evaluation. Since model-driven DSS comprises mathematical simulation, the parameters are manipulated and optimized by investigating product analysis's sensitivity to assist in decision making [8]. This dashboard offers a wide range of digital readiness assessment options, thus providing a service as a new performance measurement tool.

II. Literature Review

Understanding this performance measurement dashboard provides the contribution into the ultimate digital solution as well as market plan, business model, and technology penetration. Many researchers viewed and developed e-readiness tools and approaches from different viewpoints, environments, experiences, people, and objectives [9], and unfortunately, the gap between the concept and performance of e-readiness is inevitable [10]. For example, Beacon [11] and Verdict [12] are unable to guide the organization into recovering and identifying the priority concerns for success, and currently, the General Practitioner Information System (GPIS) and New IT/IS Capability Evaluation (NICE) mechanism are missing out on the involvement of stakeholders rather than recruiting technology consultants for a thorough market review [13]. The Building Information Modeling (BIM) Maturity Matrix is a restrictive tool applicable only to its organizational context and hard to customize. Furthermore, Technology Readiness Levels as company maturity index tool deteriorates in meeting the demands of SMEs sector, and simultaneously, Lou et al. (2019) released an e-readiness construction (ERiC) framework as a promising sustainable instrument for assessing the extent of organizational precaution to shield and bring about a competitive digital economy. Like the previous one, the ERiC framework is explicitly deployed for the United Kingdom Construction Industry (CI) and case studies [14].

Meanwhile, the deployment of performance measurement tool in environmental quality assessment management is undergoing a significant transformation with the model-driven DSS, including Charkha and Jaju (2020) with the establishment of an Analytical Hierarchical Process (AHP)-DSS for determining the performance of the supply chain in the textile industry [15]. Govindan et al. (2020) created a practical decision support system based on physicians' knowledge and expertise complemented by a fuzzy inference system to control the supply chain demand [16].

Preliminary studies on SMEs such as Doltsinis et al. (2020) have been attempting to introduce additional information on the TOPSIS-DSS to repurpose manufacturing systems products [17]. A DSS-based fuzzy credit risk evaluation is recently carried out by Chang et al. (2020) using a logistic regression classifier [18]. Furthermore, the finding revealed no consideration of SME e-readiness with the growth of DSS above. There is a limitation in the DSS approaches that encourage a wide variety of crises to benefit from this paradigm's flexible solutions. In addition, Pandey et al. (2020) reviewed a range of challenges in adopting the DSS tool, including the organizations unable to set appropriate metrics to measure market impact, insufficient information about SMEs context measurement, and lack of oversight accountability executive management [19].

Furthermore, it is crucial to create a comprehensive performance as well as an appropriate metrics system as a framework to support the next generation decision concerning critical organizational goals in the e-readiness of the SME industry. A DSS should have an in-depth research identity of the analytical attribute such as a business intelligence dashboard model to simplify the operational phase of DSS and human cognitive capacities by incorporating graphical user interfaces to attract management engagement. A dashboard feature leads to higher task performance, reduces situation awareness, and nourishing a potential out-of-the-loop problem. In a nutshell, its adoption in this study offers the management decision-makers interactive analytical knowledge and will indeed be able to actively recognize the vulnerabilities SMEs face towards effective and sustained digitalization. In addition, the involvement of multi stakeholders' perspectives on digital DSS evaluation provides them with monitoring and

surveillance platforms to ensure SME e-readiness achievement and successful acquirement.

III. METHODOLOGY

This study is developed by describing diversity as an instrument that examines SMEs' digital readiness through documentary research and interviews. Here, scholars asked four academicians from the reference sectors of economics and technology in both domains for their views on proposed digital preparation tools. Government officials and key actors represent the views of true collaborative partners in the creation of SME e-readiness including the Ministry of cooperatives and, SMEs, the Ministry of Communication and Information Technology in the central region of Java, Riau, investors from a telecommunication company, and central banks, marketplaces (Tokopedia and blanja.com), conventional and digital SMEs companies leading the process of ideas for establishing requirements. An unbiased online interview addresses concerns and issues related to digital adoption, Covid-19 results, SMEs' e-readiness, and factors affecting digitalization as well. For this reason, the suggested digital readiness evaluation criteria are summarized in Table I.

Next, the topography and technology practice against economic views has developed a conceptual framework that encompasses BA-IT Culture, Education, Financial Resources, and BA-IT Infrastructure for BA construction. TC is enrolled in TC-IT Culture, Education, Financial Resources, and TC-IT Infrastructure. MC-IT Culture, Education, Financial Resources, and MC-IT Infrastructure for MC. MG-IT Culture, Education, Financial Resources, and MG-IT Infrastructure for MG. MI-IT Culture, Education, Financial Resources, and MI-IT Infrastructure for MI. Finally, the ME is reviewed from ME-IT Culture, Education, Financial Resources, and ME-IT Infrastructure. This proposed framework grows into a foundation for designing the instruments. In this sense, two sorts of questionnaires are delivered to capture the respondents' information and knowledge concerning SMEs' evaluation. The first review is meant for decision-makers to assign the priority to each criterion and sub-criteria. The questionnaire fits the fuzzy AHP format of a one to nine scale, one just as equally important, three for moderately important, five for strongly important, seven for very strongly important, and nine for extremely important [25]. A panel discussion invited a community of decision-makers from four academies, five government officials, two managers of the central bank and marketplace, three investors, and three representatives from both digital and traditional SMEs to eliminate the language barriers and intervention in interpreting the questionnaires and thus, the weight of the criterion is defined.

