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APPLICABILITY OF SCOR-BASED DEA PERFORMANCE MEASUREMENT IN SMALL MED-SIZES ENTERPRISES

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ABSTRACT

This paper aims to test the applicability of a SCOR-based DEA benchmarking approach for SMEs in Indonesia, due to the increasing call for suitable supply chain performance measurement in the context of SMEs. The location of research was in Kupang City of the East Nusa Tenggara Province. An input-oriented DEA assuming both CRS and VRS was employed by deriving a set of metrics from the SCOR attributes. A sample of 16 SME convenience stores was selected for the illustration. Results show that the SCOR-based DEA provided a simple groundwork for supporting SME managerial decision making in terms of administering concise feedbacks and identifying directions to venture on. Moreover, analysis results alluded to a distinct, more comprehensive assessment of performances as opposed to that of traditional measurements that is prominent among SMEs. The distinct, comprehensive insights from the analysis may engage SMEs into taking up the more innovative performance measurement approach. Moreover, better awareness of supply chain metrics is foreseen. The SCOR-based DEA provided a unique approach to meet the performance of Indonesian SMEs in regard to supply chain performance measurement.

Keywords: Supply Chain, Performance Measurement, SCOR, DEA, SME

ABSTRAK

Penelitian ini bertujuan untuk menguji penerapan pendekatan perbandingan DEA berbasis SCOR pada usaha kecil dan menengah (UKM) di Indonesia. Penelitian ini dilatarbelakangi oleh panggilan studi empiris untuk pengukuran kinerja rantai pasok yang relevan pada konteks UKM. Lokasi penelitian adalah di Kota Kupang, Provinsi Nusa Tenggara Timur. Pendekatan DEA diterapkan dengan mengambil orientasi masukan dan asumsi CRS dan VRS pada 16 UKM jenis ritel modern yang berada di Kota Kupang sebagai sampel ilustrasi. Hasil penelitian menunjukkan bahwa pendekatan DEA berbasis SCOR menyajikan dasar yang sederhana untuk mendukung keputusan manajerial pada UKM dalam hal memberikan umpan balik yang ringkas serta mengidentifikasi arah yang dapat diambil untuk perbaikan. Lebih lanjut, hasil analisis menunjuk pada jenis evaluasi yang berbeda dan lebih komprehensif dibandingkan jenis pengukuran kinerja tradisional yang selama ini diterapkan UKM. Hasil pengukuran kinerja berdasarkan DEA berbasis SCOR diharapkan dapat menggerakkan UKM pada penerapan pendekatan pengukuran kinerja yang lebih inovatif dan komprehensif berkaitan dengan rantai pasok.

Kata Kunci: Rantai pasok, pengukuran kinerja, SCOR, DEA, UKM



Introduction

The perspective of supply chain management (SCM) is imperative to business organizations as it entails the means for building and enhancing competitive advantage (Cooper & Ellram, 1993). Accordingly, SCM related activities necessitates for performance measurement (PM) which provides important feedback regarding efficacy of SCM practices (Waters & Rinsler, 2014; Lapide, 2000). Throughout the modern management era, supply chain performance measurement (SCPM) has been grasped upon and implemented in large scale enterprises. That is, a variety of tools have been developed and provided relatively successful mediums for these companies to compel on improvement.

In today's era, small and medium-sized enterprises (SMEs) are being increasingly recognized as the backbone of the national economy, especially in developing countries (Lee & Wong, 2015; Kurniawati & Yuliando, 2015). This category of business setting is noted to be subject to an increasing competitive environment (Garengo et al., 2005). SMEs however, embed distinct characteristics and constraints compared to that of large enterprises (Arend & Wisner, 2005). Poor strategic planning, inadequate resources, and lack of comprehension towards critical success factors (Chalmeta et al., 2012; Greatbanks & Boaden, 1998; Garengo et al., 2005) are among the typical features of SMEs which set them apart from the larger companies. Accordingly, the widespread management tools used in the realm of large enterprises such as SCPM, would require adaptations if were to be prevalent in SMEs.

Very limited empirical investigation upon applicable SCPM in SMEs (Raymond et al., 2008; Garengo et al., 2005; Hudson et al., 2001) justifies the call for this study. A SCOR-based DEA benchmarking approach is proposed to be quintessential to SME SCPM, generally by virtue of universality, flexibility, and simplicity. DEA stands out as a PM technique primarily for its ability to handle multidimensional constructs (Berg, 2010). The SCOR model on the other hand, offers a widely-accepted SCM framework which entails supply chain core attributes (Supply Chain Council [SCC], 2010). The application of DEA by deriving a set of metrics from of the SCOR model, is envisaged to provide SMEs with a more applicable method for assessing supply chain performances.

