Supply Chain Business Intelligence and the Supply Chain Performance: The Mediating Role of Supply Chain Agility

Wissawa Aunyawong[*1], Phutthiwat Waiyawuththanapoom[#2], Sittichai Pintuma[#3], Phichitphol Sitthipo[#4]

[*1,2,3] *College of Logistics and Supply Chain, Suan Sunandha Rajabhat University, Thailand*
[#4] *Faculty of Business and Technology, Stamford International University, Thailand*
Corresponding author: [1]wissawa.au@ssru.ac.th
[2]phutthiwat.wa@ssru.ac.th
[3]sittichai.pi@ssru.ac.th
[4]phichitphol.sitthipo@stamford.edu

Abstract- **The study has planned to examine the impact of the supply chain business intelligence on the supply chain performance of the Indonesian firms. Additionally, the study has examined the mediating role of agile capability and supply chain capability. For data gathering, total 450 questionnaires were distributed and obtained only 325 questionnaires. During data screening process 23 questionnaires were excluded, since they were incomplete. Therefore, we obtained 67% response rate for the survey in present study. Partial Least Square-Structural Equation Modeling (PLS-SEM) is an important statistical procedure to carry out multivariate data analysis, Empirical analysis in this study supports the supply chain business intelligence competence with respect to technical, cultural and managerial competence. This indicates that it is necessary to utilize appropriate technologies and tools and have well-defined processes, although these are not sufficient conditions to develop business intelligence product efficiently and effectively, such as, relevant knowledge and information which facilitate in the decision-making functions of the supply chain. Besides, some inter- and intra-organizational culture elements also affect the business intelligence product creation. The prior research further supported the significance of knowledge/information-related competences to enhance agile performance characteristics and competitive performance of the supply chain.**

Keywords; *Supply Chain, Agility, Performance, Indonesia*

1. Background

Today, firms have acknowledged the significance of knowledge and information. Prior researches have reported that significant investments in enterprise systems and software have been made, such as in SC management (SCM) to make enterprise systems as the foundation for an organization[1] . Although, majority of the businesses are striving for competitive advantage. At this point, the need for effective decision-making tools has emerged to support information applications and analysis by the enterprise systems. In this regard, business intelligence (BI) is identified as an appropriate response for addressing the present needs regarding quick, easy, relevant and right access to information[2].

The intensive information technology (IT) usage allows informed and better decision-making by the managers, under different contexts [3, 34-35]. In 1989, Howard Dresner introduced the BI term to explain different methods, processes and concepts for improving the decision-making process of business through evidence-based support systems [4]. In today's business community, BI is becoming popular with its increasing significance in the effectiveness and efficiency of decision-making and information analysis, at different levels, such as, tactical, operational and strategic. The global BI system (BIS) spending in performance management and analytics applications in 2011 has reached to the level of $12.2 billion dollar from $10.5 billion, indicating the growing significance of this system. However, the literature review indicates the lack of attention in this area as well as in various BI research strategies and categories [5].

Due to a shift of modern competition from single firms to the SCs, it is becoming increasingly critical to improve SC competitiveness for the business success [6]. SC agility has been identified as a key competitiveness component in today's business environment, thereby enabling firms to achieve better competitive position, through timely and effective responding to uncertainties and market volatility [7]. SC agility is the SC's ability to deal with unexpected changes and turbulence in business environment and competitive market, and provide firms with competitive advantage through the conversion of threats and uncertainties into opportunities, using knowledge, assembling requisite assets, and relations with surprise and speed [8]. However, several prior researches have studied the effective role of information technologies and systems (IT/IS) to become agile, but only a few researches have studied agility and BI relationship, under SC context [9]. This study is motivated primarily due to the difference in BI (BI) from information technology

(IT/IS), and having its own consequences and characteristics.

This study aims to bridge the gap in the literature by analyzing that how SCBI competence affects the SC agility. In broader sense, SC can be viewed as the SC agility, and the inter-organizational SC, which are further discussed from two dimensions, namely, the agile performance and agile capabilities. In this regard, the study will also investigate the agile capabilities' role as a mediator on the agile SC performance and BI competence relationship [10]. Furthermore, the current study aims to address the need to conduct BI related empirical studies, particularly, on how it brings improvement in the organization's performance capabilities[11].

