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Predictors of Firm Performance and Supply Chain: Evidence from Indonesian Pharmaceuticals Industry

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Abstract- **The recent trend in big data application has led the organizations to think about its application. Having in mind the importance of supply chain integration and learning the current study has attempted to explore the drivers of firm performance from the supply chain perspective. Data were collected from the employees working in the pharmaceuticals companies in Indonesia. Smart-PLS was used for data analysis. The results of the study showed that there is strong significant positive relationship between big data analytical capability and firm performance. Further the results also revealed a significant influence of supply chain integration and learning on the firm performance. The results also revealed supply chain agility as a significant positive mediator between the relationships of supply chain integration, big data analytical capability, learning and firm performance. All the hypothesis were accepted.**

Keywords- *Big data, analytical ability, supply chain, integration, Indonesia.*

1. Introduction

Globally the successful organizations have created a supply chain which can retort to the dynamic and unanticipated changes in the markets. Thus, it is recognized and acknowledge as a potential source for the competitive advantage. Its management has emerged to be significant task and a challenge for the organizations because of globalization, outsourcing and continuous development in the domain of information technology [1-3] Further the emerging domain in the supply chain management is the agility which offers an organization with certain dynamic capabilities which serves as a potential competitive advantage. In this regard it was argued that agile supply chains enable an organization to be proactive in response to the changes and be flexible to the customer needs [4]. Importance of supply chain agility is undeniable. However, it has not been completely explored by the previous research [5, 6].
Nowadays information technology is playing a vital

role in business world. There is an increasing trend has been observed in the recent decades in the growth of technology application in the supply chain consequently big data emerged. It is being an important and beneficial asset can act a significant driver in effective decision making regarding the different functions of supply chain management and its improvement as well [7]. In such dynamic business world, leadership prioritize the decision making by admitting the fact of data driven approaches instead of be dependent on on their hunches [8-10]. It do drives the competitiveness as it offers the organization with different dynamic capabilities that's why organizations are keenly interested to go for big data and improve their information technology infrastructure.
It is admissible fact that BD can be of significance in organizations' operations and decision making. But still the practitioners are in between of understanding regarding the necessary abilities for data transformation into value. Of generally speaking how to make data a valuable thing for an organization. In this regard [11-15] argued that basically valuable data generation is primarily dependent upon the ability of an organization to obtain, store and process the huge volume of data which is may be real time or near to real time with the support of latest analytics. Big data is the first-hand concept worldwide which has not been exclusively explored. RFID, ERP and IoT the recent developments in supply chain management has triggered the huge data generation resultantly increased focus on the technologies which can handle the data and generate valuable results. Current study has selected the pharmaceuticals industry of the Indonesia which represents the growth trend since years as shown in the below figure 1. It is obvious from the figure that the Indonesia pharmaceuticals have been in growth since 2012. Till now its market capitalization has increased from 47.6 trillion rupiah to 72.2 trillion rupiah. Further the figure is also showing the source of raw material imported for the pharma industry. In this regard supply chain is much more important for the Indonesian pharma industry.

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Indonesia Pharmaceutical Market (in trillion rupiah)
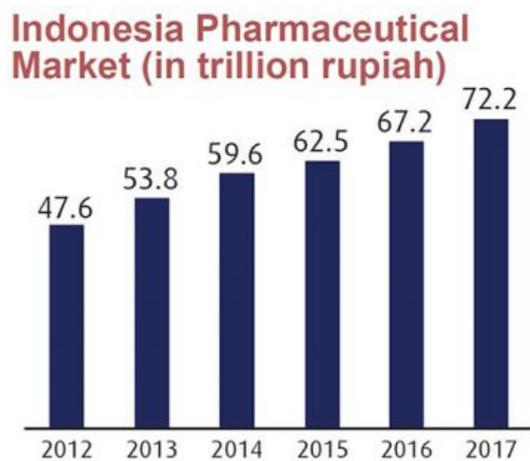
Country of Origin of Indonesia's Imported Pharmaceutical Raw Materials

