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Measuring Dynamic Capabilities of IT Resources

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***Abstract*—The concept of Dynamic Capabilities (DC) has been popular for almost two decades. Dynamic capabilities were the ability of an organization to adapt to a changing environment. Dynamic capabilities are organizations that managed resources and competencies, both internally and externally, would survive with environmental changes. Many studies have reviewed the concept of dynamic capabilities. Some studies attempted to investigate how dynamic capabilities impact business, dynamic capabilities, and dynamic capabilities. However, limited research suggests how to measure an organization's dynamic capabilities, especially the capabilities of resources that drive an organization to have dynamic capabilities. Therefore, this study tries to provide a proposed method for measuring organizational resources' dynamic capabilities, especially IT. Information technology was chosen because there was a general belief that IT could strengthen the organization's position in business competition. The model was developed with a conceptual research and case study approach. Conceptual research was carried out to develop a theoretical framework through the study of literature. At the same time, the case study was carried out for model validation. The proposed method was adopted from the IT portfolio management and portfolio mapping. Based on the validation processes, the model proposed was suitable for measuring IT resources' capabilities and describing how IT resources could support dynamic capabilities. The result shows that more dynamic IT resources could improve the dynamic capabilities of an organization.**

***Keywords*—Information technology; dynamic capability; IT capabilities; role of IT; portfolio management; portfolio mapping.**

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I. INTRODUCTION

In the last decade, research related to dynamic capabilities (DC) and their role in organizational strategy has become an exciting topic among researchers [1]–[3]. The organization's dynamic capabilities were considered to impact company performance indirectly [4] indirectly. How to create dynamic capabilities for an organization has been studied [5], [6]. Expanding the concept of DC by describing dynamic capabilities was managing resources to support organizations in dealing with environmental changes [1]. Based on IT capabilities, the IT resources indirectly improve organizational performance [4]. IT, as an organizational resource, was considered to provide organizational strength in the face of change. IT must be strategically flexible enough to cope with uncertain and flexible changes to realize potential optimization in business processes by modifying IT and process specifications to support organizations' dynamic and ever-changing environment [7].

However, how to measure the dynamic capabilities of a resource? The research that provides an overview of what methods could be used to measure dynamic capabilities was still limited. The measurement approach carried by [8] still tends to be general and broad (e.g., ability to integrate, build and configure, and others) and look for the element of dynamic capabilities (seizing, sensing, and transforming). A measuring method of dynamic capabilities has been proposed [9], [10]. The measurement method proposed was to knew how the dynamic capabilities of an organization were in general. From the various studies about the impact of IT that have been studied [11], further research was needed to study IT's role on firm performance comprehensively.

Therefore, this study developed a method for measuring IT's role in the view of dynamic capabilities. This research tries to develop a measurement method that comprehensively provides an overview of a resource's dynamic capabilities, especially IT resources. The model was developed by adopted IT portfolio management [12] and portfolio mapping [13]. IT portfolio management and IT portfolio mapping were considered suitable to represent IT's role with a dynamic capability orientation. IT Portfolio Management and portfolio mapping also could provide an

overview of the extent to which the company is IT capabilities in dealing with rapid environmental changes.

II. Materials and Method

A. Theoretical Background

1) The Dimension of Dynamic Capabilities (DC): Since DC has been first introduced [8], the researcher still interests in expanding it until now. The dynamic capabilities are the organizational ability to quickly integrate, build, and reconfigure internal and external competencies to deal with environmental changes. Dynamic capability theory was an extension of RBV (Resources Based Value) that could be used in dynamic situations and shows how company excellence was maintained at all times [5]. The dynamic capability was the process of a company or organization that uses specific resources to match existing market changes [2]. Dynamic capabilities were more focused on internal processes within the company or organization, aiming to modify its resources or company [10]. Dynamic capabilities as a form of management capability that was difficult to imitate organizationally, functionally, and technology's ability to change operational mechanisms to find new customer needs, and the ultimate goal was to improve performance [14].

The dimensions of dynamic capabilities consist of adaptive capability, absorptive capability, and innovative capability [15]. The adaptive capability was the ability to identify and capitalize on opportunities that arise from the market. The adaptive capability was measured from responding to the opportunities, monitoring markets, customers, and competitors, and allocating resources for marketing activities. The absorptive capability was the ability to evaluate and use knowledge from outside the organization. The absorptive capability was measured by the intensity of research and development activities. The innovative capability was the ability to develop new products or markets. The innovative capability was measured by the number of product or service innovations, process innovations, and new problem solutions. Generally, the definitions of adaptive, absorptive, and innovative capabilities were as in Table 1.