2. Hypothesis Development

Literature provides various definitions for the BI (BI) concept, from different contexts. The BI-related literature indicates a distinction among two approaches, which define the technical and managerial concepts [12]. In context to managerial context, BI refers to 'a systematic and organized process to integrate, acquire, disseminate and analyze information from significant external and internal sources, for decision-making and exhibiting strategic business dimensions'[13]. In this regard, the primary focus is to achieve excellence in management decision-making process and obtaining and generating relevant information at the right time and to the right people[14]. While from the technical context, BI refers to 'a set of technologies and tools, including data mining, data warehousing, dashboards, online analytical processing, reporting and analytic tools, etc. which allow information gathering, recovery, recording, analysis, and manipulation; and also help in better decision-making'. In this context, the role of BI is to support the above described BI process [15]. Basically, the BI's technical and managerial approaches share complementary relationship with the aim of providing potential and useful information for supporting the decision-making activities. In another definition, BIS is defined as 'a set of technological components, such as, applications, processes, and software tools which enable the effective production as well as distribution of the potentially useful and accurate information'[12]. Besides technical and managerial contexts, another approach exists which views BI as a product. According to this approach, 'BI is the relevant knowledge and information which explains business environment and organization under different markets, for different suppliers and customers, and under different industry trends and technologies'[16]. It shows the BI's broader view, which particularly emphasizes on business information, which supports the firm's decision-making process and is an outcome of BI technologies and processes. Therefore, the product perspective of BI is the outcome of technical and managerial approaches.

The BI competence refers to 'the organizational ability of generating BI product and then utilize this for efficient and effective business decision-making. Thus, the SC BI competence is 'the ability of sharing supply-chain based knowledge and information which facilitates the process of SC decision making at various levels, i.e. outsourcing, procurement, strategic network planning, lot sizing and detail scheduling [17]. It thus integrates information on business environment and both downstream and upstream SC partners. Based on the BI's product perspective, the SC's BI competence is characterized by technical and managerial competences. In addition, cultural competence is another required dimension for developing SC BI competence. Cultural competence is defined as 'the SC partners' ability of developing effective and strong BI culture'. It is consistent with information and knowledge related definitions, according to which BI culture is based on a belief that in most SCM activities BI is a widely used concept, in addition, the BI value is a strategic asset to attain SC success and benefits [18].

Furthermore, the planned processes and benefits of BI technologies and tools to analyze and manipulate information are unlikely to achieve and realize business success. According to [18], in terms of SC context, the BI culture is the inter-and intra-organizational culture elements which may influence BI sharing, utilization and creation in the SC [19]. BI mainly focuses on effective flow of communication, information and relationships at the level of SC. Therefore, the SC's BI culture integrates commitment and trust as the critical SC factors to be developed among the SC partners, and which may affect both information quality and information sharing, and the absence of which may make companies unwilling in frequent and honest information sharing to improve SC decision-making [20]. Besides, there are other factors like, collaboration and cooperation between downstream and upstream SC partners, which can be described as 'the degree of combined decision-making and problem solving across the SC', for instance, goal setting, process development, forecasting, inventory management, new product development and planning. Therefore, based on the aforementioned discussion, the following hypothesis is proposed

H1: SCBIC has significant impact on the SCHPR

SC agility concept comprises of two components, namely, i) the alertness of SC toward changes and surrounding environment, i.e. the ability of SC to reconfigure resources of the SC, in order to react against changes, and ii) the response capability. In the first SC agility component, the SC's opportunity-seeking capabilities are included, and the second component highlights the SC's change-enabling capabilities, indicated at the operational, episodic and strategic levels [21]. Thus, study presents the six fundamental capabilities that comes under SC agility. The agile capabilities and SC BI

competence relationship can be better understood under competence-capability relationship context. According to [22] SC agile capabilities have been derived from SC competences and are focused externally, while on the other hand, BI competence is an antecedent of agile capabilities and is focused internally. A number of empirical researches discussed how knowledge/information-related competence may significantly contributes in developing agility at SC or enterprise level. According to [23], agility is the utilization of market knowledge and information for pursuing potential opportunities, thereby confirming that information enrichment gives rise to superior SC agility.