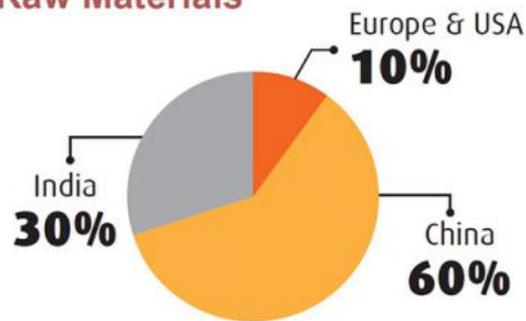Europe & USA **10%**

India **30%**

China **60%**

Figure 1 *The Jakarta Post*

Thus, this study will attempt to elaborate that how do big data, learning and supply chain integration influence the firm performance. Further the role of agility has been considered as a potential mediator. Following research questions will be entertained in this study:

1. Do the supply chain integration, learning and big data lead towards the firm performance?
2. What is the role of agility in firm performance?

Present study will contribute in the literature by providing the empirical evince regarding the role of different factors which enhance the firm performance. More importantly, it will provide valuable insights for the policy makers and practitioners regarding the big data application in supply chain and its benefits. The next section will elaborate the literature review, methods adopted for the study, results and conclusions.

2. Literature review

2.1 Firm performance

Firm performance is a broad construct which can be assessed or measured with different parameters. Same is the case with the definition of the firm performance. It has been proposed differently by different authors. It can termed as an organizational assessment which is evaluated on the basis of the productivity, market competitiveness and working of cost minimization in all the business processes to get the optimal production results [16]. From another point of view [17] has defined the firm performance as a certain level which shows that an organization is able to meet the competition in the business processes and goals accomplishment and at what stage [18]. [19] argued that firm performance can be measured from the perspective of their efficiency and effectiveness in business operations, economic principals, challenges and their solutions [12].

2.2 Supply chain agility

Organizations are striving hard to cope with the challenges being faced due to the rising competition and global business markets. Resultantly, they are forced to focus on their ability and enhance it to gain the potential competitive advantage [20]. Generally speaking organizations are fighting for their survival out of the conventional methods of doing business. Regarding the supply chain agility [21] stated that it is outcome of the firms' capability to rapidly pin point the changes, breakthroughs, and potential challenges [14]. It can be termed as vigilance of an organization. Furthermore, it is the outcomes of rapid appropriate data access; ultimate decision making how to react; rapid application of decisions taken; change of strategy and functions in order to be flexible. From the importance of supply chain agility perspective it was argued that it is actually the decision of the organizations which foster the long-run productivity and respond to the dynamic market conditions [17].

Supply chain agility predicts the firm performance and it has been established by previous research studies. [22], pointed out that the supply chain agility as of much importance in a firm's structure [23]. In addition, they also contended that tractability of the supply chain and the utilization of tech. related to the information do positively influence the supply chain agility. Further they also reported a positive impact of the supply chain agility on the firm performance. Later on [24] also argued for a relationship between supply chain agility and FP [7]. It was concluded that supply chain agility of an organization significantly predicts the supply chain performance of an organization which further influence the firm performance. In [25], conducted a study and they collected response from 97 respondents with the questionnaire [17]. The yielded a response rate of 78%. They reported a considerable positive connection between SCA and FP. Further they also concluded that organizations' supply must be agile with the purpose to conform to the dynamic business

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world requirements and challenges. The study also proved supply chain agility as an important intervening variables between tech. uncertainty and firm performance. Recently, [26] conducted a study by collecting 257 responses from the employees related to the supply chain [20]. They reported that agility does not predict the firm performance and suggested that it should be studied further before making any final prediction about it. In [27], reported that agility offers a firm with the competitiveness which ultimately lead towards the enhanced organizational performance [11]. In the light of previous available evidence it can be argued that when an organization's supply chain is flexible and able to meet and respond to the challenges it will contribute toward the better organizational performance. Hence it is hypothesized that:

H1: Supply chain agility is significantly associated with firm performance.