TABLE I
Definition of Adaptive, Absorptive, and Innovative Capability

No	Type of Ability	Sources	Definition
1.	Adaptive	[3]	The ability to sense and form opportunities (sense)
		[15]	- The responsiveness and flexibility of a company to respond to the changing environment - Organizational abilities that help facilitate the process of learning, changing, and adapting
		[16]	- A form of organizational evolution often accompanies the company's adaptability - The process of balancing between strategic and owned resources, where the company can balance strategy with existing resources
2.	Absorptive	[17]	The company's ability to increase understanding, evaluation, assimilation, and application of external knowledge through investment in certain activities
		[18]	The ability to access technology from outside, the ability to learn, and incentives or obstacles in implementing new technology
		[19]	Absorptive refers to how companies understand the capabilities of existing and new technologies and the level of employee skills to use computer-based technology.
		[20]	The organization's ability to understand, absorb, and apply new knowledge gained from external sources
		[16]	The ability to learn from various partners and have our research and experience and develop first-hand knowledge of new technology
		[21]	The capacity to identify, assimilate, and exploit new knowledge essential for firm competitive success.
		[22]	the company's ability to learn from other companies
		[23]	The ability of an organization's active to acquire, absorb, change, and utilize external knowledge
		[24]	The company's absorptive capacity as its ability to successfully replicate new knowledge
3.	Innovative	[25]	An important factor that facilitates innovative organizational culture, the characteristics of internal promotional activities and the ability to understand and respond appropriately to the external environment
		[26]	- The capacity for developing new products that satisfy market needs. - The ability to apply appropriate technology to produce new products. - The ability to adopt and developed a new product and processing technology to meet future needs. - The capacity to respond to unintentional technological activity and unexpected opportunities created by competitors
		[22]	The ability to introduce new products quickly and adopt new processes has become an important aspect of competition.
		[27]	The companies can develop new ideas and transform them into new products/processes/systems to respond to the changing market.
		[28]	The ability to mobilize knowledge from employees and combine it to create new knowledge to produce product/process innovations
		[29]	The application of relevant knowledge to achieve market value and the successful application of creative ideas to an organization

2) The Role of IT: IT's role in firm performance has become an interesting topic for researchers in the last few decades. Many studies have revealed that IT could have an impact both directly and indirectly. The research of [4]

mentioned that indirectly IT could improve organizational performance. Another impact of IT was that IT could improve market value [30]–[35]. The existence of IT could increase profits for the company [36]–[39]. Increasing customer satisfaction was also advantageous for companies that apply IT [40]–[42]. Whereas, the impact of using IT could improve environmental performance, in this case, supporting the sustainability of the environment [43].

Generally, IT was considered as a business support tool. Business support from IT could be making it management easier to make decisions [44]–[46]. The acceleration of information dissemination and integration between departments was a form of IT supports for businesses [19], [47]. Also, support for governance and administration was another support from IT in its business [48]. The impact of using IT could also make companies more responsive (agility). Identifying and analyzing the opportunities and threats was a form of quick response [4], [40], [49], [50]. IT could provide innovation and new ideas in rapid market change that was also the form of agility was another impact of IT [51]–[54].

Researchers have examined the impact of IT capabilities, but there was still debate about what was meant by IT capabilities and how these capabilities affect performance [55]. Although several studies have tried to examine the relationship between IT capabilities and operational capabilities [56]–[58], there were still limitations of research on the impact of IT on dynamic capabilities and the impact on overall competitive performance [59].

3) Portfolio Management: The concept of portfolio management was gathering all projects into one place and controlling it as a set of interrelated activities [60]. The portfolio included grouping programs, projects, services, or assets selected, managed, and monitored to obtain optimal business value [61]. IT Portfolio Management helps organizations manage IT assets by identifying risks, benefits, costs, and alignment of each IT asset and provides an overall picture for executives to get better IT information to make the right decision [62]. The benefits, costs, and risks of individual investments could be assessed from portfolio management to determine the investment made a significant contribution to the organizational performance or not [63]. IT portfolio management's benefits were improving business alignment strategies, control centers, reducing costs, improving communication between business units, providing competitive advantages, and better decision-making [64]. Implementation of IT portfolio management for an organization or company was not easy. The application of IT portfolio management solutions was a major and complicated endeavor for an organization and requires significant changes in business processes and organizational structure [62]. IT portfolio management was also considered a method that could help companies make decisions and align with business strategies [65].

4) Investment Portfolio Mapping: The Investment Mapping Methodology was an evaluation technique that consists of recommendations for making an investment portfolio map, evaluating the overall IT strategy, identifying, and evaluating individual investments, and managing *profits after implementation.* There were several methods for portfolio mapping. Based on the IT portfolio management by [12], portfolio mapping was conducted by using McFarlan's matrix. The other portfolio mapping method was developed by Peters [13]. The portfolio mapping proposed by Peters [13] could be used to identify the benefit of IT investment and manage those benefits effectively. It is identified that there were three categories of benefits: (1) enhancing productivity, (2) risk minimization, and (3) business expansion. Also, map IT investment based on their orientation. The orientation was consisting of i). infrastructure, ii). Business operation, iii). Market influencing. Peters gives an illustration in mapping after each of the IT investments rated for benefits and orientation. The organization could assess the investment that has been conducted was still focused on costs or already focused on opportunities by describing the mapping.