A SC is truly agile if it possesses four characteristics, three of these characteristics are: virtuality, process integration, and market sensitiveness, which are information-based in nature. [23] also acknowledged that knowledge management capabilities and knowledge significantly contribute in developing enterprise agility. A few researchers highlighted the IT capabilities' role in creating response and sensing capabilities. Furthermore, another study [24] also confirmed the positive association among agile SC capabilities and IT competence, where IT competence refers to 'the extent that information technology is utilized in an effective manner for managing information'. In this regard, it is argued that in terms of technical, cultural, and managerial competence, the SC BI competence significantly contributes in developing agile capabilities. These capabilities improve the ability of alertness through relevant knowledge and information provision, regarding general business environment and SC itself [21]. In addition, it enhances the quickly responding ability against changes, through making well-informed reconfiguration decisions of the SC, which is one of the significant components of SC's response process. Thus, it is hypothesized that:

H2: SCBIC has significant impact on the AGCAB

H3: AGCAB has significant impact on the SCHPR.

The SC agility is also described as the SC's agile performance. It thus relates to the successful marketing of wide range of high-quality and low-cost products, with different volumes and short lead times, which add more value to the customers [7]. Thus, the agile SC performance integrates SC performance outcomes, particularly those which have achieved competitiveness and success under turbulent and dynamic business environment, for instance, process changeover times, customer satisfaction, technological competitiveness, delivery performance, product innovation and stock turns [25]. Therefore, given the SC BI competence definition, 'it is a resource which satisfies the organization's RBV criteria to achieve and maintain competitive advantage'[26]. Therefore, it can be argued that BI competence contributes in enhancing SC agile performance. Some researchers attempted to address BI's potential role in improving performance and competitiveness, under same line of reasoning. Such as,[27] identified the ways in which BIS influences both organizational and business process performance. Furthermore, it has also been argued that bringing improvement in the efficiency and effectiveness of SC analytics through BI approach serves as an important element in achieving competitive advantage. In addition, a study of [2] found a positive impact of business analytics capabilities on core SC processes performance, such that, plan, make, source and deliver. Moreover, several researchers have recognized knowledge/information related competences as a potential source to achieve superior competitive performance, with regards to new product development cost, responsiveness, and overall customer satisfaction. These findings give rise to the following hypothesis:

H4: AGCAB mediates the relationship between the SCBIC and SCHPR.

SCs refers to 'a set of firms which closely work in a network and constantly require improvement in their capacity and operations, either by customers or suppliers'. Agility has gained significant attention in SC management research and production research, because of its managerial significance[28]. Thus, SC agility (SCA) refers to 'a dynamic capability, which allows organizations to quickly respond and adapt to market and demand changes, throughout the SC'[29]. Therefore, SCA extends from the single-firm context to the SC level and also includes alignment among major suppliers and customers. [1] recently conducted studies on SCA, where former attempted to analyze SCA-integration relationship, while the latter analyzed the empirical works on SCA and assessed the possible association among operational performance and SCA. Just like AC, SC agility (SCA) is a multi-dimensional and a broad concept covering various disciplines. With the increased recognition of the positive effects of agility, various concepts have been offered by the researchers regarding agility. In addition, they also proposed various normative frameworks for describing the possible associations between agility and variables of interest. In another study,[30] did a review of agility-related models, suggesting both disadvantages and advantages of each model for SCA. Thus, in this study, the aim is to seek for an effective framework which may identify the enablers of agility across firms and what characteristics must be possessed by a SC to become agile, since frameworks which are single-firm and internally oriented are likely to be theoretically non-useful in creating a connection among SCA and AC.

In this study, we adopted [3] developed framework, which has also been adapted by [4]. The main features of an agile SC include: network-based and virtual, process integration and market sensitivity. The market sensitivity dimension enables the SCs to better anticipate the threats

and opportunities and respond to real demands, while the virtual SCs are the SCs that are information-based and not inventory-based, and they work by using IT for online data sharing between suppliers and buyers [31]. In a similar vein, agile SC tends to establish collaborative relationship between SC members, as those firms that share high collaboration can effectively and quickly respond to market changes. At last, the term process integration refers to 'the common systems, collaboratively working among suppliers and buyers, shared information and joint product development'[32]. Such characteristics in SCs enable them to quickly adapt in response to market changes and become competitive [33].

