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## Article

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## OPERATIONS, INFORMATION & TECHNOLOGY | RESEARCH ARTICLE

# The relationship between architecture, social, law and market in determine challenges of big data analysis for Malaysia SMEs

Min-Hooi Chuah<sup>1\*</sup> and Ramayah Thurusamry<sup>1</sup>

**Abstract:** The study aims to review the challenges of implementing big data by Malaysian small- and medium-size enterprises (SMEs) as well as to figure out the relationship between architecture, social, law and market. Currently, there is limited research and literature examining the challenges of big data analysis in Malaysia SMEs. This paper has opted for a thorough analysis of the complexities of implementing big data at SMEs in Malaysia by applying a comprehensive literature search from different databases, journals, Google scholar, IEEE and content review. This research offers practical insights into the complexities of taking Big Data in SMEs in Malaysia. It is proposed that law, architecture, social and market can be applied by Malaysian SMEs to adopt big data analytic. The authors used quantitative survey. This is done by soliciting criteria from general managers/managing directors/CEOs or data analysts from LinkedIn group. Data were analysed by partial least square.



Min-Hooi Chuah



Min-Hooi Chuah

### ABOUT THE AUTHORS

Min-Hooi Chuah, Dr. Chuah MH, received her PhD from Universiti Tunku Abdul Rahman in the area of Business Intelligence in 2019. She was part time lecturer in several university such as UCSI University, Kolej Tunku Abdul Rahman, First City University College. Currently, she is postdoctoral fellow in Universiti Sains Malaysia. She started her teaching career as lecturer with the joined Universiti Tunku Abdul Rahman (UTAR) in the Faculty of Information and Communication Technology in Perak Campus (FICT-PK).

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### PUBLIC INTEREST STATEMENT

This study figured the challenges faced by Malaysia SMEs based on the legal, architecture, social and market issues. Based on the review of previous literature studies in this field, it is evident that there is a need to highlight a more comprehensive framework for identifying the challenges faced by Malaysia SMEs. The results show that architecture has significant effect on market, architecture has significant effect on social, law has significant effect on market and social has significant effect on market. The limitation of this research is small sample sizes that may be impossible to generalise the findings of this study. Future research will be conducted in more geographical area as well to increase the sample sizes to obtain more generalizing results.

This research makes contribution to academics and practitioners to the emerge of predictive model to suit the challenges of big data adoption in Malaysia SMES.

**Subjects:** Legal, Ethical & Social Aspects of IT; Information & Communication Technology (ICT); Communication Technology Internet & Multimedia;

**Keywords:** big data; business analysis; SMEs; Malaysia; partial least square

## 1. Introduction

Small- and medium-size enterprises (SMEs) can be defined as small, medium and micro-sized enterprises. Medium-sized businesses have less than 250 employees and a turnover of less than 50 million euros or a monetary record aggregate of less than 43 million euros. (European Commission, 2016). Small-sized organisations, on the other hand, have fewer than 50 employees and a turnover of less than ten million euros or an accounting report aggregate of less than ten million euros (European Commission, 2016). Micro-sized businesses have less than ten employees and a turnover of less than two million euros (European Commission, 2016). The Ministry of International Trade (MITI) is the largest supporter of SMEs in Malaysia, assisting and protecting Malaysian interests in international trade and encouraging the development of industrial operations (Hashim & Wafa, 2002; Mori, 2005; Zizah et al., 2010). The Malaysian Industrial Development Association (MIDA), established under the Malaysian Investment Development Authority Act, is the government's primary body for promoting Malaysia's manufacturing and service industries and ensuring that the country's economy improves (Hashim & Wafa, 2002; Mori, 2005; Zizah et al., 2010).

The Small and Medium Industries Development Corporation (SMIDEC) is another government body that is responsible for expanding skilled and resilient Malaysian SMEs so that they may compete globally (Hashim & Wafa, 2002; Mori, 2005; Zizah et al., 2010). MATRADE (Malaysia External Trade Development Corporation) is tasked with promoting Malaysia's exports and assisting many local businesses in gaining new market share in international markets (Hashim & Wafa, 2002; Mori, 2005; Zizah et al., 2010). Even with the exponential expansion of big data in SMEs, adoption of big data by SMEs is still limited (MacGregor & Vrazalic, 2005) and large organisations are shown to profit more from SMEs in terms of enhanced sales and cost reductions enabled by big data (Riquelme, 2002).