B. Measurement Development

The measurement model development started by the processes to build the initial concept of the model. Concept development begins with determining the point of view of evaluating IT's role and selecting measurement methods. The concept of dynamic capabilities is used as the basic concept of the measurement model. The development of the concept of dynamic capabilities was made to clarify the perspective of dynamic capabilities. The method was chosen after the concept view was obtained.

The method was chosen after a literature review was conducted related to methods that could be used to measure the role of IT comprehensively. Also, the method chosen was a method that could be developed with a dynamic capability view. Therefore, IT portfolio management methods and portfolio mapping were chosen.

The verification method was carried out to determine whether the model created was suitable for measuring IT's role and could be applied. The verification process itself was carried out by seeking experts' opinions on the model that has been made. The experts selected in this study were people who have experience preparing IT / SI strategies.

The expertise that has been chosen consisted of the lead of IT Consultant, The Vice President (VP) of IT Governance and Strategic Planning and an IT Enterprise Architect Staff. The interview was conducted by exploring how the company's process of developing an IS / IT strategy. What framework/models were commonly used in the process of developing an IS/IT strategy. This information was collected because the method created in this study refers to IS / IT strategic planning [12].

The model that has been verified would be implemented in the case study. The implementation was conducted to validate the model. The chosen organization was a state-owned enterprise that was engaged in port services for more than two (2) decades. As a big company, it was supported by big enough information technology. The IT resources owned by companies were quite elaborate.

Data collection was needed to implement the model. The required data were collected by interviewing and collecting report data (the company's long-term plan, IT master plan, reports and proposals of IT investment, performance reports, service catalogs, internal regulations, and other supporting data). Interviews were conducted with two key informants in

the company: the senior vice president (SVP) of information and communication technology and IT Project management staff and IT staff's service management. Interviews were conducted besides confirming data and extend the information that may be not reflected in the document.

Besides internal data, external data was collected to analyze external conditions that affect business and IT. External data includes current technological trends, local or state government regulations, political situations, social conditions, and economic conditions. External data was collected from many instances, including the Central Bureau of Statistics, the national development planning ministry, state-owned enterprises ministry or other ministry regulations relating to company business.

C. Measurement Model

The dynamic capability measurement model of IT resources was adopted from two main models consist of IT portfolio management [12] and portfolio mapping [13]. The concept of formulating IT/IS strategies [12] provides an overview of the stages related to the preparation of IT / IS strategies by utilizing portfolio management. The IT portfolio management method [12] considers overall factors, not only internal business factors but also external business factors, then this study adopts the stages of preparing IT portfolio management [12]. The portfolio mapping method [13] could be adjusted to dynamic capabilities concept. Therefore, the model extended portfolio management with portfolio mapping. The steps of the model to assess the role of IT was as shown in Fig. 1.

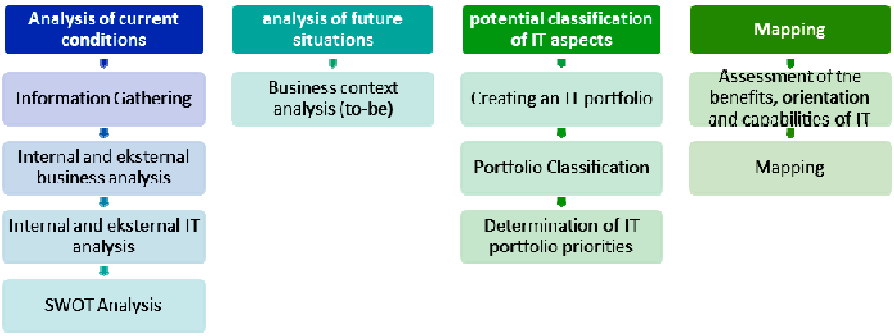

Fig. 1 The measurement models

In the portfolio management concept [12], the first step to creating portfolio management was analyzing current conditions. Analysis of current conditions was conducted by looking at factors that affect business or IT, both internally and externally. The current condition analysis was carried out with several activities consisting of information gathering (stakeholders, users, and IT department units) and internal and external analysis (business and IT). Based on the data and information collected, a SWOT analysis could be established. An analysis of the future situation of an organization was carried out after current conditions were analyzed. Analysis of the future situation was carried out to know the direction of the organization's business. Analysis of the future situation was conducted by creating a future business context and analyzing future expectations.

The next step after future situation analysis was the potential classification of IT aspects. This process's activity was creating an IT Portfolio, portfolio classification, and determining the priorities of the IT portfolio. IT resource portfolios could be drawn up based on an analysis of current conditions and future situations. The portfolio was developed by concerning aspects of IT resources. The aspect of IT resources in this study refers to the concept of IT resources [66], which said that IT consists of three aspects (software, hardware, and services). The classification was conducted based on McFarlan's quadrant (strategic, high potential, key operational, and support) after all the aspects were collected. The classification process was carried out by assessing each aspect with key indicators adopted from key requirements [67] on a Likert scale. The key indicators themselves consist of two categories (driving forces and critical requirements). A five-point Likert scale was used to answer the key indicators, starting from strongly disagree in scale one to strongly agree in scale 5. The classification of the IT portfolio was obtained based on the results of this assessment.