2.3 Learning

In [28] argued that organizational learning is a process which supports an organization to accumulate, generate and utilize the knowledge. Which further serves the basis for an organization to advance its financial performance. From the organizational learning theory lens it is actually the ability of an organization to process the knowledge which is significant for the creativity. Learning can be divided into two type such as external and internal learning. External can be stated as accumulation and generation of knowledge in which suppliers and customers are also involved to solve a particular problem [18]. The continuous learning helps an organization to improve its operations which further reflects in high performance of it. In this regard it was argued that when an organization involves itself in continuous learning there are more chances that it can become an agile organization [29]. Form the external learning point of view it has been argued that organizations must learn from the outside their environment which will provide them with new knowledge and increase their response to the customer demands. It will also provide an organization with the competitive advantage which will serve as a potential booster for the improved performance [30].

Internal learning of an organization denotes to the process in which recommendations of the employees are considered during the decision making and development of any product [18]. Based on the empirical and conceptual evidence available it is hypothesized that:

H2: Learning is significantly associated with supply chain agility.

H2a: Learning is significantly associated with firm performance.

H2b: Supply chain agility is a significant mediator between relationship of learning and firm performance.

2.4 Supply chain integration

Global competition among the organizations has changes the business is being done and it has force organizations to relocate the strategic orientation and its application. Partnerships with other firms lead towards the competitive advantage. Over the years organizations have emphasized on the development of strategies that can bring much desired change and performance in firms. Anyhow, organizations have acknowledged that alignment of strategies with the internal and external forces is best to achieve competitive advantage. Thus, it created a need for the supply chain integration [13]. It is the degree to which an organization incorporates with its other supply chain members to accomplish a productive flow of information, products, decisions, money and information with effective and efficient cost, value and speed. Organizations are working to incorporate their supply chains to accomplish improved and flexible supply chain which can respond to the changing business needs.

Previously studies have reported a considerable connection between supply chain integration and agility. Which affirms that the integrated supply chain which means that all the partners are following the similar practice and protecting their interested will tend to make the supply chain agile with the ability to respond to the dynamic situations. Therefore, it is concluded that having an integrated supply chain makes it agile which further adds to the improved firm performance. Thus it is hypothesized that:

H3: Supply chain integration is significantly associated with supply chain agility.

H3a: Supply chain integration is significantly associated with firm performance.

H3b: Supply chain agility is a significant mediator between relationship of Supply chain integration and firm performance.

2.5 Big data analytics capability

In recent years big data has emerged to be a new source of better productivity and firm performance. Besides this it also serves as a challenge for the organizations as well. Big data analytical capability is widely regarded as the transformation of the how the firms are carrying out their business [4]. Recently it has been proposed as "the potential to transform management theory and practice. It is the next big thing in innovation" [15]. Firms are investing lot more investments in developing the capabilities to handle the big data and reap its benefits. It is also being focused as a source of sustainable competitive advantage. Alone

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in 2013 2.1 trillion US dollars were spent on big data analytical capabilities [25]. Which enlightens the importance and attention being paid to the big data. Big data is a promising technique for optimal results and previously it has been reported that it resulted in approximately 6% higher productivity. Similarly a recent study which targeted the Fortune 1000 companies indicated that 91% of the listed companies are now capitalizing the big data and there is slight increase of 85% from the previous year [21].

It is being widely adopted and proved to be productive. It can be affirmed from the fact that approximately 87% of the organizations consider that big data analytics have changed their competitive advantage base within three years. Notably, 89% also contended that the organizations which do not go for big data analytics will lose market and their momentum [8]. Till now the investments in big data has not reached to its full potential as there are several unexplored links between big data and organizational performance.