Meanwhile, the second review has been conducted as a digital readiness assessment tool, and the questionnaire investigates the level of consensus amongst SME players on the nature of their SMEs' criteria and sub-criteria. As key players in SMEs business, the respondents are constrained to owner, service, management, operation, marketing, and production team. In this regard, 24 questions with five Linkert-scale were submitted to 118 SMEs in Riau Province and limited to SMEs food companies. The companies were considered as one of Indonesia's government focuses on creative business development, and they have a low significant impact on the spread of Covid-19 in Indonesia SMEs. Thus, it tends to increase the demand due to panic buying and social distance restrictions.

TABLE I. SMES E-READINESS CRITERIA

Economical Perceives		
No.	***Criteria***	***Reference***
1	Business activities (BA) - BA is highlighted by production, distribution, and consumer protection activities.	[2] [20]
2	Transaction (TC) is spelled out as market practices on automated data collection and distribution of innovative manufacturing systems and resources from the text, sounds, and visual images.	[21] [22]
3	Marketing (MC) is reflected as ideas, products, services, technology, and refining ideas to fulfill the market demand, to determine and satisfy the needs and target market aspirations.	[23] [24]
4	Management (MG) is the motivation of SMEs to plan, govern, organize, control, maintain, and sustain the business.	[18]
5	Micro Environment (MI) is defined as internal factors that directly or do not affect the digital readiness of an SME, such as the stakeholder perceptions, marketing systems, productivity, management, operational functions, technology adoption, the market demands, policy/strategy/vision, pricing, and licensing.	[18] [2]
6	Macro Environment (ME) is characterized as external influencing factors of SMEs, viz. demographic, economic, technology, environmental, political, government support, cultural, and a broader competitor landscape.	[11] [12]
Technological Perceives		
1	IT-Culture is defined as social culture, awareness, knowledge, creativity, attitude, and behavior to emotionally adapt to digitalization, satisfaction, trust, and confidence.	[11][14] [8]
2	IT-Education is specified as the readiness to cultivate hard and soft skills for digital technology adoption, knowledge sharing capability, creativity, and innovation.	[11][14] [8]
3	IT-Financial Resources is set up as SMEs' financial asset readiness in terms of loans or capital assistance, grants, and resources supported programs through training, seminars, and exhibitions.	[5]
4	IT-Infrastructure is characterized as SMEs' readiness concerning the IT infrastructure, hardware, and software to bolster digitalization, time access, and its utilization.	[6]

Furthermore, Covid-19 offers SME food companies a chance to expand through digital transformation and adoption to lower social business interaction. The DSS dashboard system is then applied as a business intelligent model-driven DSS to automate this study's mechanism, starting with acquiring expert knowledge and team research and ending with a comprehensive review of the e-readiness assessment in survey two. Adopting a hybrid F-AHP and OMAX approach enhanced this DSS dashboard's capability as an intelligent decision-making tool for SMEs' e-readiness testing. The application is developed using Hypertext Preprocessor (PHP) and PHPMyAdmin for programming languages and MySQL databases. Blackbox and User Acceptance Testing (UAT) are designed to monitor end-users performance and compliance alongside application development.

A. F-AHP

One of the tests performed on the model-driven DSS is multi-criteria decision making (MCDM), and it has used careful analysis of decision-making processes such as AHP, Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Weighted Product (WP), Simple Additive Weighting (SAW), Multi-objective optimization based on ratio analysis (MOORA). Among the above approaches, AHP is one of the most widely encountered performance tests of model-driven DSS as a single or hybrid AHP. It is a robust and practical scientific procedure that minimizes terrible decision-making [26].

Furthermore, it optimally advances the amount and contribution of what-if scenarios and their granularity to the consistency of proposed alternatives [27]. In other words, it provides a powerful cascading multi-criteria decision-making tool for aggregate and objective purposes. Tariq et al. (2020) studied its capability to render the classification of unbiased and confidential parameters and aggregate the specified versatility by relative calculation [28], while Okfalisa et al. (2018) and Okfalisa et al. (2021) successfully gave its application approach to encourage and track the organization's output through the set priority values for Key Performance Indicators (KPIs) [29 and 30]. AHP attempts the preferences more than one of the amazing series selected from one to nine range for scaling based on the perceptions made by the decision-makers [31].