The selection process of IT aspects that have been compiled in the IT portfolio was needed to determine the potential aspects that best represent IT resources. In the process of classifying potential aspects of IT, a selection of IT resources was made by selecting the aspect that did not meet the value of the indicator. It was determined that the threshold for each assessment to determine the most potential IT portfolio. The aspect selected was an aspect with a minimum of two indicators of the driving factors and two parameters of the key parameters and a value of 4 or more. The portfolio mapping was carried out by the results of the potential classification of IT aspects.

The initial mapping process was conducted by assessing the benefits, orientation, and IT resources' dynamic capabilities. Peters has built sub-categories with specific ranges for each benefit and orientation category [13]. For each sub-category, given a specific range value. These sub-categories have been defined to ensure that the aspect was included in the sub-category or not. The mapping processes were expanded with the dynamic capabilities concept. The development process of mapping was begun by creating categories and sub-categories of dynamic capabilities. The type of ability in Table 1 was used as the categories. Based on the definition of the categories, it could be classified into sub-categories, as shown in Figure 2.

The results of the assessment carried out mapping. The first mapping was conducted by mapping the results of the orientation evaluation of the benefits. The way to map it was

to make orientation as an axis (x) and benefits as an axis (y). The range of sub-categories' function was to determine x1 and x2 or y1 and y2 from an aspect. The mapping was then continued by mapping the orientation assessment results on dynamic capabilities and the benefits of dynamic capabilities.

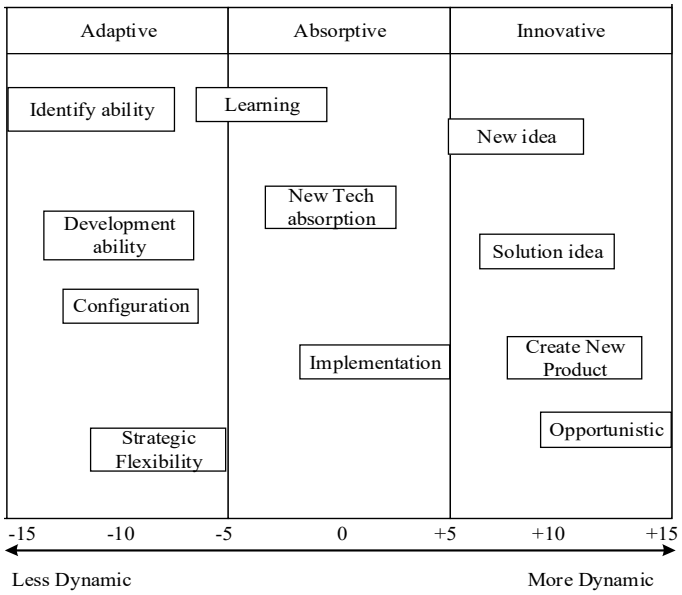

Fig. 2 Categories and sub-categories the dynamic capabilities

III. Results and Discussion

The result of verifying processes and implementing the method was described as follows.

A. Verifying and Validation of Model

1) Verifying Model: From the initial verification process with EA and VP staff, the process of an IS / IT strategic planning in the case study was by referring to a framework that was TOGAF. It was found that to formulate an IT strategy carried out through a search for motivation that could be represented by the company's vision, mission, and goals, and then made a new principle of strategy analysis by measuring the company's ability. Those activities could be said as information gathering. The information-gathering activity was collected from stakeholder, customer, business process owner, and IT department. Information gathering was conducted concerning four aspects (business, data flow, applications, and technology) that comprise a company. In addition to searching for current conditions, it was also necessary to analyze future conditions to determine IT support's gap analysis.

The future analysis was conducted by observing the company's objective and analyzing the future context of the business. The result of the process of IS/IT strategic planning was a work package. Work packages consist of the portfolio of IT, IT initiative programs, the roadmap, timeline, and the programs' budgeting.

The verification process was continued with the interview with the Lead Consultant (LC). The process of the verification was started by showing the model to the LC. Based on the results of interviews with Lead Consultants, it was found that the measurement model could be used to capture IT roles. In the expert's opinion, this model was also useful in terms of providing an overview of IT's position. Therefore, based on instrument verification results, it could be concluded that the instruments built have met the requirements to measure the role of IT in a company.

2) Model Implementation: Based on an analysis of current conditions and an analysis of future situations that could affect a company's business and information technology, the company's IT portfolio was obtained. Details of the company's IT portfolio were in appendix (A). There were 37 aspects of the software, 4 aspects of hardware, and one aspect of service. IT portfolio that has been constructed was grouped with the McFarlan's quadrant (strategic, high potential, key operational, and support). The results of McFarlan's quadrant were shown in Table 2.