The awareness of investing big data analytic in SMEs is important (Ghobakhloo et al.). According to Soroka et al. (2017), big data adoption enables SMEs to achieve overall measures in cost, profitability, revenues, growth and agility through performance analysis, productivity, efficiency, new market divisions, financial stability and control and innovation. The potential value of big data shines when used to carry out the decision-making process (Provost & Fawcett, 2013). Big data can boost SMEs' competitiveness by integrating supply chain partners and inter-organizational functions, while also providing critical information (Bhagwat & Sharma, 2007). Big data can be of great assistance to SMEs by providing the infrastructure required to ensure that the right types of information are available at the right time (Premkumar, 2003).

## 2. Literature review

The approach employed in this study involves a comprehensive library search and literature review on Malaysia SMEs and various challenges highlighted, irrespective of economical, organisational or managerial aspects. The library search consists of online and offline content, ranging from newspaper articles to book articles.

A summary of the challenges of big data analytics faced by Malaysia SMEs are shown in Table 1.

**Table 1. Summary of challenges of big data analytics faced by Malaysia SMEs**

Challenges	Author (Date)
Legal	Coleman et al. (2016), Iqbal et al. (2018), Del Vecchio et al. (2018), Ardagna et al. (2016), Vajjhala and Ramollari (2016), Kiziltan (2018), Kalan and Unalir (2016), Karim et al. (2017), Sivarajah et al. (2017), and Makhele (2018).
Architecture	Coleman et al. (2016), Shah et al. (2017), Del Vecchio et al. (2018), Soroka et al. (2017), Ardagna et al. (2016), Vajjhala and Ramollari (2016), Kiziltan (2018), Moyne and Iskandar (2017), Kalan and Unalir (2016), Karim et al. (2017), Mbassegue et al. (2016), Seseni and Mbohwa (2018), Sivarajah et al. (2017), Gupta et al. (2018), Limpeeticharoenchot et al. (2020), Makhele (2018), and Rajabion (2018).
Social	Coleman et al. (2016), Shah et al. (2017), Iqbal et al. (2018), Ardagna et al. (2016), Kiziltan (2018), Kalan and Unalir (2016), Karim et al. (2017), Mbassegue et al. (2016), Sivarajah et al. (2017), Baharuden et al. (2019), Limpeeticharoenchot et al. (2020), and Makhele (2018).
Market	Coleman et al. (2016), Shah et al. (2017), Iqbal et al. (2018), Soroka et al. (2017), Kiziltan (2018), Kalan and Unalir (2016), Limpeeticharoenchot et al. (2020), Makhele (2018), and Nemati and Khajeheian (2018).

(Developed by: Authors)

### 2.0.1. Legal perspectives: Concerns about data protection and data privacy

One of big challenge in big data analysis for SMEs stated by Jagadish et al. (2014) is data protection and data privacy. There is risk of personal data particulars are not appropriately used during data analysis process (Jambunathan & Venkatesan, 2016). The usage of big data especially in funding agencies, academic and medical sectors in term of data protection and security is much lower (Mardis, 2016). Various researchers have studied on data privacy and security issues in data analysis. For instance, Sorensen et al. (2010) examined privacy issues concerning the hosting of open accessible servers. Furthermore, it is difficult and need extra budget to find a lawyer consulting data protection (Coleman et al., 2016).

### 2.0.2. Social perspectives

Social issues especially organisation culture is another concern of implementing big data analysis in Malaysia SMEs. Coleman et al. (2016) pointed out that people in the organisation are not ready for co-ownership information and there is a must to develop a non-hierarchical culture of trust. Organisations need to be open minded and willing to change to new environmental challenges (Manyika et al.). Smith (2007) pointed out that the social norms in the nation also influenced the adoption of big data analysis particularly in SMEs.

### 2.0.3. Architecture perspectives: Lack of infrastructure to process high volume data efficiently

Infrastructure is another challenge of big data analysis in SMEs. Companies need a good equipment, hardware, software and middleware to process big data to handle and interpret data quickly and efficiently (Laney, 2001). Still yet, SMEs find it difficult to handle challenge as they are not able to process data rapidly as a result of the lack of infrastructure (Del Vecchio et al., 2018).