Nonetheless, decision-making practices and rational thinking are hard to pinpoint into a constraint scale and produce victory over language problems in translating the decisions. Furthermore, the persistent matrices for criteria don't launch completely, and information disaster occurs when good and bad scores compensate [32]. In addition, the number of criteria and alternatives used in the measurement also affects the AHP's difficulties.

In a nutshell, the F-AHP emerges as a revolutionary approach in facing the disadvantages of AHP by emphasizing the decision-making uncertainty, the fuzziness of human reasoning style, and linguistics terms issues [33]. Furthermore, it's triangular fuzzy is sufficient in altering the algebraic language of decision-makers to the level of significance of criteria [34 and 20]. It is chosen as an intuitive model since this study captures the respondents' knowledge through natural language, to deploy the weighting criteria and alternatives for digital readiness assessment. It also offers a reasonably stable mechanism to reduce the problems defined by the weighting factors. Its integration with OMAX develops into a new task and progress in this study to increase the revelation of F-AHP for digital readiness analysis. Subsequent studies have tried to link MADM, such as AHP, with OMAX [29 and 21]. However, it is not currently able to discover F-AHP convergence for OMAX. This assimilation of fuzzy logic and OMAX appears as a new contingency in performance measurement analysis.

The employment of Dashboard DSS-based F-AHP in this study follows the formula below [30].

- It follows the AHP modeling method to determine the comparison matric and calculate the consistent values ($CR \leq 0.1$) of the criteria and sub-criteria parameters.
- It then converts the AHP comparison matrix's value into the F-AHP value with the Triangular Fuzzy Number (TFN) scale. TFN is a trapezoidal fuzzy number that is widespread in F-AHP studies. It provides a linear mathematical formula to measure the criteria and alternatives with fuzzy triangular numbers that are denoted in simple parameters.
- To calculate Fuzzy Synthesis's value (Si) where M is defined as TFN number, m for the numbers of criteria, i and j as row and column of the matrix, and p as the value of variables defined in l, m, and u values.

$$Si = -1 \sum_{j=1}^{m} M_{gi}^{j} x \left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{gi}^{j}\right] \quad (1)$$

- To determine the vector value (V), M2 = (l2, m2, u2) $\geqslant$ M1 = (l1, m1, u1) are defined as a vector value.

$$V\ (M_2 \geq M_1) = \sup\ [\min\ (\pi M_1\ (x)), \min\ (\pi M_2\ (y))] \quad (2)$$

$$V(M_2 \geq M_1) = \begin{cases} 1\ if\ m_2 \geq m_1 \\ 0\ if\ l_1 \geq u_2 \\ \frac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)} \end{cases} \quad (3)$$

- To calculate De-fuzzification Ordinary Value (d').

For k = 1, 2, n; k $\neq$ I, we obtain the vector weight value:

$$W' = (d'\ (A1), d\ '(A2), \ldots\ldots d'\ (An))\ T \quad (4)$$

- To multiple the normalization value of fuzzy vector weights (W) by the following formula.

$$Sd(A_n) = \frac{d'}{\sum_{i=1}^{n} d(A_n)} \quad (5)$$

$$W = (d\ (A1), d\ (A2), \ldots, d\ (An))\ T \quad (6)$$

- Where W is a non-fuzzy number.
- It is ending with the calculation of the final weight of recommendation.

B. OMAX (Scoring)

OMAX is a device scoring tool based on the default KPI outcomes by keeping the matrix in a single measure, and it

allows the data interpretation to be relatively simple, easy to understand, flexible, and supports the units' normalization from different measurement specifications. A test system with OMAX balances each indicator's value scale and, as a result, each parameter's similar objective level is accomplished and compared to determine its position [21]. The previous studies observed on OMAX, including Paduloh and Hardi (2020) that measured the company productivity based on the automotive paint industry's KPIs [22] and, Margareta et al. (2020) integrated OMAX and AHP to measure the Green Warehouse KPIs [23]. The above studies have clarified how OMAX and AHP allow optimum achievement of performance assessment. Therefore, this study aimed to explore future OMAX values through its conjunction with the latest F-AHP levy to assess SMEs' digital readiness.

Here, OMAX as the operating system works by the proportion of each KPIs or criteria based on the total of the intermediate value divided into three levels viz highest, middle, and lowest level complemented by the traffic light system method as depicted in Fig. 1.