TABLE II
The Group of IT Portfolios Based on McFarlan's Quadrant

Strategic	High Potential
- Vessel Administration System and Automation System - Terminal Operating System (TOS) - Vehicle and Traditional Terminal System - Integrated Billing System - Data Center	- EPIC (Enterprise Performance Indicator Center System) - Operational Report System

Key Operational	Support	
- E-procurement - REMOTE (Real Estate Monitoring and Other Services) System - SAP - Portal Information System - Data Master Management System	- Gate system - Operational Resources Budgeting system - KPI System - Individual performance management system - Knowledge management system - Internal audit system - E-Gratification - E-Class - Risk Analysis - Helpdesk - Management work plan system - Legal information system - Meeting Room application	- Safe box - Questionnaire - Business Partner Cooperation - CRM - INCO - Milea - SMPP - My Pelindo - E-Mudik - Website Pelindo - E-PPID - E-Boarding - Enterprise Service Bus - MPLS - POCC - Service Desk of TI

It was found that the IT aspects of the company have covered all categories of McFarlan. From all aspects, 69% of IT aspects were still in the support quadrant. Only 11% of IT aspects is in strategic positions. It could be seen that the concentration of corporate investment was still on the efficiency of work.

The next step after categorizing the IT portfolio was selecting the potential of the IT portfolio. The results of the IT portfolio potential selection process were as shown in Fig. 3. It has obtained 15 aspects of IT portfolios that were considered the most representative of the current IT conditions.

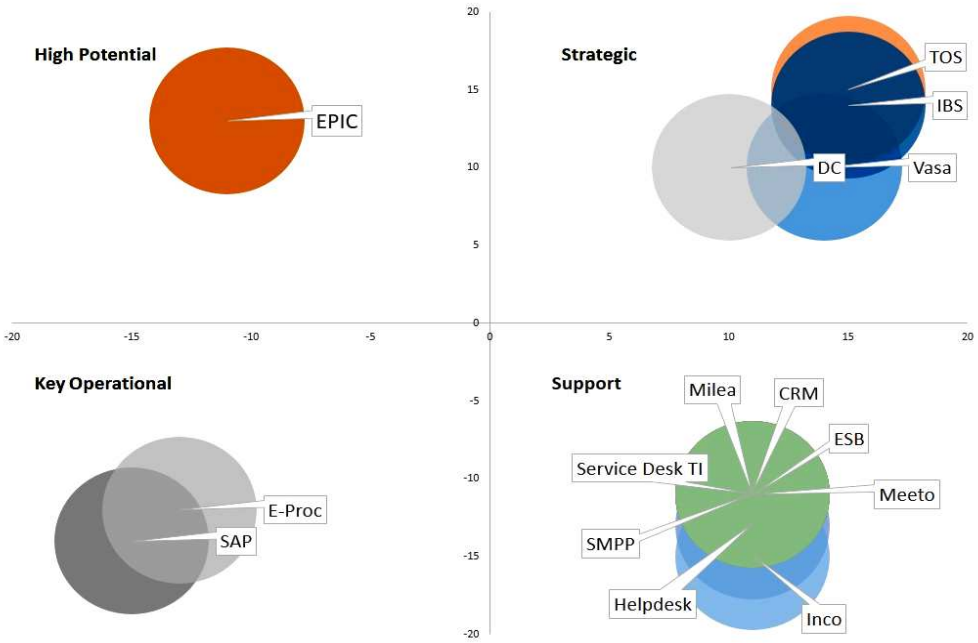

Fig. 3 The potential aspect of IT Portfolio

Based on the potential aspect that has been selected, assessment for benefits, orientations, and dynamic capabilities were carried out. Table 3 shows the results of the assessment of each aspect of IT.The assessment result was used for mapping processes.

TABLE III
THE ASSESSMENT RESULT OF THE IT ASPECT

IT Aspects	Benefits		Orientations		Capabilities	
Vasa	+5	+9	+6	+12	-6	+5
TOS	+5	+15	+6	+12	-6	+15
IBS	+5	+15	+10	+15	+5	+15
DC	-5	-1	-10	-15	-3	+5
EPIC	0	+5	-3	+1	-5	-11
SAP	-5	+3	-3	+4	-5	-11
E-Proc	-2	+2	0	-5	-5	-15
Helpdesk	-5	-13	-5	-12	-10	-15
Meet	-8	-13	-2	-6	-7	-15
CRM	-5	-9	-3	1	-8	-15
Inco	-5	-13	-2	-6	-8	-15
Milea	-8	-13	-2	-6	-8	-15
SMPP	-5	-13	0	+4	-5	-15
ESB	-3	+1	-8	-15	-5	-15
Service Desk TI	-5	-13	-5	-15	-7	-15

The first mapping was the mapping of IT orientation over benefits. It was intended to see how broad the scope of benefits of IT orientation has been made. The mapping of orientation and benefits was conducted by placing the IT orientation on the (x) axis and benefits on the (y) axis. The result of mapping the orientation of IT for the benefits could be seen in Fig. 4