The SCOR-based DEA technique is proposed to bridge the appeals for and to overcome the shortages of SME SCPM. It features the capacity to incorporate multiple and adjustable metrics to the conformance of elementary settings in SMEs. The application is anticipated to provide a simple groundwork for supporting decision making in terms of administering concise feedbacks and identifying specific directions to venture on. It is

furthermore expected to trigger realization of supply chain critical factors, the importance of an all-rounded, multiple metric performance-based assessment, and provision for improvement plans. Respectively, the objective of this research is to test the applicability of the SCOR-based DEA approach within the realm of SMEs, particularly upon convenience store configurations in Indonesia. SMEs in Indonesia account for 99% of the total businesses enterprises (Machmud & Sidharta, 2016). Within that domain, a significant growth of the convenience store formats has been ongoing since the 2000s (Sunanto, 2012), hence the particular configuration and place is selected for this study.

Supply Chain Performance Measurement Techniques

The underlying necessity of SCPM roots in the logic that whatever gets measured will eventually get improved. Accordingly, measuring supply chain performance will provide important feedback which will trigger supply chain improvement (Waters & Rinsler, 2014). Administering the wrong measurement system may lead to supply chain performance degradation (Lapide, 2000), therefore selecting appropriate measurement tools is deemed critical. Researchers have pointed to the importance for PM systems to embed characteristics of clarity and simplicity (Garengo et al., 2005). Likewise, Beamon in Beamon (1999) presents inclusiveness, universality, measurability, and consistency as criteria of effective PMs. Several popular techniques towards SCPM are presented in Table 1.

Table 1 Strengths and Weaknesses of SCPM Techniques

Techniques	Strengths	Weaknesses
SCOR	Compatible across industries, provides deterministic measures	Rigid, unsuitable for dynamic & specific settings
BSC	Comprehensive (strategic to operational) and balanced (financial and non-financial measures)	Disjointed link between the measures, incompatible for small enterprises
Benchmarking	Can drive towards change, embeds an external perspective, free metrics selection	Limited to provide only a groundwork for future improvements

Referring to the characteristics of an exceptional PM system as mentioned in the description above, benchmarking is considered as a stand-out approach for it embeds the aspect of universality while at the same time able to justify for the other criteria. Bringing SCM into the context, a benchmarking approach incorporating a set of metrics devised from the SCOR model is envisaged to be more advantageous and adaptable to supply chain settings. A robust SCOR-derived benchmarking method, however, requires an analytical approach that could strongly justify for clarity, simplicity, inclusiveness, universality, measurability and consistency.

Data Envelopment Analysis (DEA) is an analytical approach in benchmarking which embeds all characteristics as mentioned. DEA provides a single measurement index (Cooper et al., 2006) which is simple yet in a sense more meaningful as the single judgement is oftentimes more straightforward and clarifying compared to multiple indexes which could lead managers to lean on several metrics and undermine the rest. The quantitative feature of DEA justifies for measurability and consistency, which lacks in qualitative approaches. Moreover, the advantage of DEA which can incorporate multiple inputs and outputs without requiring an explicit functional form relating them (Berg, 2010), suggests the technique to be applicable across various business settings.

DEA application as a benchmarking instrument through deriving SCOR metrics is relatively new to empirical studies. Wong & Wong (2007) initiated a groundwork for such study in using DEA by constructing its variables from a deduction of the SCOR attributes, and demonstrated the applicability of the model in a manufacturing supply chain context. Different from Wong & Wong (2007), this research attempts to incorporate a richer set of derived SCOR metrics such as reliability and agility, as well as to introduce the technique into a more challenging setting. A particular scene that is recognized to be challenging to embrace the widespread business management concepts and tools including SCPM, is that of the small and medium enterprises (SMEs).

Small and Medium Enterprises (SMEs)

SMEs play an important role in a nation's economy, both in developed and developing countries (Lee & Wong, 2015; Garengo & Sharma, 2014; Zhao, 2012; Cassel et al., 2001). Likewise, Beck et al. (2005) signifies the capacity of SMEs in association with GDP per capita growth. Boldizzoni & Serio in Garengo et al. (2005) recognize the increasing competitive business environment as an antecedent towards SME development. Considering this critical post of SMEs, best practices of SCM in conjunction with appropriate PM systems are considered essential for leveraging economic growth, supplementary to enhancing the development and competitive advantage of SMEs.