Market perspectives: Highly complex analytics solutions in the software market

Market issues especially lack of availability of existing analytical software tools in the market is another challenge of implementing big data in companies. For example, it is hard to identify

**Table 2. Type of industries**

Type	Percentage	Frequency
Financial services	27.9%	12
Oil and gas processing	7.0%	3
Telecommunication	2.3%	1
Manufacturing	14%	6
Government	2.3%	1
Hotel and restaurants	4.7%	2
Health care and life sciences	4.7%	2
Others	37.2%	16
Total	100%	43

**Table 3. Company's size distribution**

Company's size	Percentage	Frequency
Micro (0–9 person employed)	14%	6
Small (10–49 person employed)	9.3%	4
Medium (50–250 person employed)	76.7%	33
Total	100%	43

analytical solutions with powerful analytical capabilities together with interactive user-friendly features (Coleman et al., 2016). Coleman et al. (2016) and Iqbal et al. (2018) stated that analytical software tools that exist in the market are two types. However, these two types of software are not suitable owing to the absence of expertise in data analytics (Coleman et al., 2016) and simple but not useful (Coleman et al., 2016; Iqbal et al., 2018).

### 3. Hypothesis

Big data harnessing can lead to many challenges, which include design of system for processing, the means for analysing and the problems of scientific research. The authors form hypotheses as below:

Hypothesis 1: Architecture has significant effect on market

Hypothesis 2: Architecture has significant effect on social

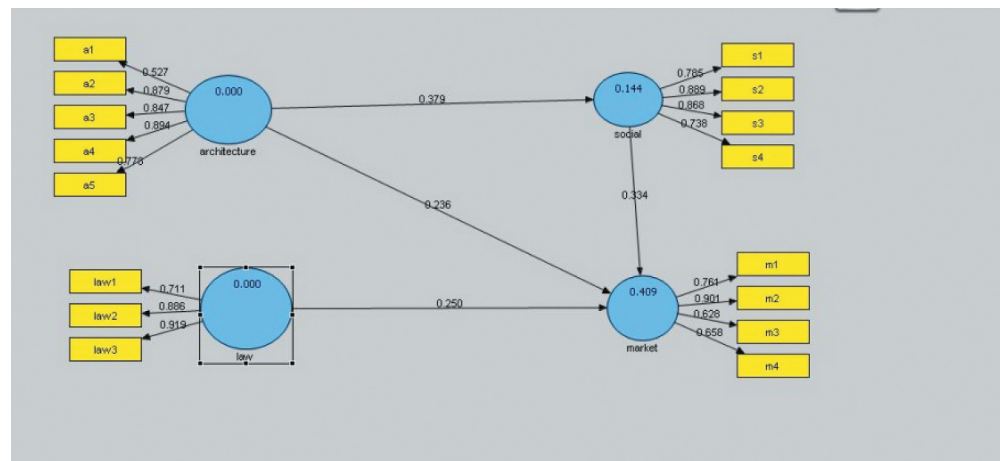
Hypothesis 3: Law has significant effect on market

Hypothesis 4: Social has significant effect on market

### 4. Methodology

Typically, the survey was conducted in the duration of seven months, from January 2021 to July 2021. First, the heads of Human Resource or Public Relation department staffs of the Malaysia SMES were contacted through a phone conversation or through e-mail. The e-mail was sent to Human Resource or Public Relation department to invite them whether the companies are interested to participate in the survey and inform the companies the estimated time that might be taken for the survey. The companies were informed that the survey is for research purpose only and ensured that the participant's identities were kept secret, not disclosed to any unauthorised third party. Next, if the companies agree to participate in the survey, survey link

**Figure 1. PLS-SEM structure.**



was sent to the participants to fill up the survey. To improve the response rate, invitation also was sent in various Facebook group and LinkedIn group, such as Malaysia big data group, Malaysia SMES group, big data analysis group. Among 121 survey questionnaires sent, only 43 respondents were obtained. The response rate is 35%. Table 2 below shows the demographics of the respondents.

Table 2 shows the distribution of the type of the industry of the companies that participated in the survey. It is found that out of 43 respondents, others industry was the highest (37.2%), followed by financial services (27.9 %), manufacturing (14 %), oil and gas processing (7%), hotel and restaurants (4.7%), healthcare and life sciences (4.7%) and telecommunication (2.3%).