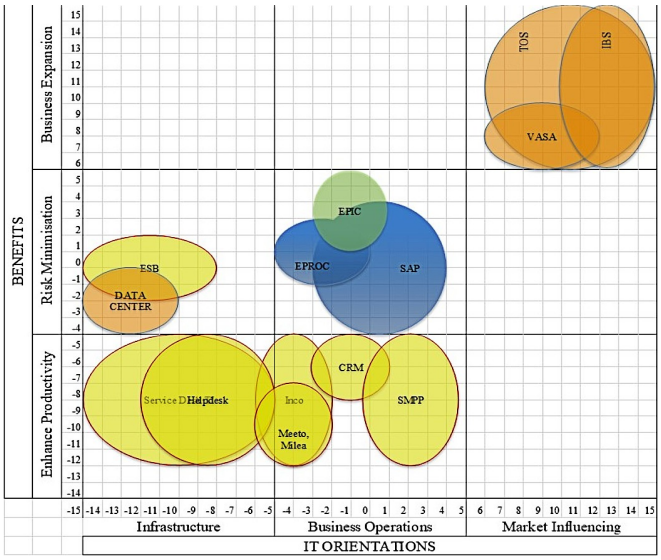

Fig. 4 The mapping of benefits and orientations

From the mapping results, it was found that the concentration of IT aspects in the case study still concentrates on factors of increasing productivity, and minimizing risks and aspects of IT were still on the orientation of infrastructure and business operations. It was found that 79% of IT aspects showed that IT resources were still focused on costs [13]. However, that did not mean that companies did not think about opportunities related to the market. It was proven from the mapping that there were three (3) aspects or 21% were in the focus position to seize opportunities or create opportunities for companies. After

the orientation was mapped to benefits, the next step was mapping the orientations to dynamic capabilities and benefits to dynamic capabilities. The last map was conducted to know how dynamic was the orientations and the benefits. The organizations could make a right step to create new strategies by the map. The detail of the map could be seen in Fig. 5 and Fig. 6.

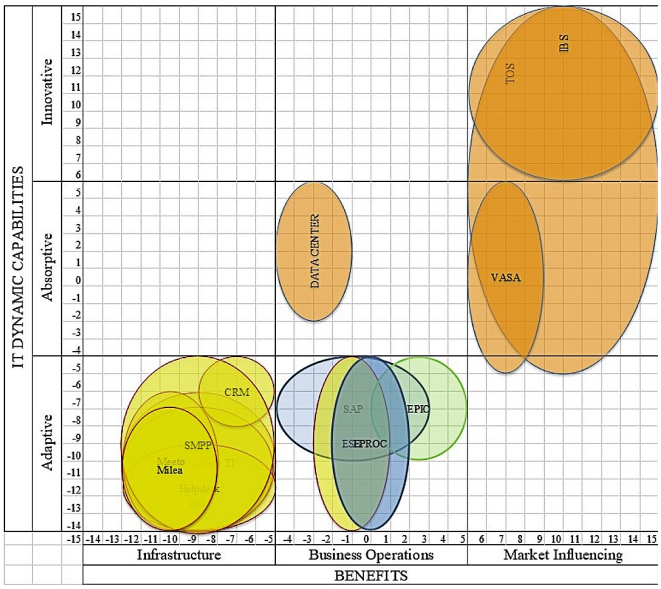

Fig. 5 Mapping the orientations to the dynamic capabilities

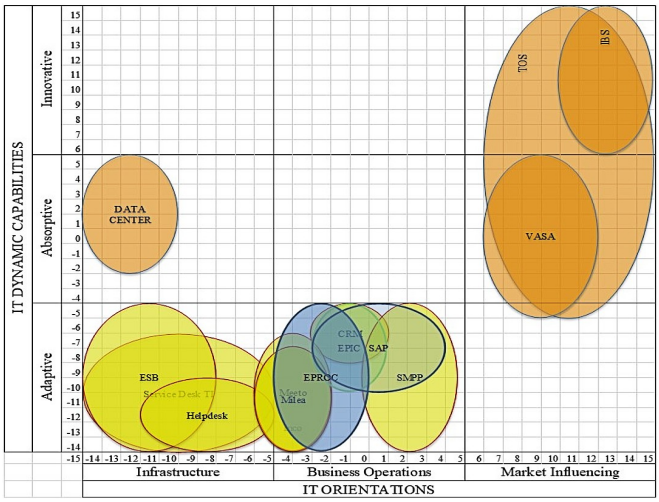

Fig. 6 Mapping the benefits of the dynamic capabilities

B. *Discussion*

The IT role measurement model was developed based on Ward and Peppard's portfolio management on IS/IT strategy formulation [12] and portfolio mapping by Peters [13]. The portfolio mapping of Peters was chosen with the consideration that the Peters portfolio mapping could be developed following the concept of the DC dimension. The initial stages in the process of measuring roles of IT were begun with an analysis of the current conditions in the model consisting of several activities. Based on the verification, current condition analysis could be simplified in information-gathering activity and SWOT analysis. Internal/external analysis of business and IT environment could be included in the information gathering. In the implementation process, information-gathering could be carried out by observing internal and external documents in the case study, information related to the needs of stakeholders, existing conditions of information technology, obstacles, and achievements of the implementation of IT programs could be adequately confirmed through an interview process with IT project management staff and SVP of ICT.