SMEs and SCM

Basic frameworks and the implementation of SCM in the SME context differ from those of large enterprises (Simamora et al., 2016; Vaaland & Heide, 2007; Arend & Wisner, 2005). SCM models used in large enterprises cannot just be replicated into the SME realm. The smaller-sized companies embed distinct characteristics differentiating them from larger enterprises (Ates et al., 2013; Storey, 2016). For example, Vaaland & Heide (2007) point that SMEs are less focused on any integration systems whatsoever with other actors in

the supply chain. This implies that SMEs tend to accentuate their own benefits and interests, which leads to added total costs along the supply pipeline. Moreover, SMEs put lower regards to formalized planning and control systems (Vaaland & Heide, 2007). Such argument could be related to the limited resources in smaller companies, as well as to shortages of managerial knowledge related to business management. Moreover, the case for smaller enterprises in developing countries is that business owners are usually taking up the role as sole manager of the enterprise, which could deter focused and effective strategic directions. These premises suggest that a more elementary concept related to SCM would be best suited to the SME backdrop in developing countries.

SMEs and Performance Measurement

Given the necessity for SME PM as mentioned earlier, its implementation is concluded to be scarce (Chalmeta et al., 2012). Bititci et al. (2012) pointed out the poor take ups of PM into the SME context. SMEs generally do not fully comprehend to their critical success factors, thus impeding efforts and significance of measurement (Greatbanks and Boaden, 1998). Accordingly, these typical SMEs would not recognize upon critical areas that needs focus for improvement. This may induce costly improvements as well as ambitious changes to irrelevant functions which could lead to business degradation. Moreover, there are arguments that lack of resources and poor involvement of managers and time allocation contribute to the difficulty, negligence, and failure of PM in SMEs (Chalmeta et al., 2012; Garengo et al., 2005; Tenhunen et al., 2001).

Similar to the findings of SCM in SMEs, Taylor & Taylor (2014) remark that PM implementation in large firms is not necessarily the most relevant 'levers' in SMEs. Likewise, Bititci et al. (2012) underline the need to consider the fundamental differences between SMEs and large enterprises when dealing with PM. Instances where popular PM models used by large enterprises fail in SMEs are found in Hvolby & Thorstenson (2000). The arguments laid above points that complex PM systems may as well not be appropriate for SMEs. This leads to a proposition that SMEs would require a more adaptable SCPM which is to be simple enough to be used yet powerful to clarify findings and trigger improvements.

Research Gap

A research gap is identified as absence of suitable PM approaches to measure supply chain performances in SMEs. Moreover, empirical research concerning PM in SMEs is still rare, where the call for studies relating to the topic is recognized on a recurring basis (Raymond et al., 2008; Garengo et al., 2005; Hudson et al., 2001). This research sets to

fill in the particular gap by adapting the SCOR performance attributes into the basic DEA framework to provide a more applicable instrument for SMEs to adopt in regard to SCPM.

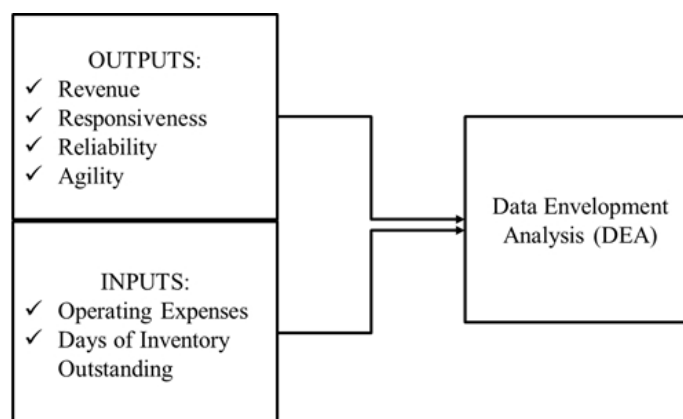
Method

In accordance to the aim of this study, a research hypothesis is formulated as follows:

H₁: If the SCOR-DEA approach is applicable to SME convenience stores, then it will provide a relevant and appropriate medium for supporting organizational decision-making to envisage performance improvements.