Whereas some of the previous researchers also contended that even though huge investments are being made in big data but still it pose a potential threat to that investment. It is more or less a myth which is asked to show the productivity by providing an organization with capability to do new things and outclass performance. Thus, based on such an informative debate and mixed views available regarding the big data, the present study hypothesize that:

H4: *Big data analytics capability is significantly associated with supply chain agility.*

H4a: *Big data analytics is significantly associated with firm performance.*

H4b: *Supply chain agility is a significant mediator between relationship of big data analytics and firm performance.*

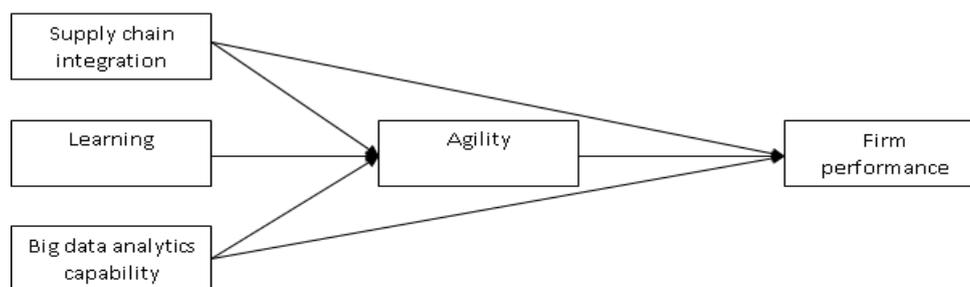Following figure 2 is showing the theoretical framework for the study:

Figure 2. The framework

3. Methodology

The purpose of current study is to explore drivers for the supply chain agility. Further the study also explored that how the agility do contributes towards the improved organizational performance. More importantly the study has considered the role of big data which is the currently emerging topic. The nature of study is quantitative and descriptive.

Point 5-Likert scale has been used for all the measurements in this study. All the analysis were performed via Smart-PLS as it allows to run test even the sample size is small and it is non-parametric software.

3. Results

Table 1. Confirmatory factor analysis

Constructs	Items	Loadings	Alpha	CR	AVE
Supply Chain Agility	AG1	0.910	0.913	0.939	0.793
	AG2	0.853			
	AG3	0.890			
	AG4	0.908			
Big Data Analytical Capability	BDAC1	0.882	0.890	0.925	0.755
	BDAC2	0.782			
	BDAC3	0.914			
	BDAC4	0.891			
Firm Performance	FP1	0.786	0.840	0.893	0.676
	FP2	0.826			
	FP3	0.848			
	FP4	0.829			
Learning	Le1	0.809	0.849	0.898	0.688
	Le2	0.851			
	Le3	0.836			
	Le4	0.822			
Supply Chain Integration	SI1	0.754	0.763	0.865	0.681
	SI2	0.856			
	SI3	0.861			

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Smart-PLS has been use d for the data analysis. Before going for the SEM, first of all validity of the constructs was determined. Table 1 is representing Alpha values for all the variables. It is actually the internal consistency of the scale the value of it should be greater than 0.7 [9]. As per the table all the Alpha values for the variables supply chain agility, big data analytical capability, firm performance learning and supply chain integration are 0.913, 0.890, 0.840, 0.849

and 0.763 respectively. All the vales are greater than 0.7 establishing the reliability of the scale.

Values of factor loadings, composite reliability and average variance extract are used to determine the convergent validity of the scale, the values for all of them should be greater than 0.7, 0.8 and 0.5 respectively. As per the table 1 the values for the factor loadings, CR and AVE are more than 0.7, 0.8 and 0.5 respectively which affirms the convergent validity of the scale.

Table 2. Discriminant Validity

	AG	BDAC	FP	Le	SI
AG					
BDAC	0.314				
FP	0.376	0.844			
Le	0.324	0.648	0.737		
SI	0.348	0.533	0.631	0.665	

The second criterion for the validity is to confirm the discriminant validity. The present study has used the latest technique for the discriminant validity which is "Hetrotrait-Monotrait Correlation Ratio". According to HTMT all the correlations between the variables should be less than 0.85. As per table 2 all the correlation values among the variables are less than