Table 3 indicates the company's size. With respect to the size of an organisation, it is classified into micro (with less than 10 employees), small (10–49 employees) and medium (50–250

**Table 4. Loading, composite reliability and AVE value for latent variables**

Latent variables	Indicators	Loadings	Composite reliability	AVE
Architecture	A1	0.527	0.894	0.634
	A2	0.879		
	A3	0.847		
	A4	0.893		
	A5	0.778		
Law	law1	0.711	0.880	0.712
	law2	0.886		
	law3	0.919		
Market	m1	0.761	0.830	0.554
	m2	0.901		
	m3	0.628		
	m4	0.658		
Social	s1	0.785	0.892	0.676
	s2	0.889		
	s3	0.868		
	s4	0.738		



**Table 5. Discriminant validity**

	<b>Architecture</b>	<b>Law</b>	<b>Market</b>	<b>Social</b>
Architecture	<b>1.000</b>			
Law	0.510	<b>1.000</b>		
Market	0.653	0.699	<b>1.000</b>	
Social	0.616	0.728	0.746	<b>1.000</b>

**Table 6. R squared value**

<b>Latent variables</b>	<b>R<sup>2</sup></b>
<b>Market</b>	0.410
<b>Social</b>	0.143

**Table 7. The path coefficients**

	<b>T statistics ( O/STDEV )</b>
<b>architecture -&gt; market</b>	3.69
<b>architecture -&gt; social</b>	5.01
<b>law -&gt; market</b>	2.52
<b>social -&gt; market</b>	3.57

employee). It was found that maximum number of the participants came from the medium companies (76.7%), followed by micro-companies (14%) and from the small companies (9.3%).

## 5. Results and analysis

In this research, the software SmartPLS Version 2.0 has been used. Partial least square (PLS) is a technique for analysing and modelling data (Reinartz et al., 2009). PLS has been widely used in the study of information systems and other business disciplines (Henseler et al., 2009). PLS is powerful tool especially to deal with small data (Majchrzak et al., 2005). Hair et al. (2011) introduced “10-times rule” technique, which widely used minimum sample size estimation method in PLS-SEM. It is based on the concept that the sample size should be more than 10 times the maximum number of inner or outer model linkages pointing at any latent variable in the model. In this research, only 4 variables were involved, and hence according to Hair et al. (2011), the minimum sample should be 40. From the survey conducted, 44 respondents were obtained, and thus this fulfilled the c) rule.

Figure 1 presents the PLS-SEM structure. The PLS-SEM structure is two exogenous variable (social and market) and two endogenous variables (law and architecture).

Architecture: 5 items

Law: 3 items

Social: 4 items

Market: 4 items

Table 4 shows the loadings, composite reliability and average variable extracted (AVE) value for latent variables (architecture, law, social and market). It was found from Table 2 that all the



indicators have achieved value more than 0.6. Wong (2013) stated that minimum acceptance level of indicator reliability is 0.4. So, the loading of all the indicators are reliable and valid.

It also found that composite reliability of all the latent variables have achieved value more than 0.7. Wong (2013) stated that minimum acceptance level composite reliability is 0.7. So, the composite reliability of all the latent variables are well established.

In term of convergent validity, aAVE for latent variables is examined. Table 4 indicates the AVE value for all the latent variables that are greater than the acceptable threshold of 0.5 (Wong, 2013), and so convergent validity is confirmed.

### 5.1. Discriminant validity

Fornell and Larcker (1981) argued that if the square root of AVE in each latent variable is greater than other correlation values among the latent variables, then this value can be used to show discriminant validity. To do so, a table is prepared with the square root of AVE manually calculated and represented in bold diagonally in the table. Table 5 showed that latent variable is greater than other correlation values among the latent variables, thus discriminant validity is proved.

Table 6 shows the value of R squared. Hair et al. (2011) stated that minimum R squared value must be 0.2, while Frost (2014) stated that minimum R squared value must be 0.25. Frost (2014) explained that endogenous (independent) variable is significance, p value must be more than 0.05 and coefficient is 2. Therefore, an increase in one unit of endogenous (independent) variable will result in an increase in two units of exogenous (dependent) variable. In another word, by increasing one unit of exogenous (dependent) variable will result in increasing 0.5 unit of endogenous (independent) variable, and hence R value is 0.5. R squared is  $0.5 \times 0.5 = 0.25$ . From Table 6, it was found that R squared value for latent variables for market are more than 0.25; hence, the model is considered a good fit. The R squared value for social is 0.143. This mean that the relationship of architecture to social is weak.