Data collection aims to extract essential information as the basis for running the DEA test. The collection of data comprises that of primary and secondary data. Primary data is collected through survey questionnaire directed to the customer side of each company under observation. This data collection aims to assemble metric values which are related to customer services. Deriving from SCOR attributes, this collection of data angles to measure retail responsiveness, reliability, and agility. Secondary data collection on the other hand, aims to capture metric values that have been recorded in internal company reports. Derived from SCOR attributes relative to SME retailing, this type of data aims to record information regarding revenue, operating expenses, and days of inventory outstanding (DIO). Collectively with that of primary data, this pool of figures will be constructed into SCOR input and output viewpoints following Kocaoglu et al., (2013), and will serve as the raw data to conduct the DEA analysis. Figure 2 illustrates the classification of the collected data.

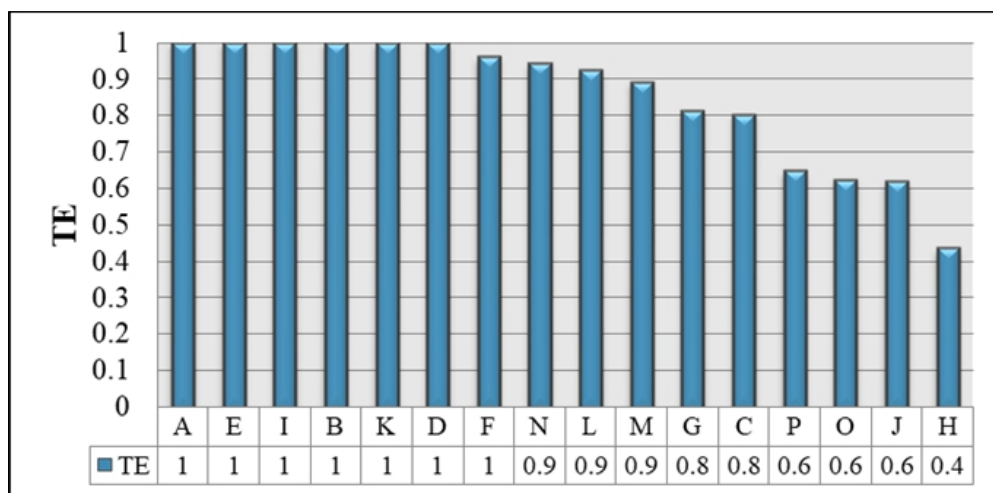
Figure 1 Classification of the SCOR-DEA Variables for DEA



The sampling technique used in this research is purposive sampling. Accordingly, the research sample is chosen based on what is considered appropriate for the study. Sample of this research is that of convenience stores which are categorized as SMEs in Kupang City, East Nusa Tenggara Province, Indonesia. The number of cases for the DEA test in

this research is based on the empirical rule set by Golany & Roll (1989), which sets the minimum number of observations as at least twice the number of DEA variables. 16 convenience stores were selected as the sample for this study, where 12 stores belonged to that of small sized enterprises category, and 4 belonged to that of medium sized enterprises category. The general profile of the sample were that of those trading mainly fast moving consumer goods (FMCG), locally owned (not belonging to a renowned, bigger chain), employs 2-8 workers, and year of establishment ranged from 2004 to 2014.