0.85 which affirms the discriminant validity of scale. As the convergent validity and discriminant validity is established now it is allowed to move towards the hypothesis test. Below figure 3 is showing the outcome of confirmatory factor analysis
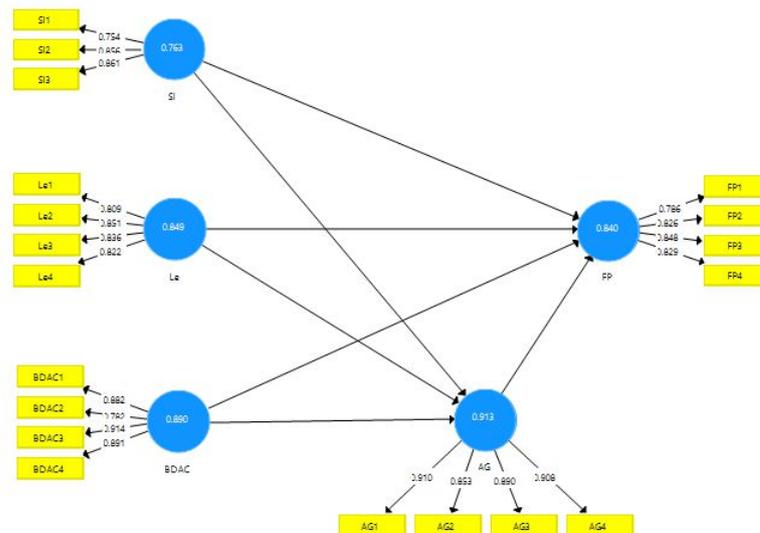

Figure 3. Path Coefficients

Table 3. Structural Equation Modeling

Hypothesized Relationships	Beta	SD	t	p	Decision	R2	f2	VIF
AG -> FP	0.078	0.024	3.301	p<0.05	Supported		0.014	1.139
BDAC -> AG	0.143	0.045	3.194	p<0.05	Supported	0.122	0.020	1.526
BDAC -> FP	0.519	0.027	19.082	p<0.05	Supported	0.619	0.456	1.549
Le -> AG	0.118	0.049	2.402	p<0.05	Supported		0.010	1.720
Le -> FP	0.240	0.029	8.338	p<0.05	Supported		0.088	1.735
SI -> AG	0.166	0.039	4.214	p<0.05	Supported		0.021	1.454
SI -> FP	0.127	0.028	4.458	p<0.05	Supported		0.029	1.458

Table 3 is showing the results for the direct relationship between the variables. As per the results of the study supply chain agility is proved to be significantly and positively associated with firm

performance. The value of the relationship is 0.078 which means that agility has explained only 7% of the variance in the firm performance. The more agile the firm supply chain the greater will be the firm

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performance. Furthermore, the results also reported a favorable influence of big data analytics capabilities on the supply chain agility. It can be asserted that when the organizations use the big data for the decision making, they tend to consider various aspects of it which will ultimately lead them towards flexible ad agile supply chain. It further lead towards the firm performance. Big data application in the business offers valuable insights to the companies through which they can see the bigger picture and take better decision leading towards improved performance. Similar results have been presented by the results of the study with a positive influence of big data analytical capability on the firm performance.

Furthermore the results also showed a favorable impact of learning on the supply chain agility. The more the supply chain partners teach about the new things and gain new knowledge the better there will be decisions in supply chain. The learning will provide them with up to date knowledge regarding the business problems and how to solve them. Thus the application of new knowledge in the business operations will improve them and result in enhanced organizational performance. The results of the study also provided a positive influence of learning on the firm performance. Integrated supply chain creates a synergy at all the levels and among all the supply chain partners which thus improves the decision making across the channels. The results of the study also showed that there is significant positive impact of integration of supply chain on the supply chain agility and firm performance. All the hypothesis were supported and accepted.