H5: SCBIC has significant impact on the SCAGL

H6: SCAGL has significant impact on the SCHPR.

H7: SCAGL mediates the relationship between the SCBIC and SCHPR.

3. Methodology

For data collection, we employed structured questionnaire and for data analysis we used quantitative approach. For this study, the targeted population is the Small and Medium Enterprises (SMEs) in Indonesia. The sample in this study were selected through convenient sampling, because this technique is appropriate for this research context. However, the informers of this study include business owners and business partners, managers or executives associated to Indonesian SMEs. For obtaining effective and useful information, the door-to-door survey was also conducted [34].

For data gathering, total 450 questionnaires were distributed and obtained only 325 questionnaires. During data screening process 23 questionnaires were excluded, since they were incomplete. Therefore, we obtained 67% response rate for the survey in present study. Partial Least Square-Structural Equation Modeling (PLS-SEM) is an important statistical procedure to carry out multivariate data analysis, and to find possible association among observed and latent variables. In terms of analysis, it has an important advantage of handling multiple independents and dependents, and is capable of handling missing data and screening, multi-collinearity problem among the explanatory variables, making stronger and appropriate predictions and creating independent latent variables for the dependent variables.

4. Results

This section involves the discussion regarding PLS-SEM analysis. The first part in PLS-SEM analysis is the outer or the measurement model. Outer model indicates that part of the model which describes the nature of association among latent variable and its indicators. Measurement model has two parts, namely, reflective blocks and formative blocks. In outer model, the all items and components of each variable are measured and determines that whether the items (indicators) load theoretically well on their respective constructs. Simply put, the outer model analysis confirms that all survey items are appropriately measuring those constructs which they were intended to measure, thereby confirming that the items are valid and reliable.

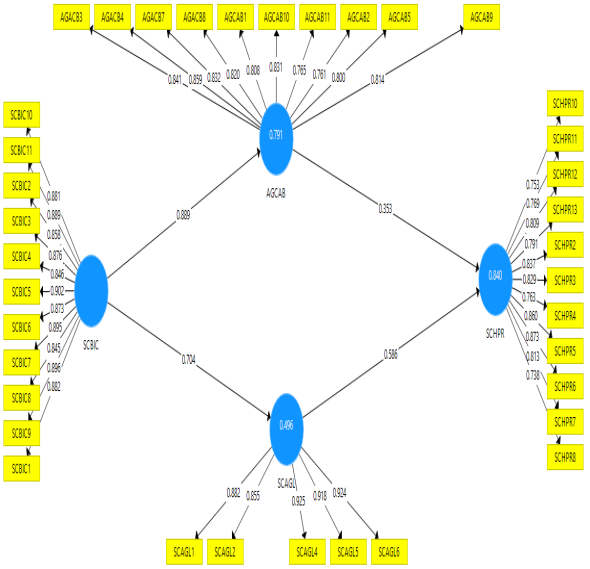

Figure 1. Measurement Model

Table 1. Reliability

	AGCAB	Cronbach's Alpha	CR	AVE
AGACB3	0.841	0.943	0.951	0.662
AGACB4	0.859			
AGACB7	0.832			
AGACB8	0.820			
AGCAB1	0.808			
AGCAB10	0.831			
AGCAB11	0.765			
AGCAB2	0.761			
AGCAB5	0.800			
AGCAB9	0.814			
SCAGL1	0.882	0.942	0.956	0.812
SCAGL2	0.855			
SCAGL4	0.925			
SCAGL5	0.918			
SCAGL6	0.924			
SCBIC10	0.881			
SCBIC11	0.889			
SCBIC1	0.882	0.970	0.973	0.769
SCBIC2	0.858			
SCBIC3	0.876			
SCBIC4	0.846			
SCBIC5	0.902			
SCBIC6	0.873			