Table 7 shows the path coefficients

Hypothesis 1: Architecture has significant effect on market.

From the table above, it is found that T statistics for architecture->market is 3.69, which is larger than 1.96; therefore, hypothesis 1 is accepted.

Hypothesis 2: Architecture has significant effect on social.

From the table above, it is found that T statistics for architecture->social is 5.01, which is larger than 1.96; therefore, hypothesis 2 is accepted.

Hypothesis 3: Law has significant effect on market.

From the table above, it is found that T statistics for law->market is 2.52, which is larger than 1.96; therefore, hypothesis 3 is accepted.

Hypothesis 4: Social has significant effect on market.

From the table above, it is found that T statistics for social->market is 3.57, which is larger than 1.96; therefore, hypothesis 3 is accepted.

## 6. Discussion

The resource-based view (RBV) theory argued that a source of competitive advantage is the firm's resources and capabilities (Afsharghasemi et al., 2013). The resource-based view indicated that a corporation can only gain a competitive advantage if it has access to distinct value resources

such as having good architecture that are difficult for competitors to mimic (Afsharghasemi et al., 2013). Market orientation is seen as one of the internal capabilities and resources that might potentially lead to a sustained competitive advantage. It is valuable, rare, not interchangeable and imperfectly imitable (Hult et al., 2005; Zhou et al., 2008). The RBV is a resource that can help us understand the nature of market orientation. It is an intangible characteristic of a corporation that allows it to supervise market information and give higher value to its consumers (Hunt & Lambe, 2000). Kaur and Kaur (2018) stated that there are two types of infrastructure: social and economic infrastructure. The social infrastructure is the infrastructure that assist in the promotion of education, health and community-related standard of the people (Kaur & Kaur, 2018). Economic infrastructure is the infrastructure that helps to promote the economic/market environment. Thus, infrastructure plays important role for social and market (Kaur & Kaur, 2018). Social norms is defined as various standards, customs, values, beliefs and faith (Ocansey, 2017). Cultures produce a great challenge for marketing worldwide (Ocansey, 2017). Fathoni and Rodoni (2018) found that there is impact on organization culture towards marketing performance. Based on their ethical culture, organizations may be categorized as ethical or immoral firms (Chadegani & Jari, 2016). Khayatmoghadam (2020) proved that there is significant relationship between professional ethics with organization culture.

The RBV stated that a company wants to take advantage of the legal system (law) must not only be able to identify legal resources but also be able to deploy those resources to meet its financial goals (Masson & Shariff, 2011). As a result, the company must possess specific aptitudes, such as competence, to utilize its resources efficiently and successfully in accordance with its economic objectives (market; Masson & Shariff, 2011).

In term of architecture (infrastructure), the organisations need a good quality of hardware, software and middleware to handle and process big data analysis. However, one of the main challenges of the SME facing is the high cost of infrastructure. Therefore, it is suggested for SME to utilize cloud computing technology without investing so much on the infrastructure. The organisations can use software on demand like SaaS (Software-as-a-Service) to overcome the budget issues.

In short, the research provides a thorough understanding of the challenges associated with big data adoption in SMEs. This study is useful especially for the academic or IT professionals who want to adopt big data in SMEs. The outcome of this research will also help to improve the performance of big data adoption in SMEs from a management standpoint.

## 7. Conclusion

This study figured the challenges faced by Malaysia SMEs based on the legal, architecture, social and market issues. Based on the review of previous literature studies in this field, it is evident that there is a need to highlight a more comprehensive framework for identifying the challenges faced by Malaysia SMEs. The results show that architecture has significant effect on market, architecture has significant effect on social, law has significant effect on market and social has significant effect on market. The limitation of this research is small sample sizes that may be impossible to generalise the findings of this study. Future research will be conducted in more geographical area as well to increase the sample sizes to obtain more generalizing results.

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### Disclosure statement

No potential conflict of interest was reported by the author(s).

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