Table 4. Specific Indirect Effects

Hypothesized Relationships	Beta	SD	t	p	Decision
BDAC -> AG -> FP	0.011	0.005	2.261	p<0.05	Supported
Le -> AG -> FP	0.009	0.005	1.858	p<0.05	Supported
SI -> AG -> FP	0.013	0.005	2.571	p<0.05	Supported

Table 4 represents the mediation outcomes for the research model. As per the table supply chain agility has proved to be a significant and positive mediator between all the variables and firm performance. Big data analytics capability impact on firm performance tend to be low as compared to its direct impact on firm performance. Anyhow results are significant and thus hypothesis is accepted. Furthermore, SCA has also been found to a significant intervening variable between the connection of learning and FP. Finally, the outcomes also showed a significant positive mediation between supply chain integration and firm performance. All the results are significant thus all the mediation hypothesis are accepted. Following figure 4 is showing the outcome of structural equation modeling:
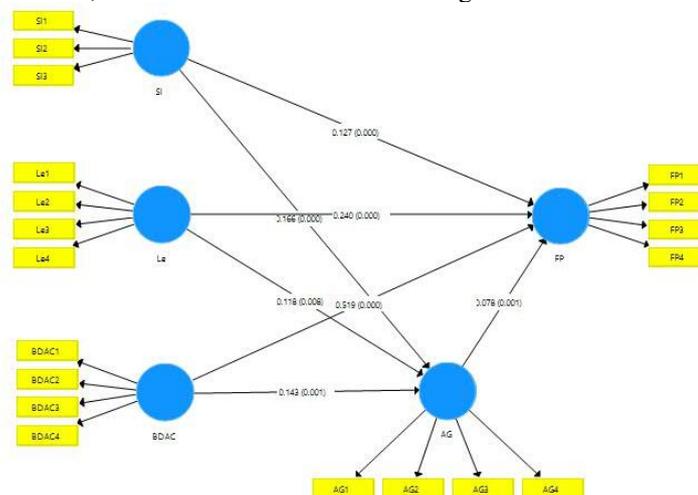

Figure 4: structural equation

5. Discussion

The present study attempted to enlighten the connection between supply chain integration, big data analytics capability and firm performance. Furthermore, the study also considered the supply chain agility as a potential intervening variable. The study has hypothesized that there is significant relationship between big data analytical capability and agility. The results of the study supported the argument. Further the study hypothesized that supply chain agility and learning are significantly connected with the supply chain agility. The results showed a significant positive values for the mentioned relationships. Thus all the relationships between independents and dependent variables are significant and supported the hypothesis.

In addition the results revealed a positive significant connection between agility and firm performance. The statistical findings are positive and significant which establish that hypothesis is accepted. Hypothesis H1, H2, H2a, H3, H3a, H4, and H4a are seconded by the results and thus accepted. Moreover, study results revealed supply chain agility as a significant and positive mediator between all the independent variables (supply chain integration, learning and big data analytical capability) and firm performance. The results are significant and positive thus all the

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hypothesis are supported. Hypothesis H2b, H3b and H4b are accepted.

6. Conclusion

It is concluded that when partners in a supply chain share their processes, knowledge and make joint decisions it tends to create opportunities for both the internal and external partners of the supply chain. More importantly, the big data analytical capabilities found to have strongest influence on the firm performance. It is feasible to state that the big data analytics provide the organizations with the ability to forecast the future trends and take decision regarding the business operations. The study has accomplished all of its research objectives and successfully answered all the research questions. Major concern was the firm performance whereas the most important predictor was big data analytical capability. Organizations can benefit from the study findings as there are multiple predictors for the supply chain agility and performance. They can develop their big data analytical infrastructure to improve their supply chains. Present

study findings can potentially lead towards better policy making and supply chain improvements.

Despite the study has achieved all its object still there are some limitations and future areas which can be addressed in future research. First of all the study is cross-sectional which limits its explanation power regarding the casual effects. Second data has been collected from a single source which can result in rater bias. Third there were some respondents' resistance in filling up the questionnaires due to fear of misuse of information or disclose to their superior. All the limitations can be turned into interesting future areas. There are also some future areas to be explored further. First of all a comparative study between different sectors can be designed to have better insights into big data application. The current study model should be studied in IT industry as nowadays IT companies are using the big data to take decisions and forecast for future. Longitudinal research is recommend for the same research model in future

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