The next stage of the model was future analysis. In the future analysis consist of future business context analysis and future expectation. From the implementation model, the future expectation could be collected by interviewing the SVP. Based on the verification, the process of creating a portfolio, classifications, prioritizations, and portfolio mapping included in the gap analysis proses. In the implementation process, the process of making a portfolio, classification, prioritization, and portfolio mapping could be implemented and finally produced a map result of IT positions. The result of mapping could be given a good overview of the top management about the position of IT resources. IT's capabilities could be presented well in the map and could capture what the capabilities of IT were. When the model was built, it was submitted to the LC and obtained positive responses from experts who stated that this model was suitable for the process of measuring the role of IT. The expert also stated that these processes could be used to capture IT positions. Based on the capturing, strategic steps could be made in the future. It could be concluded that the entire process was built to measure IT's role was appropriate and could be applied. The processes that were built could also produce an overview of IT positions. The final model of the process of measuring the role of IT was as shown in Fig. 7.

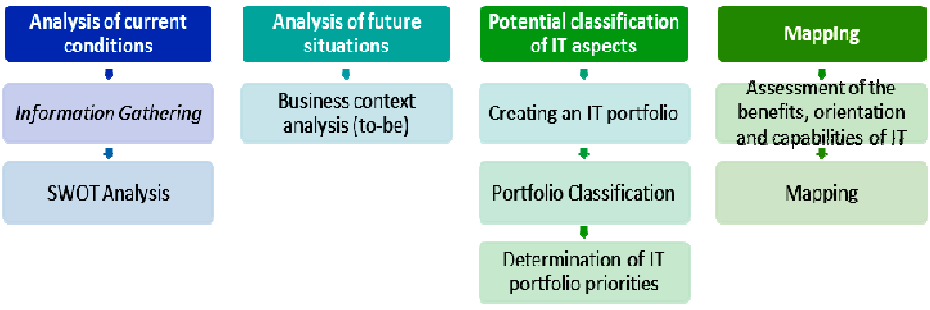

Fig. 7 The final model of measurement

Theoretically, this research contributes to the information system and strategic management literature. Starting with trying to understand that IT could contribute to a company's dynamic capabilities, research was conducted by building a model for measuring IT's role. Thus, it shows that the theoretical foundation put forward by the view of dynamic capabilities, which was often vague and abstract, could be decomposed into a series of specific processes where it was easier to assess IT's role. In other words, this article examines how effective companies were in managing IT to enable or enhance the company's dynamic capabilities.

The development of the IT role measurement model departs from understanding the concept of dynamic capabilities, where there were many perspectives in the concept of dynamic capabilities. Generally, the standard of dynamic capability measurement was also still not established. The concept of dynamic capabilities carried out in this study itself refers to the concept of dynamic capability dimensions [15].

In line with the concept carried, the researchers proposed a model that was built based on two main models consist of the IS/IT strategic planning model [12]and mapping the IT portfolio [13]. By conducting interviews and explore the opinions to experts, this research tries to verify the model. Implementing the model also carried out to ensure accuracy and validate the measurement model. The results show that the model's steps were appropriate to measure the role of IT in an organization. Furthermore, this research shows that it was possible to measure IT's role because of dynamic capabilities.

IV. Conclusion

This study's starting point was beginning by two backgrounds consisting of the dynamic capability measurement standards that were limited and the absence of a comprehensive IT role assessment. Therefore, this study tries to propose a model for measuring the role of IT. The proposed model was developed from two models: portfolio management on strategic planning IS/IT [12] and portfolio mapping [13]. Based on the model verification results, it was found that the stages in measuring the role of IT were appropriate and could be applied even with a slight change in activity at each stage. In this research, there were still limitations. First, the model was only implemented in a case study. The implementation model on the various case studies was needed to determine the consistency of the measurement model stages.