Part A in Fig. 1 describes the parameters influencing the efficiency and performance of the KPI, while Part B quantifies the degree of performance from the highest (10) to the lowest (0) by considering class and interval interpolation values.

$$\Delta X_{L-H} = \frac{Y_H - Y_L}{X_H - X_L} \quad (7)$$

The interval between high and low levels is the numbers at high levels, YL as numbers at low levels, XH as variables for the highest levels, and XL as variables for the lowest levels. Part C exemplifies the value analysis of KPIs that is outlined by the following formula.

$$value = level \times weight \quad (8)$$

Meanwhile, the index variable shows the initialization of criteria as the ultimate measures of efficiency. The OMAX traffic light system remarks the KPIs were levelling with three colors: green, yellow, and red. The green rates the scale level ranged from 6 to 10, where a good category is rated from 6 to 7, the very good type is enumerated by 8, and the excellent class is racked up from 9 to 10. The yellow color warned the measurement condition far from reaching the goal and scored from 2 to 5. It prescribes the level values 2 to 3 as bad category and the values 4 to 5 as the average order. The red color indicates the below-targeted achievement, thus requiring immediate improvement, and in this case, the OMAX curves are 0 to 1, with 0 indicating the rating class and 1 the terrible section. This traffic light system approach has been successfully solved in many labelling cases. Furthermore, it is found that the traffic light system is consistent, reduces confusion, and wastes time in determining the performance of KPIs, and as a result, it boosts the labelling criteria's efficiency in digital readiness assessment.

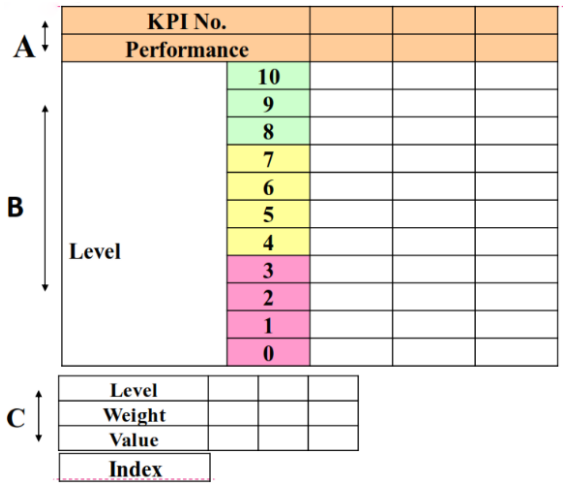

Fig. 1. OMAX Method Assessment Scheme [42].

IV. Result

A. KPIs Weighting Analysis – F-AHP

F-AHP resolves a questionnaire and appraises the significant weight values of SMEs' digital readiness parameters following Equation (1) to (6), and Table II is obtained in this sense. Initially, the AHP computing of comparison matrices and consistent values has led to the reasonableness and consistency of SMEs' entire digital readiness assessment parameters with the values 0.10, 0.08, 1.24, and 6.51 for CI, CR, Ratio Index (RI), and "λ maks" respectively. Hence, the parameter weighting values rank the criteria in Transaction (TC) of 0.29, Marketing (MC) and Micro Environment (MI) of 0.22, Management (MG) of 0.15, Macro Environment (MA) of 0.07, and Business Activity (BA) of 0.05, respectively. Next, the fuzzy synthesis values resulting from the operation performed on TFN are defined by Table II. Furthermore, from equations (4) to (6), Table II has elucidated the removal of fuzziness from the values of the ordinary and fuzzy vector weights (w). Thus, it attributes the summary of the priority weight value of the indicator and sub-indicators with the transaction (TC) as the most significant indicator (0.30) followed by Marketing (MC) and Micro Environment (MI) to a vector value of 0.24, Management (MG) provides 0.20, Macro Environment (MA), and Business Activity (BA) correspond to the vector values of 0.03 and 0.02, respectively. Furthermore, the weighted analysis reveals that TC-Education contributes to the weight values at 0,54, as the main sub-indicators of the transaction (TC). TC-Financial Resource, TC-Technical Infrastructure, and TC- Culture determines the vector values of 0.33, 0.13, and 0.08, respectively. Therefore, the priority indicators and sub-indicators for the SMEs digitization assessment model are established between SMEs and their stakeholders. This model as a performance measurement instrument is recommended as an aid for further analysis.

TABLE II. THE RECAPITULATION OF F-AHP PRIORITY FOR SMES DIGITAL READINESS VARIABLES AND SUB-VARIABLES

Variable	W	Si			Sub Variable	Si		
		L	*M*	*U*		*L*	*M*	*U*
Business Activity (BA)	0.02	0.06	0.09	0.18	BA-Culture	0.06	0.09	0.14
					BA-Education	0.43	0.25	0.41
					BA-Financial Resources	0.43	0.16	0.28
					BA-Technical Infrastructure	0.14	0.10	0.17
Transaction (TC)	0.30	0.09	0.17	0.31	TC-Culture	0.08	0.09	0.15
					TC-Education	0.54	0.28	0.44
					TC-Financial Resources	0.33	0.12	0.23
					TC-Technical Infrastructure	0.13	0.10	0.18
Marketing (MC)	0.24	0.09	0.17	0.32	MC-Culture	0.21	0.10	0.18
					MC-Education	0.27	0.19	0.35
					MC-Financial Resources	0.27	0.13	0.26
					MC-Technical Infrastructure	0.26	0.11	0.21
Management (MG)	0.20	0.08	0.16	0.29	MG-Culture	0.13	0.09	0.15
					MG-Education	0.31	0.20	0.35
					MG-Financial Resources	0.26	0.11	0.20
					MG-Technical Infrastructure	0.31	0.17	0.30
Micro Environment (MI)	0.24	0.19	0.29	0.46	MI-Culture	0.19	0.13	0.17
					MI-Education	0.36	0.14	0.28
					MI-Financial Resources	0.09	0.13	0.16
					MI-Technical Infrastructure	0.36	0.22	0.38
Macro Environment (MA)	0.03	0.06	0.11	0.21	MA-Culture	0.36	0.14	0.28
					MA-Education	0.09	0.13	0.16
					MA-Financial Resources	0.36	0.22	0.38
					MA-Technical Infrastructure	0.13	0.08	0.11