SCBIC7	**0.895**			
SCBIC8	**0.845**			
SCBIC9	**0.896**			
SCHPR10	**0.753**	**0.945**	**0.953**	**0.647**
SCHPR11	**0.769**			
SCHPR12	**0.809**			
SCHPR13	**0.791**			
SCHPR2	**0.837**			
SCHPR3	**0.829**			
SCHPR4	**0.763**			
SCHPR5	**0.860**			
SCHPR6	**0.873**			
SCHPR7	**0.813**			
SCHPR8	**0.738**			

The key measures of PLS-SEM analysis are validity and reliability, which are observed for outer model evaluation [33]. Thus, for each construct, the Cronbach alpha coefficient and CR values were obtained in current research, and Table 5.8 indicates that all these values are within the recommended range, i.e. above 0.70 [34]. In current study, the composite reliability (CR) values turn out as 0.83-0.91, which shows that the measurement model is reliable. Thus, once the reliability and validity are established, the convergent validity is determined in the next step, which shows the point that two measures of the same constructs which are supposed to be theoretically related are actually found as related. Thus, [33] suggest that convergent validity is successfully assessed when it indicates high correlation among other tests for measuring a similar construct. In the same context, AVE is employed to identify a convergence element in measuring the construct, having 0.50 or above as a standard value [34].

Afterwards, the study established the discriminant validity, which represents the extent that a construct differs in comparison to other constructs. It also refers to measures of constructs which are theoretically unrelated [7]. For measuring discriminant validity, Fornell-Larcker criterion is the conventional approach. Besides, another more liberal approach can also be used, namely cross-loading examination method, as it is expected to exhibit more constructs having adequate discriminant validity.

Table 2. Validity

	AGCAB	SCAGL	SCBIC	SCHPR
AGCAB	**0.894**			
SCAGL	0.889	**0.901**		
SCBIC	0.879	0.804	**0.877**	
SCHPR	0.860	0.704	0.733	**0.804**

Previously, validity and reliability tests were carried out to assess the results of the outer or the measurement model. These tests have assessed the measurement model's ability and existing relationships among study items. Moreover, another important criterion is checking for the multi-collinearity, which must be checked before estimating the structural model [7]. A systematic analysis of the structural model is done in this study to test the set of hypotheses (1-5) and to get comprehensive picture of the study outcomes. The inner model evaluation begins by estimating the direct association among dependent and independent variables in the model. PLS-SEM algorithm was used for assessing the size of path-coefficients, while, their significance was determined using bootstrapping method in Smart PLS.

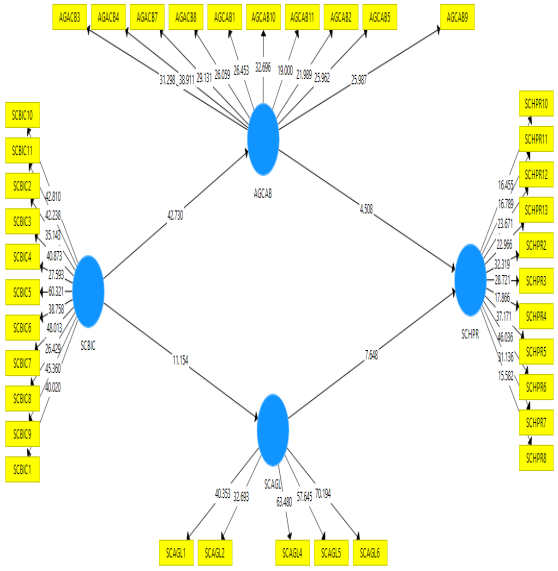

Figure 2. Structural Model

Table 3. Direct Relationships

	(O)	(M)	(STDEV)	(|O/STDEV|)	P Values
AGCAB -> SCHPR	0.353	0.357	0.078	4.508	**0.000**
SCAGL -> SCHPR	0.586	0.584	0.077	7.648	**0.000**
SCBIC -> AGCAB	0.889	0.890	0.021	42.730	**0.000**
SCBIC -> SCAGL	0.704	0.706	0.063	11.154	**0.000**
SCBIC -> SCHPR	0.727	0.729	0.052	14.034	**0.000**

[35] suggest that association among dependent and independent variables may occur due to the indirect

mediation effect, which is considered as a second important requirement for achieving significant relationship among variables. It is in fact the independent variable's effect on mediator as well as on dependent variables. Thus, if independent variable has an insignificant effect on the dependent variable with the involvement of mediator, then it shows no effect of mediation on the variables.