Figure 2 TE Scores under CRS



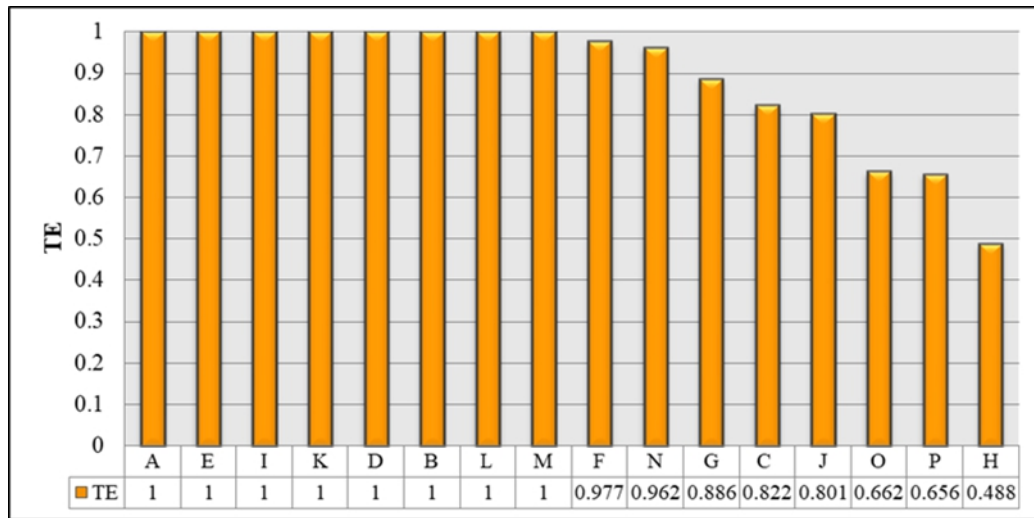
Results and Discussion

DEA Efficiency Scores

TEs under CRS are presented in Figure 3. As evident, 6 DMUs are pointed to be efficient hence rendering the other 10 as inefficient. Units A, B, D, E, I, and K produced TEs of 1 or 100% efficiency, thus proposing the pool to be the best performers and define the efficient frontier. This implies that no other DMUs within the sample can manage to reduce their inputs for given amount of outputs better than those 6 efficient units. With an efficiency rating of 0.435, DMU H is pointed to be the least efficient unit out of the set.

TE scores under VRS are displayed in Figure 4. As observed, 8 DMUs established efficiency scores of 1 hence defining the efficient frontier. The lowest TE is attributed to DMU H with a score of 0.48.

Figure 3 TE Scores under VRS



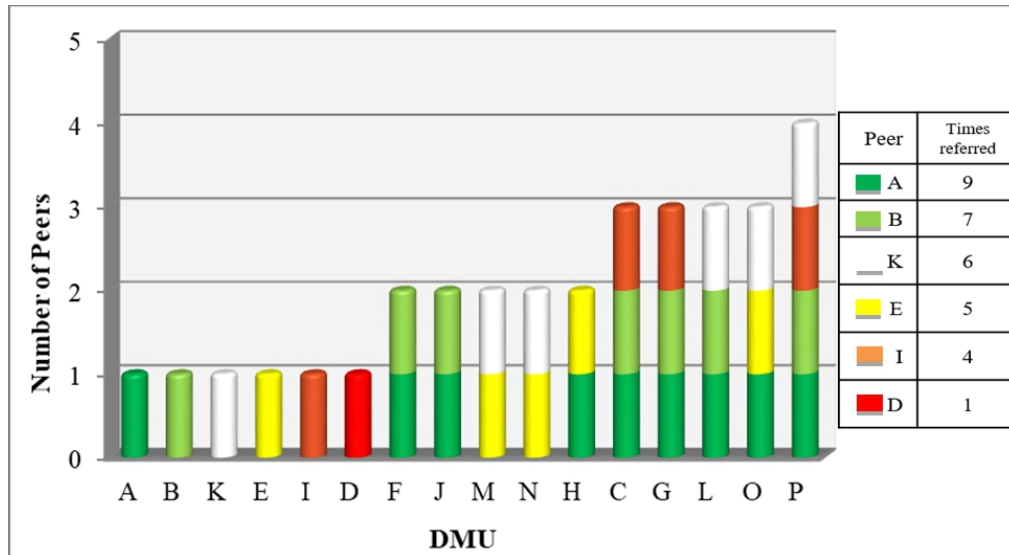
Overall, the TE scores under both returns to scale assumptions show practical discrimination among the retailers under examination. That is, DEA is able to demonstrate disparities in supply chain performances of the DMUs, where 62.5% of the DMUs in the set are rendered inefficient under CRS and 50% are inefficient under VRS. Results of the analysis highlight that DEA accounts for an all-inclusive evaluation of performances based on a variety of variables. If retail performances are to be judged solely based on revenue, which is perhaps the most traditional indicator of business assessment, DMUs with the highest revenues would be construed as the better performers. Contrary, DEA points all 6 retailers with the highest revenues to be inefficient under CRS, and 3 of the top 6 as inefficient under VRS. This shows that the larger size does not simply suggest that better efficiency is at hand, in fact even the smaller sized enterprises have been proven to be efficient. A similar argument can be manifested for the input variables. Having relatively lower level of inputs does not guarantee a firm to lie on the efficient frontier. DMU F, which was recognized to hold the 3rd lowest DIO and the 4th lowest operating expenses, is regarded as inefficient under both return to scale assumptions.

DMU Peers

Figure 4 depicts the summary of DMU peers under CRS. It can be observed that DMUs C and G are both referred to A, B, and I. The linear combination of three units creates a virtual DMU which determines the technical inefficiencies of C and G. Similar grouping of peers are found for DMUs F and J (both referred to A and B) and DMUs M and N (referred to E and K). All inefficient units can therefore obtain insights to reducing their inputs relative to the information provided by their peers, without affecting their outputs. Norman and Stoker (1991) proposed that the most referred to DMUs are those of the robustly

efficient units, while those which are referred to only once or twice are classified as the marginally efficient ones. Referring to Figure 4, DMU A is seen to be referred to at a total of 9 times, thus pointing it to be the strongest unit of the set.