B. OMAX-Labeling Analysis

The OMAX labelling emphasized the second survey analysis that delivered 118 questionnaires for food industrial SMEs in Riau Province. It rated SMEs' degree of performance hinged on the F-AHP estimation weight values and following the Equations (7) and (8). As a result, Table III revealed the recapitulation of SMEs' readiness at Riau Province. Furthermore, the survey found that the highest criteria value for SMEs' digital readiness in Riau is Marketing (MC) with "Good" (7.75) and an "Average" for the entire MC sub-criteria. It then was followed by Macro Environment (MA) for index level of "Average" (5.34), Management (MG) for the index degree of "Average" (4.68), Micro Environment (MI) with index "Average" (4.32), Transaction (TC) with the category of "Bad" (3.84), and Business Activity (BA) with the class of "Bad" (3.78), respectively. Besides, Table III further describes the calculation performance analysis for each sub-criterion.

Fig. 2 and Table IV display the comprehensive evaluation of SMEs' digital readiness in the Riau province. In Fig. 2, out of the 118 SMEs in Riau Province, their performance was 42.37%, 36.44%, 11.86%, 5.08%, and 4.24% at the "Average" level, "Bad" degree, "Good," "Very Good," and at "Excellent" group respectively. The thorough levelling index of 118 SMEs for BA, TC, MC, MG, MI, and MA parameters is illustrated in Table IV. The root cause analysis is then addressed according to each sub-criterion indication. Thus, the stakeholders are advised in taking curative action.

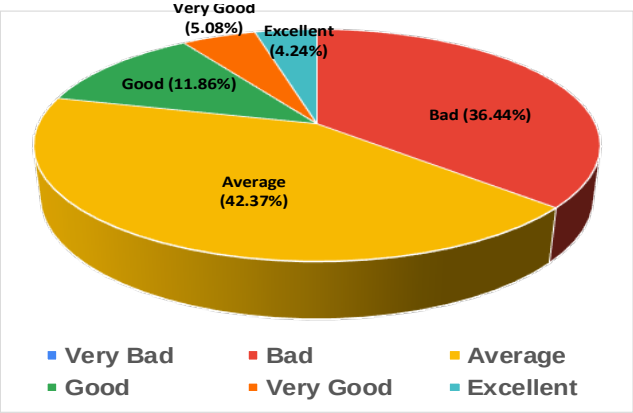

Fig. 2. The Percentage of SMEs Digital Readiness at Riau Province.

TABLE III. THE RECAPITULATION OF OMAX FOR SMES DIGITAL READINESS IN RIAU PROVINCE

Variable	Sub-Variable	Achievement	OMAX Level	Performance Value	OMAX Category	Index
BA	BA-Culture	58.47	3	0.18	Bad	3.78 (Bad)
	BA-Education	60.17	3	1.29	Bad	
	BA-Financial Resources	55.30	3	1.29	Bad	
	BA-Technical Infrastructure	62.50	3	1.02	Bad	
TC	TC-Culture	62.5	3	0.24	Bad	3.84 (Bad)
	TC-Education	58.90	3	1.62	Bad	
	TC-Financial Resources	58.26	3	0.99	Bad	
	TC-Technical Infrastructure	61.02	3	0.99	Bad	
MC	MC-Culture	69.70	5	2.15	Average	7.75 (Good)
	MC-Education	65.47	4	1.88	Average	
	MC-Financial Resources	65.04	4	1.88	Average	
	MC-Technical Infrastructure	65.25	4	1.84	Average	
MG	MG-Culture	66.74	4	1.32	Average	4.68 (Average)
	MG-Education	62.92	3	0.99	Bad	
	MG-Financial Resources	60.81	3	1.38	Bad	
	MG-Technical Infrastructure	61.86	3	0.99	Bad	
MI	MI-Culture	58.48	3	1.17	Bad	4.32 (Average)
	MI-Education	65.04	4	1.44	Average	
	MI-Financial Resources	58.48	3	0.27	Bad	
	MI-Technical Infrastructure	64.62	4	1.44	Average	
MA	MA-Culture	66.95	4	1.32	Average	5.34 (Average)
	MA-Education	65.25	4	1.8	Average	
	MA-Financial Resources	58.26	3	1.11	Bad	
	MA-Technical Infrastructure	62.92	3	1.11	Bad	