Table 4. Mediation

	(O)	(M)	(STDEV)	(|O/STDEV|)	P Values
SCBIC -> AGCAB -> SCHPR	0.314	0.318	0.073	4.326	**0.000**
SCBIC -> SCAGL -> SCHPR	0.413	0.410	0.053	7.772	**0.000**

Coefficient of determination is commonly used to analyze the study's conceptual model [18]. The R^2 values like 0.02, 0.13 and 0.27 are represented as weak, moderate and fair values, respectively. For structural model assessment, predictive relevance ability of a model is another important criterion which must be observed.

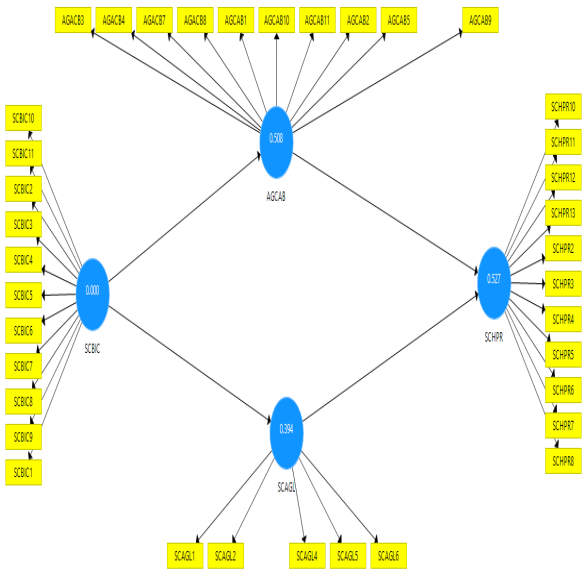

Figure 3. Blindfolding

For this purpose, Stone-Geisser's (Q^2) test can be used for measuring the predictive relevance through blindfolding procedures [7]. Thus, for endogenous latent constructs, the cross-validated redundancy measure was obtained through Stone-Geisser test to estimate Q^2 value through blindfolding procedure.

Table 5. Q-square and R-square

	SSO	SSE	Q^2	R Square
AGCAB	2170.000	1067.504	0.508	0.791
SCAGL	1085.000	656.990	0.394	0.496
SCHPR	2387.000	1129.630	0.527	0.840

5. Conclusion

Empirical analysis in this study supports the SC BI competence with respect to technical, cultural and managerial competence. The previous researches such as[19] may provide justification for the multi-dimensionality of SC BI competence, by suggesting dissociation among BI approaches and the corresponding association among these approaches. This indicates that it is necessary to utilize appropriate technologies and tools and have well-defined processes, although these are not sufficient conditions to develop BI product efficiently and effectively, such as, relevant knowledge and information which facilitate in the decision-making functions of the SC. Besides, some inter- and intra-organizational culture elements also affect the BI product creation. Therefore, there is a need to develop a supportive and strong BI culture between the partners of SC for smooth functioning of BI technologies and processes. This is also consistent with those prior researches which particularly focused on the significance of knowledge and information culture for superior performance and business success [15].

The impact of SC BI competence on SC agile capabilities is also supported by the study results. Therefore, in BI process, the higher the SC competence levels with specific BI culture, using BI technologies and tools, the higher will be the response capability in operational, episodic and strategic SC areas and level of alertness to change. As expected, the findings also support that BI does not merely manifest quickly change detecting ability outside and within the SC, rather it facilitates in making informed and better decisions about SC resource reconfiguration and appropriate actions against identified changes in a timely manner. These two constructs were reported to share a significant positive association, which can also be considered under competence-capability framework, since this framework perceive BI competence as the agile capabilities factor and an internally focused factor. In addition, the empirical evidence obtained in this study is also consistent with prior researches [10] and reported knowledge and information as the major contributory factors in developing SC agility, with regards to response and sensing capabilities. Moreover, SC BI competence is found to influence SC agile performance, through agile capabilities, both indirectly and directly. Such impact on agile performance indicates that SC competence in BI technologies, culture and process is likely to bring improvement in the SC performance, particularly in dimensions which specify competitiveness and success level under turbulent and dynamic

environment. Direct impact of BI competence ascribes the differences in SC's agile performance to the differences in BI competence. It supports the BI competence value as a key business resource, in RBV context. The arguments from the literature [16] on BI's beneficial effects in SC can be used to justify the obtained evidence.