Figure 4 DMU Peers Under CRS



The display in Figure 5 provides the summary of DMUs and their peers under VRS. Similar grouping of peers was only found for units C, F and G, all of which are referred to the linear combination of DMUs A, D, E, and I. DMUs A, E, and I tops the list of peer count and defining the strongest units. The differences between the peers of under CRS and VRS is related to the approaches of the underlying assumptions, one in which VRS is subject to envelope its data points more tightly than that of CRS, thus producing a distinct set of efficient units thus different efficient frontier.

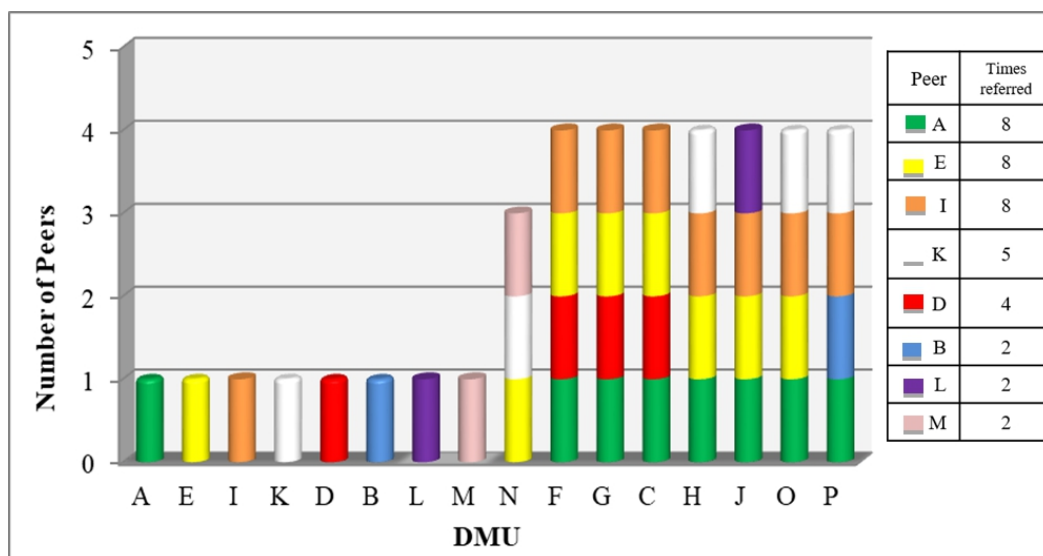
The information on DMU peers can be sought to be beneficial for the DMU managers to focus their attention onto only of a subgroup of DMUs instead of the entire set under analysis. The insights on their “closest” referred competitors could suggest that the managers of the inefficient DMUs may be able to embark upon improving their approaches or practices by looking more closely to that of their DMU peers. This may avoid the DMUs to undertake unnecessary directions by trying to emulate best practices in redundancy or trying to achieve unrealistic targets.

Sensitivity Analysis

As presented in Table 2, DMU H is assigned with the largest amounts of inadequacy of the controllable inputs. With input 1 excess of Rp. 6,499,707.931 and input 2 excesses of around 65 days, both variables translate to a 56.52% slack. The smallest difference was

found for DMU F, with both inputs realizing a 4.01% gap. DMU F should therefore endeavour on a slight cut on its operating expenses and DIO to be equally efficient with its peers. Presented in Table 3, the smallest inputs inadequacy is found for DMU F, with both inputs realizing a 2.29% gap with the efficient frontier. The largest gap is attributed to DMU H, also realizing proportional slacks as 51.16%. The overall results point to some compelling improvement potentials for most of the inefficient retailers. Such improvement however, should be perceived in regard to the ability to actually control the input reductions. Some retail managers may be subject to uncontrollable variables, for example the number of days in which inventory is held due to supplier-related constraints, in such that expected gains could not be realized.

Figure 5 DMU Peers Under VRS



The research projected the SCOR-based DEA approach to fill in the requisite for SCPM in SMEs, and to correspond to the constraints of the poor grasp SMEs have towards SCPM. The data collection process confirmed poor measurement systems in the practice of SMEs; no SCM-related PM systems were identified, and performance assessments were generally based on financial measures. Thus, it highlighted the need for a more comprehensive PM tool for SMEs.