TABLE IV. THE ASSESSMENT INDEX OF SMES DIGITAL READINESS AT RIAU PROVINCE

SMEs No.	Index	Category	SMEs No.	Index	Category	SMEs No.	Index	Category	SMEs No.	Index	Category
SME1	2.36	Bad	SME10	3.14	Bad	SME19	3.81	Bad	SME28	3.64	Bad
SME2	6.94	Good	SME11	6.66	Good	SME20	2.63	Bad	SME29	4,6	Average
SME3	3.64	Bad	SME12	4.46	Average	SME21	5.28	Average	SME30	8.82	Very Good
SME4	5	Average	SME13	2.59	bad	SME22	7.34	Good	SME31	4.87	Average
SME5	6.56	Good	SME14	2.87	bad	SME23	8.1	Very Good	SME32	3.35	Bad
SME6	6.14	Good	SME15	5.92	Average	SME24	3.46	Bad	……	……	……
SME7	4.69	Average	SME16	4.92	Average	SME25	4.43	Average	SME116	4.28	Average
SME8	4.5	Average	SME17	9.82	Excellent	SME26	4.44	Average	SME117	4.28	Average
SME9	3.25	Bad	SME18	3.14	Bad	SME27	5	Average	SME118	5.26	Average

C. Dashboard System Development

Fig. 3 shows the SMEs Readiness Assessment Dashboard application architecture and design setup. It is designed according to the approach and components of the DSS framework and also eligible for two key players, which include; users derived from decision-makers comprising researchers, government engagement, the central bank, marketplaces managers, investors, and also participants designated for the end-users from 118 SMEs in the province of Riau. This application is designed to provide stakeholders with an integrated and interactive platform to rack up the weight on F-AHP and make predictions for SME digital readiness predictions. Here, two questionnaire mechanisms are built through this application. It provides an exact word, video, and text formatted to eliminate gaps when performing the job. The system interfaces are equipped with the information and knowledge activities, so focusing on the outcome of analyzes and tracking of the SMEs readiness assessment as well as

scoring issues. Finally, the assessment analytical report is performed by the system as intelligent recommendations in tackling the problems identification for the stakeholders and SMEs actors as well. Fig. 4 explains the general SMEs analysis report as outcome report generate that exhibiting the performance achievement of indicators and constructs in terms of BA, TC, MC, MG, MA, and MI. Besides, the index performance percentage is also displayed as resume index of the whole SMEs in Riau Province. The graphical performance of indicators and constructs informs the SMEs achievement and provide the recommendation on how to bring about the optimal fulfillment. Fig. 5 is public OMAX calculation page in disclosing the SMEs mapping performance calculation within 10 leveling indexes into overall performance calculation. Fig. 6 resolves the performance calculation index for one SME case study namely Kebab Frozen. This page describes the graphic performance for indicators and constructs, OMAX calculation, and overall performance analysis whether this SME in good, bad, or average leveling index. Lastly, Fig. 7 expounds the mapping performance of SMEs in Riau Province based on the google map location. The rules' foundation is based on the result of DSS analysis and displayed as user interface results.

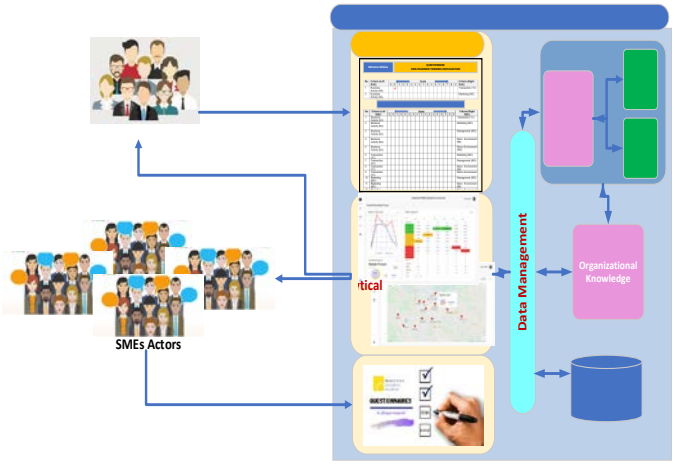

Fig. 3. System Architecture for Dashboard SMEs Readiness Assessment.