REFERENCES

[1] S. Trivedi, S. Negi, N. Anand, R. Patankar, and G. Kumar, *"ERP solution for effective supply chain of micro, small and medium-sized enterprises: a case study of customised ERP solution development and deployment for MSMEs in the Haryana state of India,"* International Journal of Business Innovation and Research, Vol. 17, pp. 516-535, 2018.

[2] S. Rouhani, A. Ashrafi, A. Z. Ravasan, and S. Afshari, *"The impact model of business intelligence on decision support and organizational benefits,"* Journal of Enterprise Information Management, 2016.

[3] A. Gunasekaran, N. Subramanian, and T. Papadopoulos, *"Information technology for competitive advantage within logistics and supply chains: A review,"* Transportation Research Part E: Logistics and Transportation Review, Vol. 99, pp. 14-33, 2017.

[4] D. Arnott and G. Pervan, *"A critical analysis of decision support systems research revisited: the rise of design science,"* in Enacting Research Methods in Information Systems, ed: Springer, 2016, pp. 43-103.

[5] V.-H. Trieu, *"Getting value from Business Intelligence systems: A review and research agenda,"* Decision Support Systems, Vol. 93, pp. 111-124, 2017.

[6] H. Michelson, S. Boucher, X. Cheng, J. Huang, and X. Jia, *"Connecting supermarkets and farms: the role of intermediaries in Walmart China's fresh produce supply chains,"* Renewable Agriculture and Food Systems, Vol. 33, pp. 47-59, 2018.

[7] A. T. Chan, E. W. Ngai, and K. K. Moon, *"The effects of strategic and manufacturing flexibilities and supply chain agility on firm performance in the fashion industry,"* European Journal of Operational Research, Vol. 259, pp. 486-499, 2017.

[8] I. Reid, H. Ismail, and H. Sharifi, *A framework for operational agility: how SMEs are evaluating their supply chain integration,* in Managing in a VUCA World, ed: Springer, 2016, pp. 151-168.

[9] S. Fayezi, A. Zutshi, and A. O'Loughlin, *"Understanding and development of supply chain agility and flexibility: a structured literature review,"* International Journal of Management Reviews, vol. 19, pp. 379-407, 2017.

[10] M. Tarafdar and S. Qrunfleh, *"Agile supply chain strategy and supply chain performance: complementary roles of supply chain practices and information systems capability for agility,"* International Journal of Production Research, Vol. 55, pp. 925-938, 2017.

[11] L. Fink, N. Yogev, and A. Even, *"Business intelligence and organizational learning: An empirical investigation of value creation processes,"* Information & Management, Vol. 54, pp. 38-56, 2017.

[12] M. Banerjee and M. Mishra, *"Retail supply chain management practices in India: A business intelligence perspective,"* Journal of Retailing and Consumer Services, Vol. 34, pp. 248-259, 2017.

[13] A. Intezari and S. Gressel, *"Information and reformation in KM systems: big data and strategic decision-making,"* Journal of Knowledge Management, 2017.

[14] Y. M. A. Amuna, M. J. Al Shobaki, and S. S. A. Naser, *"The Role of Knowledge-Based Computerized Management Information Systems in the Administrative Decision-Making Process,"* 2017.

[15] G. Zheng, C. Zheng, and L. Li, *"Bringing business intelligence to health information technology curriculum,"* Journal of Information Systems Education, Vol. 25, p. 6, 2019.

[16] M. Moniruzzaman, S. Kurnia, A. Parkes, and S. B. Maynard, *"Business intelligence and supply chain agility,"* arXiv preprint arXiv:1606.03511, 2016.