Research results point that the SCOR-based DEA managed to administer a concise, insightful, and simple-enough approach towards SCPM in SMEs. Results in profile of the single, quantitative efficiency index accounts for concise assessments to performance efficacy which provide quick and accurate feedback, conforming to the critical features of PMs (Neely et al., 1996). Peer identification and sensitivity analysis provide specific focus each inefficient store should endeavour to earn efficient status. Accordingly, gross

deficiency of recognition to critical success factors in SMEs (Greatbanks & Boaden, 1998) may be resolved. Moreover, enhanced SME managerial conception is anticipated following the “eye-opening” demonstration of the multiple metric technique, which provided a distinct, comprehensive view to SCPM compared to traditional approaches.

Table 2 Sensitivity Results Under CRS

DMU	Original Value (Rp)		DEA Target Value (Rp)		Difference (Rp)		Percentage	
	Op. Expenses	DIO	Op. Expenses	DIO	Op. Expenses	DIO	Op. Expenses	DIO
C	4,765,500	99	3,822,809.47	79.416	942,690.526	19.584	19.78%	19.78%
F	4,267,500	66	4,096,386.51	63.354	171,113.489	2.646	4.01%	4.01%
G	4,885,500	108	3,963,427.14	87.616	922,072.863	20.384	18.87%	18.87%
H	11,500,000	114	5,000,292.07	49.568	6,499,707.931	64.432	56.52%	56.52%
J	7,350,500	119	4,540,150.75	73.502	2,810,349.250	45.498	38.23%	38.23%
L	23,861,000	141	22,023,577.82	130.142	1,837,422.176	10.858	7.70%	7.70%
M	20,884,500	80	14,975,102.38	71.248	5,909,397.620	8.752	28.30%	10.94%
N	21,990,900	97	18,726,408.94	91.503	3,264,491.062	5.497	14.84%	5.67%
O	11,941,200	86	7,426,913.18	53.488	4,514,286.819	32.512	37.80%	37.80%
P	7,902,100	165	5,113,782.99	106.778	2,788,317.015	58.222	35.29%	35.29%

Table 3 Sensitivity Analysis Under VRS

DMU	Original Value (Rp)		DEA Target Value (Rp)		Difference (Rp)		Percentage	
	Op. Expenses	DIO	Op. Expenses	DIO	Op. Expenses	DIO	Op. Expenses	DIO
C	4,765,500	99	3,919,182.23	81.418	846,317.772	17.582	17.76%	17.76%
F	4,267,500	66	4,169,972.56	64.492	97,527.436	1.508	2.29%	2.28%
G	4,885,500	108	4,329,948.79	95.719	555,551.207	12.281	11.37%	11.37%
H	11,500,000	114	5,616,358.85	55.675	5,883,641.150	58.325	51.16%	51.16%
J	7,350,500	119	5,890,171.69	95.358	1,460,328.313	23.642	19.87%	19.87%
N	21,990,900	97	19,852,591.65	93.333	2,138,308.351	3.667	9.72%	3.78%
O	11,941,200	86	7,907,863.77	56.952	4,033,336.234	29.048	33.78%	33.78%
P	7,902,100	165	5,185,640.06	108.279	2,716,459.936	56.721	34.38%	34.38%

The SCOR-based DEA application was sufficient to overcome particular weaknesses apparent in the widespread SCPM tools. The proportionate use of financial and non-financial metrics alludes to overcome the lack of such balance as pointed by Gunasekaran et al. (2001). Likewise, the shortfall of customer focus (Gunasekaran et al., 2001) was abridged by the customer-facing measures. The DEA model embodied a more inclusive SCOR-derived metrics than that of Wong & Wong (2007) which overlooked reliability and agility dimensions. Agility in particular is a fundamental feature of SMEs, which is

advocated to not be excluded in assessment measures for the related context. Melnyck et al. (2014) argued that the widespread SCPM tools are deficient to assert metrics flexibility. Correspondingly, the SCOR-based DEA demonstrated a flexible selection and usage of metrics, which was justified through the SCOR attributes deduction to adjust for the elementary blueprint of SMEs in Indonesia, which severely lacks in supply chain metrics development and comprehensive data recording. Referring to the capacity of the SCOR-based DEA approach to present a relevant and appropriate instrument for SMEs to envisage performance improvements, the hypothesis proposed in Section 3.1 is attested to be true.