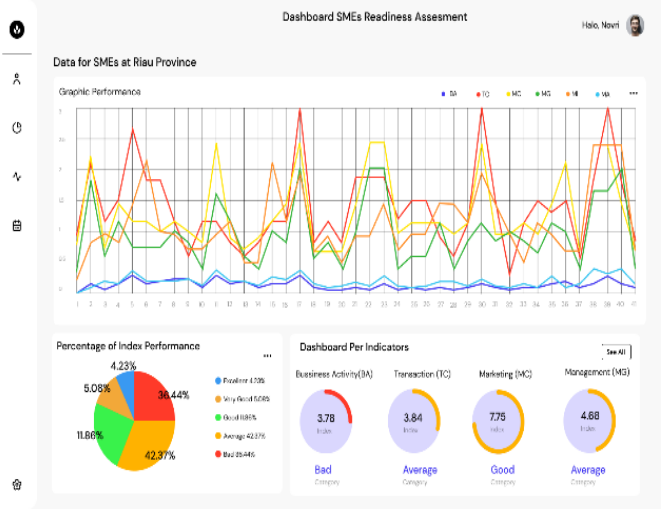

Fig. 4. General SMEs Scoring.

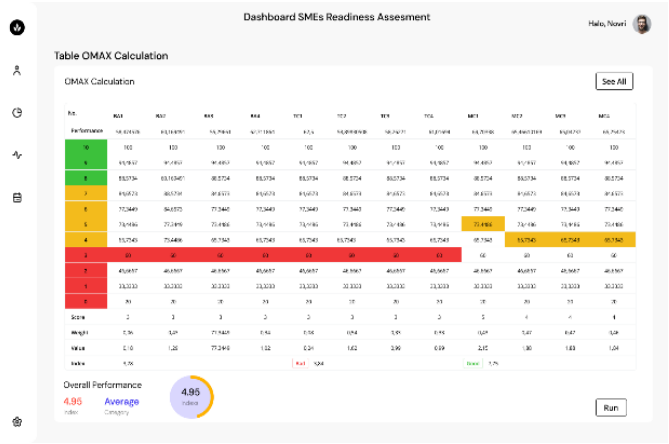

Fig. 5. General SMEs OMAX Calculation.

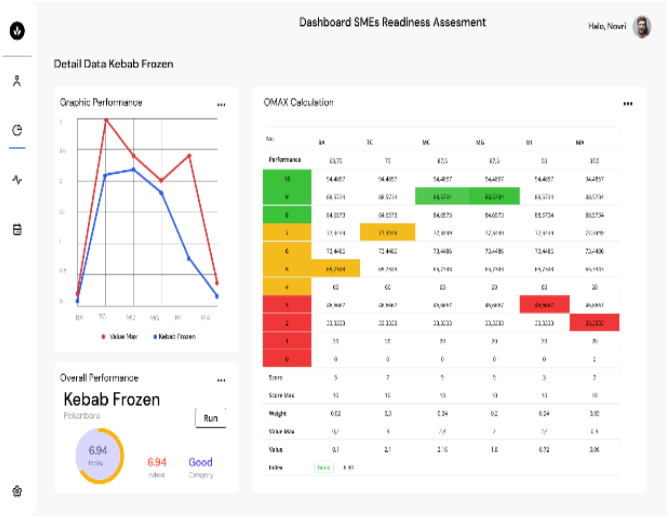

Fig. 6. SMEs OMAX Calculation for Case Study: Kebab Frozen.

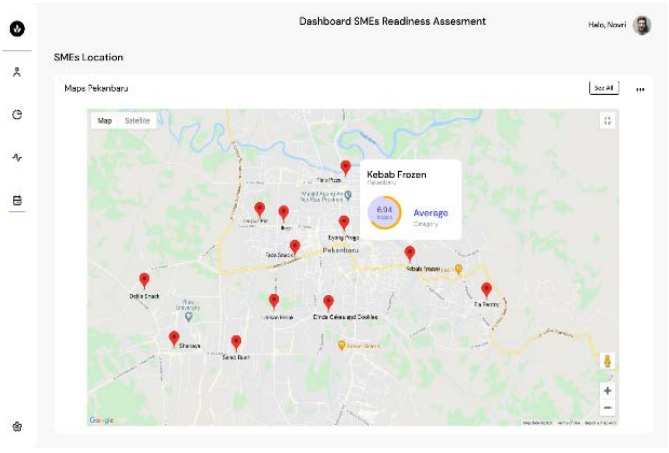

Fig. 7. SMEs Mapping Performance at Riau Province.

Furthermore, A Blackbox software evaluation was successfully conducted, and 128 functions were correctly completed to test the reliability and functionality of the dashboard, including the three parts of the AHP-questionnaires, the three aspects of Assessment-questionnaires, and the three of the SME General Analysis Task, one of SMEs surveying

and mapping functions, and 118 tasks of SMEs analysis. In addition, a UAT survey is carried out by a five Linkert Scale questionnaire. In terms of user adoption of applications and functions, user-friendly applications, system interfaces, and utilization, 22 stakeholders and 118 SME participants were required to participate.

The survey showed that 85% of the respondents had no issues with the dashboard, and the application was designed to be user-friendly. The interface provided was very attractive, and 88% of respondents reported that the dashboard was constructive and will provide better clarity and understanding when reviewing formatted content, graphs, and tables. Concerning the dashboard utility, 90% of respondents have suggested that this application boost SMEs' efficiency for digital businesses' success. Furthermore, the dashboard examines SMEs' potential growth in Riau Province by defining policies, strategies, and supporting measures to improve digital business achievement.