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APPENDIX (A) IT PORTFOLIO

Category	No.	Portfolio Name	Descriptions
Software	1	VASA	The Vessel Administration System and Automation (VASA) handles ship service transactions that include requests, planning, changes, cancellations, extensions, shortening, realisation, verification of services, to the billing of ship services.
	2	Terminal Operating System	TOS systems consist of Container TOS and Cargo TOS. It was a standardised application that accommodates Container Service (CTOS), and Cargo Service (Cargo TOS) needs in the case study's terminals following the patterns and variations of business processes specified.
	3	Gate System	A system accommodates gate service activities.
	4	Remote	An application that used to support various service processes of businesses and property owned by companies
	5	Vehicle and Traditional Terminal System	Vehicle and Traditional Terminal System to support the process of Ro-Ro ship activities and to support the operational processes of traditional terminal ships.
	6	Operational Resouces Budgeting system	The application that used to support the payment process of Unloading Workers, Pilot's honour, and Operator's honour
	7	Operational Report System	The application uses for monitoring operational reports. Users of this application were the middle management to find out the trend of ship flow, ship traffic, productivity, and ship performance to be reported to top management every month.
	8	Epic (Enterprise Performance Indicator Center System)	A mobile application contains corporate financial and operational dashboards. The user of this application was Top Management.
	9	SAP	A software-based on ERP (Enterprise Resources Planning) that was used as a tool to assist company management administrations. Module which has been applied to case studies: Controlling (CO), Project System (PS), Financial Accounting (FI), Plant Maintenance (PM), Material Management (MM), Human Capital Management (HCM), Business Planning and Consolidation (BPC)), Business Intelligence / Business Room (BI / BW), Dashboard, and Employee / Management Self Service (ESS / MSS)
	10	Input KPI	The system that used by the head office and branch offices to fill in the company's Key Performance Indicator data (non-budget performance).
	11	Individual performance management system	An application used to assess employee performance every year.
	12	Knowledge Management System (iKnow)	An application used for knowledge management in a corporate environment
	13	Internal audit system (SI-SPI)	The application used by the Company's Internal Auditor Unit for administration and reporting of internal audit activities
	14	E-Gratifications	The application used to provide reports related to gratifications for all company employees
	15	E-Class	The application used to accommodate transactions related to claims for insurance. This application was used by management and risk management systems unit to communicate and transact with brokers / CASH (intermediaries) to make insurance claims.
	16	Rian (risk analysis)	Spreadsheet application that was used in managing company operational risk
	17	Helpdesk	The application that used by the Information and Communication Technology department in recording incidents, requests, problems, and IT configuration management.
	18	Management work plan system	The application used to collect and monitor work plans for 1 year.
	19	Legal information system	The application used to display information about legal products produced by the Government, Directors, General Managers, etc.
	20	Meeting room application	The application was used to schedule for the use of meeting rooms at the Head Office
	21	Safebox	The application provides folders for sharing documents between employees. Only be used for sharing documents related to the company
	22	Questionnaire	A web-based application that was used to collect information through questionnaires, as well as reporting of respondents' results
	23	Business partner cooperations (KSMU)	The application used for recording related to the company's business cooperation agreement with external parties
	24	CRM	Information system used by management as analytical material in making port marketing business policies to service users
	25	Inco	The applications for customer and company used for financial administration and monitoring such as printing the bill, invoices, and release of accounts receivable locking
	26	Milea	The application used for administration, and numbering of documents and electronic signatures (e.g. minutes of meetings, correspondence)
	27	E-Procurement	The application used to assist the procurement process starting from the announcement of the auction, aanwijzing, up to the stages of determining the winner of the auction
	28	Monitoring Procurement Payments System (SMPP)	Information system used for vendor submission of payments, and monitoring of third party payment bill files. This system consists of two modules, namely the AIM System and Procure to Pay.

Category	No.	Portfolio Name	Descriptions
	29	My Pelindo	The mobile-based employee portal includes recording attendance, voting, news, forums, questionnaires, monitoring the agenda of each user meeting, viewing employee assessment results, looking at salaries and others.
	30	IBS (Integrated Billing System)	A web-based and mobile customer portal carries the concept of a one-stop service, where the application allows customers to: make registrations, booking for services, tracking the services, payments, billing, and complaining the services.
	31	E-Mudik	The application used by the public to register free homecoming programs organised by the Company
	32	Website	A web-based application that contains all general information related to the company
	33	E-PPID	The application used to open data to the public. Information shared was only general and not confidential
	34	E-Boarding	The application used as a passenger pass automation that has a feature to print passenger boarding, as a control of the number of passengers, and count the number of incoming passes
	35	Portal SI	The application used for user management and corporate application access rights management used by companies
	36	Manajemen Data Master (MDM)	The application used to maintain all master data used in other applications. Master data that was maintained, such as customer data, ships, equipment and Human Resources (HR).
	37	Enterprise Service Bus	A web-based system connects applications with other applications. The function of this system was for data integration as well as front office applications with SAP modules, or for the user authentication process.
Hardware (devices, communication networks and CCTV)	38	MPLS	Internal network to connect between head office and branches
	39	Data Center	Data Center was the main facility for hosting infrastructure, IT devices and corporate data. These facilities include spaces composed of computer networks and storage media that are used to organise, store, process and disseminate large amounts of data.
	40	Disaster Recovery Centre	A secondary facility for hosting infrastructure, IT devices and data as backups at the Data Center (DC). Facilities used by companies to restore technology and operational infrastructure and/or continue company operations when main data centres are not available.
	41	Port Operation Command Centre	Command centre facility owned by the company for monitoring terminal operations.
IT Services	42	IT Service Desk	Single point of contact, where users could report incidents, problems, requests for access rights, licenses, data and even requests for new applications or application modifications. This service was in the form of a call centre and self-service (through the helpdesk application).