SMEs tend to be at the lower end for formalized planning and control systems (Vaaland & Heide, 2007). Therefore, the sole judgment factor of DEA's efficiency index and peer group identification are anticipated to be more appealing compared to lengthy, complex assessments in regard to engaging managers into improvement initiatives. Pooling of peers allows for the inefficient stores to look for closely-related references. Such is quantitatively reflected in the sensitivity analysis. Each input can be pushed to be reduced to the amount assigned collectively by the peer units. The peer units however, do not only suggest for inputs treatment. Protocols to enhance outputs can also be derived by mirroring that of the peers. For instance, an inefficient store may seek on identifying distinct service features in the peer group related to agility, which is perhaps the most visible differentiator to be recognized. Accordingly, that store may be able to enhance the variety of products being sold to push for output improvement.

Traditional based performance measures give misleading signals for improvement (Neely, 1998; Kaplan & Norton, 1992). Such which were apparent among the SMEs could be related to the incomprehension towards PM benefits (Taticchi et al, 2010), which creates negligence of embracing PM systems. Data analysis illustrated inadequacy of the traditional measures to provide a holistic evaluation towards supply chain performance, therefore highlighting the potential of the SCOR-base DEA to reconcile these issues. Accordingly, SMEs are expected to be more enticed to take up the more innovative PM approach. Furthermore, the SCOR-based DEA is considered beneficial to provide SMEs with recognition upon standard critical supply chain indicators. As the retailers do not apprehend to such measures (evidenced though the absence of recording of indicators such as DIO and all service-related metrics), the study is anticipated to create awareness of these key indicators. The store managers therefore can encourage recordings of the related supply chain indicators, up to the extent to developing their own KPIs that correspond to strategic considerations. A technology-based platform of data recordings

may be initiated among the chains to keep track of performances. Such initiative is strongly advocated by Taticchi et al. (2010) who assert that effective take-ups of PMs in SMEs should be conditioned with adequate IT tools. Moreover, DEA can be employed by the stores for future efficiency assessments as they grow and expand into multiple chains. Managers may seek more applicable metrics for the analysis, complementing to strategic and contextual considerations. As SMEs are subject to a flexible and dynamic environment (Ates et al., 2013; Zhao, 2012; Garengo et al., 2005), the freedom to devise their own set of metrics is deemed largely imperative. This indeed, can be facilitated through the SCOR-based DEA approach.

Conclusion

This research was initiated due to the necessity for and lack of SCPM empirical studies and applications in SMEs (Raymond et al., 2008; Garengo et al., 2005; Hudson et al., 2001). A SCOR-based DEA model was projected to serve the SME retailing context in Indonesia, and was validated to administer a relevant and appropriate medium for the SMEs to envisage for future improvement initiatives. Constraints to SCPM (Bititci et al., 2012; Chalmeta et al., 2012, Vaaland & Heide, 2007; Garengo et al., 2005; Tenhunen et al., 2001; Hvolby & Thorstenson, 2000; Greatbanks & Boaden, 1998) were addressed by employing a simple and flexible benchmarking application which incorporated multiple and relatable metrics to the conformance of the elementary settings of SMEs. Unique SCOR-derived metrics were constructed to meet the blueprint of SMEs in Indonesia, which was short of convenient bookkeeping hence ready-to-use data.

The insights obtained from the DEA results assisted the SME store managers to identify how well they are currently performing relative to their competitors, as well as to provide directions to which specific areas they should venture on. This includes the pooling of benchmarking units or peers for more closely references to better practices. Particularly, an important insight was conveyed in regard to the value of an all-rounded, multiple metric approach which proved to provide a more holistic and meaningful assessment. Accordingly, this could lead the store managers to depart from traditional measurement systems which rely on financial, single metrics which alludes to misleading improvement signals (Neely, 1998; Kaplan & Norton, 1992). The store managers may realize that higher revenues do not necessarily minister efficiency, nor does mere smaller expenses. Poor perceptions of SMEs towards PM benefits (Taticchi et al., 2010) can therefore be reformed. At the slightest, the results are expected to trigger awareness among the SMEs upon the importance of PM systems as well as a rough overview of basic supply chain critical factors. This in turn is anticipated to prompt the stores for better data recording and

keeping, and to engage on the development of more relevant metrics and PM initiatives. However, the limitation to the DEA benchmarking application lies on the requirement for proper information technology infrastructure and human capital in order to optimize the application itself, one which could be a constraint for SMEs.

This study provided a groundwork for the application of a SCOR-based DEA in retailing SMEs. Future studies could include several renowned practitioners of the underlying sector into the analysis to seize richer insights. Multiple time periods could also be useful in capturing seasonal trends, which would likely affect policies in such as inventory levels. Furthermore, additional DEA variables could be tested as to be derived from the level-1 SCOR metrics, which could provide a deeper and more comprehensive assessment relating to DEA discrimination and resource reallocation scenarios.

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