V. Discussion

In this study, F-AHP weighting has been successfully identifying the outstanding factors in assessing the digital readiness of SMEs. F-AHP in DSS approach cascades the assessment of multi-criteria decision making in digital readiness constructs into detailed sub-indicators weighting and model development. For instance, this model provides transaction (TC) as the index of the top-weighted value down warding into sub-criteria TC-Education and TC-Financial Resource as the main criteria that would directly influence the general performance index of SMEs. In a nutshell, SMEs must take a comprehensive approach to the weighted priority of criteria and sub-criteria to enhance a sophisticated digital readiness index achievement. This assessment advises stakeholders to enforce these systems to support digitally-driven transaction settings by ultimately achieving the highest criteria and sub-criteria, such as TC-Financial Resources, Education, Culture, and TC-Technical Infrastructure. Furthermore, the issuance of regulations, policies, and understood the transaction-driven procedure, security, quality, and protections develop into the government's consideration and accountability of customers and SMEs practitioners. In addition, the adoption of technologies requires that entrepreneurs and innovative SMEs transaction flow encourage the forecasting of the future of networking, collaboration partnerships, shared services, expansion programs approaching digitalization, as well as funding requests from others both internally and externally, thus allowing digital commerce to thrive [12]. Besides, the digital transaction's success requires the involvement of leaders and empowerment by external stakeholders and employees in promoting the environment and technology in business production, management, marketing, technical infrastructure, skills, and resources [6]. The above initiative is considered growing into the greatest danger in SMEs' digitalization. Moeuf et al. (2018) substantiated that those managers and external experts play a unique role in the success and failure of a digitalized SME project [24].

Meanwhile, beholding on the OMAX calculation analysis index whereby 42.37% of SMEs in "Average" and 36.44% in "Bad" status indicates that SMEs in the Province of Riau need to make a great deal of digital sustainability commitment. Herein, the OMAX scoring and leveling index has been flourishingly accurate in mapping the SME's performance and achievement. The integration of F-AHP and OMAX equip a deep and cascading performance analysis by considering the customized perceptions of stakeholders [35]. The Riau province condition reflects the generalization of SMEs' performance on Sumatra Island due to the possible growth of SMEs on this island. Furthermore, its geographical position is adjacent to the entrance and business transactions with several Southeast Asian countries such as Malaysia, Singapore, and Thailand, providing a considerable bonus opportunity in this area for accelerating the digital businesses, finance and investors, partnerships, and networking.

Corresponding to the dashboard system development and interface are interactively designed to provide decision-makers with a helpful overview and easy to interpret using gauges, graphs, traffic light strategies, and map analysis. According to Nadj et al. (2020), the dashboard's reciprocal analytical features strengthen the DSS operational process [36]. Herein, the model-driven DSS component has been software implemented in a hybrid analysis stage using F-AHP and OMAX approaches, and the integration of these in decision-making allows for better and optimized benefit analysis. Furthermore, OMAX and fuzzy blending bring new and meaningful success measurement values [11]. Meanwhile, data management alongside organizational knowledge is processed in the knowledge repository according to the SME's digital preparation model's parameters and sub-parameters. Hence, the knowledge recommendation analysis furnishes a new and innovative problem-solving way to aid SMEs in increasing and conducting the curative actions towards their successful preparedness for the sustainability of the digital business era.

VI. Conclusion

The era of the new-normal has accelerated the implementation of digitization around the world. To sustain the nation's economy, Indonesia has made various breakthroughs to achieve digital success in all facets of life, especially for the SMEs industry, which plays an essential role in its economy. Despite SMEs having the slightest effect from the Covid-19 spread, they still need to adopt various solutions and digital acceleration to survive. The high risk of digital transformation and adoption leads the stakeholders to take action as well as digital preparation evaluation by considering the views perceived of both supply chain activities and technology. This study has successfully developed a DSS dashboard that measured SMEs' readiness towards digital business from 6 main variables and 24 sub-variables sets as criteria of SMEs' e-readiness model. The model-driven DSS application has effectively analyzed the requirements and employs the F-AHP to generate priority weight, and the views of stakeholders from government, academicians, investors, marketplaces, banking, and SME participants are considered weighted judgment in the dashboard calculation.

Furthermore, the OMAX analysis has empirically mapped 118 SMEs in Riau province with a levelling index and root cause analysis. The study reveals that SMEs' overall performance in Riau is measured by an average index,

requiring more government and stakeholders' attention for corrective actions. It shows that the overall achievements of SMEs in Riau are below the average index, which requires further consideration by the governments and stakeholders' corrective action. In terms of accessibility and utility, this dashboard application was tested and confirmed to advise decision-makers in addressing the current issues based on their review findings and the feedback presented.

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