[17] K. Luokkanen-Rabetino, A. Rajala, I. Sillanpää, and K. Shahzad, *Supply Chain Intelligence,* in Real-time Strategy and Business Intelligence, ed: Springer, 2017, pp. 193-223.

[18] D. Arunachalam, N. Kumar, and J. P. Kawalek, *"Understanding big data analytics capabilities in supply chain management: Unravelling the issues, challenges and implications for practice,"* Transportation Research Part E: Logistics and Transportation Review, Vol. 114, pp. 416-436, 2018.

[19] R. Rajaguru and M. J. Matanda, *"Role of compatibility and supply chain process integration in facilitating supply chain capabilities and organizational performance,"* Supply Chain Management: An International Journal, 2019.

[20] N. Zaheer and P. Trkman, *"An information sharing theory perspective on willingness to share information in supply chains,"* The International Journal of Logistics Management, 2017.

[21] N. A. Manaf and K. Ibrahim, *"Poverty reduction for sustainable development: Malaysia's evidence-based solutions,"* Global Journal of Social Sciences Studies, Vol. 3, No. 1, pp. 29-42, 2017.

[22] P.C. Mahesh, *"Empowering youth through youth engagement in social action in India,"* International

Journal of Innovation, Creativity and Change, Vol. 4, No. 1, pp. 16-28, 2018.

[23] W. Okoumba, *Supply chain management best practices, agility, risk management and performance in small and medium enterprises in South Africa,* Vaal University of Technology, 2018.

[24] H. Liu, S. Wei, W. Ke, K. K. Wei, and Z. Hua, *"The configuration between supply chain integration and information technology competency: A resource orchestration perspective,"* Journal of Operations Management, Vol. 44, pp. 13-29, 2016.

[25] M. S. S. Jajja, K. A. Chatha, and S. Farooq, *"Impact of supply chain risk on agility performance: Mediating role of supply chain integration,"* International Journal of Production Economics, Vol. 205, pp. 118-138, 2018.

[26] D. Mishra, Z. Luo, B. Hazen, E. Hassini, and C. Foropon, *"Organizational capabilities that enable big data and predictive analytics diffusion and organizational performance,"* Management Decision, 2018.

[27] M. Tavana, K. Szabat, and K. Puranam, *Organizational productivity and performance measurements using predictive modeling and analytics:* IGI Global, 2016.

[28] D. J. Ketchen Jr and G. T. M. Hult, *"Bridging organization theory and supply chain management: The case of best value supply chains,"* Journal of Operations Management, Vol. 25, pp. 573-580, 2007.

[29] T. J. Pettit, K. L. Croxton, and J. Fiksel, *"The evolution of resilience in supply chain management: a retrospective on ensuring supply chain resilience,"* Journal of Business Logistics, Vol. 40, pp. 56-65, 2019.

[30] A. Martinez-Sanchez and F. Lahoz-Leo, *"Supply chain agility: a mediator for absorptive capacity,"* Baltic Journal of Management, 2018.

[31] M. J. Braunscheidel and N. C. Suresh, *Cultivating supply chain agility: managerial actions derived from established antecedents,* in Supply Chain Risk Management, ed: Springer, 2018, pp. 289-309.

[32] K. Korpela, J. Hallikas, and T. Dahlberg, *"Digital supply chain transformation toward blockchain integration,"* in proceedings of the 50th Hawaii international conference on system sciences, 2017.

[33] J. F. Hair, J. J. Risher, M. Sarstedt, and C. M. Ringle, *"When to use and how to report the results of PLS-SEM,"* European Business Review, 2019.

[34] Jermsittiparsert, K. & Pithuk, L. (2019). Exploring the Link between Adaptability, Information Technology, Agility, Mutual Trust, and Flexibility of a Humanitarian Supply Chain. International Journal of Innovation, Creativity and Change, 5(2), 432-447.

[35] Thongrawd, C., Bootpo, W., Thipha, S., & Jermsittiparsert, K. (2019). Exploring the Nexus of Green Information Technology Capital, Environmental Corporate Social Responsibility, Environmental Performance and the Business Competitiveness of Thai Sports Industry Firms. Journal of Human Sport and Exercise, 14(5 Proc), S2127-S2141.