

Knowledge, attitude, challenges of big data analytics based on information technology staffs point of view in a developing country

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ABSTRACT

Introduction: The skilled IT staff about big data analytics can motivate organizations to adopt the big data analytics. The aim of the current study is to present the knowledge, attitude, and challenges of the big data analytics based on IT staffs' viewpoints in a developing country.

Material and Methods: A self-administered semi-structured questionnaire was developed based on a literature review. Content validity and face validity were measured using Delphi technique. The questionnaire comprised of three parts including knowledge, attitude, and challenges. Descriptive statistics were used to summarize the results. The chi-square test was applied to identify associations between knowledge and attitude of participants with the demographic characteristics.

Results: Out of a total of 250 IT staffs, 120 participated in the study. Knowledge levels were low, moderate, and high in 35.0%, 33.3%, and 31.7 % of the participants, respectively. The two most affecting factors on the knowledge level of participants were age groups and sex. IT staffs hold a positive attitude toward big data analytics. The most of IT staffs believed that big data management is necessary for the country and they agreed that big data analyzes can provide many advantages to organization managers. As well, 35 challenges of the big data analytics were identified.

Conclusion: The results showed that the big data analytics face with many problems in following issues: awareness and education, recruiting skilled specialists, presentation big data analytics benefits to IT managers and policy-makers, conducting research projects, developing a strategic plan at national and local levels.

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INTRODUCTION

For the past 20 years, growth of the Internet and the various technologies make it appear that the world is witnessing the generation a massive amount of data in all industries. At this point, predicted data production will be 10 times greater than the current level over the coming decades [1, 2]. Big data refers to "large, diverse, complex, longitudinal, and distributed datasets generated from instruments, sensors, Internet transactions, email, video, click streams, and all other digital sources available today and in the future." [3]. Big data is too big data to be handled and analyzed by traditional database

software tools and traditional analytic methods [4]. As well, the amount, variety, and speed of data increases, uncertainty inherent within big data, leading to a lack of confidence in the resulting traditional analytic methods and it has become almost impossible to process the big data with the existing methods. Advanced data analysis methods can be used to handle and analyze these data [5].

The methods used to analyze big data are known as "big data analytics" that refers to "the process of analyzing a large number of datasets to explore patterns, unidentified correlations, market trends, users preferences, and other valuable information

that previously could not be analyzed and handed with traditional tools” [5]. Big data analytics encompass many benefits such as reducing cost, improving quality of services, reducing errors, providing highly accurate models, discovering useful data patterns, improving data quality, facilitating data interpretation, exploring important features, and summarizing and sharing data for critical decisions making [2, 6-10]. Big data analytics were used in a diverse range of fields. Some of them included the banking industry, medical care, education, insurance, transportation, ambulance monitoring, traffic management, and appointment scheduling management [11-15].

Though the benefits of big data analytics are factual and considerable, it remains a number of challenges that must be addressed to fully realize the potential of big data advantages. Many countries including, developing countries are still far behind in the big data analytics [16]. However, organizations attempting to deploy big data analytics face numerous obstacles, including a lack of specialists with data management and analysis skills for big data. Even, they face fundamental barriers such as inadequate technological infrastructure and lack of financial resource. These issues led to the field of big data analytics grow slowly [17-20] and be in early-stage in various industries. Despite the important role of big data analytics as a powerful source of value for all industries, big data remains a fashionable but not well understood or fully clarified concept [21].

Since the spread of Internet and IT technologies in organizations’ developing countries and big data analytics are in early-stage in these countries, the skilled IT staff about big data analytics can motivate organizations to consider the advantage of this field. As well, conducting an empirical study for investigating the IT staffs’ knowledge level and attitude toward the big data analytics can provide scientific evidence. Hence, to assess the attitude and knowledge of IT staffs and understanding the challenges of implementation of big data analytics is the focus of this paper. The aim of the present study is to evaluate the knowledge level, attitude, and challenges of the big data analytics based on IT staff viewpoints in Mashhad which is the second-most populous city in Iran as a developing country.

MATERIAL AND METHODS

Study location

This cross-sectional study was conducted on IT staffs who worked in various organizations in Mashhad, Iran. Mashhad is the largest city in the eastern of Iran with about 3 million people, located on the border with Afghanistan and Turkmenistan, there are 70 public organizations and private organizations in Mashhad.

Instrument

A self-administered semi-structured questionnaire was formed based on a literature review in google scholar, science direct, and EMBASE databases to collect data. An expert panel with expertise in medical informatics, biostatistics, health information management, and computer science was recruited as content experts. Two Delphi rounds were performed by 11 experts to ensure content validity and face validity of the questionnaire.

The final version of the questionnaire comprised of 27 questions that covered three sections including knowledge, attitude, and challenges about the big data analytics based in IT staff point of view. The sections and questions of the questionnaire are shown in Table 1.

The knowledge section encompassed 10 multiple-choice questions. There were four possible answers to each question, of which one was correct. Participants were requested to respond to each of the questions. A correctly answered question was scored 1 and an incorrectly answered question was scored 0. The knowledge’s score was the sum of the correctly answered questions. The knowledge’s score was categorized as follows: 1- Low (0-3), 2- Moderate (4-5 scores), and 3- High (6-10).

The attitude section consisted of 10 closed-ended questions on a 6-Likert scale range from 1 to 6 and 3 multiple-choice questions. In this section, the rang of completely agree, mostly agree, and slightly agree were consider as “positive attitude” and the rang of slightly disagree, mostly disagree, and completely disagree were consider as “negative attitude”.

Challenges section had 3 multiple-choice questions and one open-ended question. In an open-ended question, patricians could express the challenges of big data analytics in the country. Identified challenges of big data analytics were extracted and categorized independently by two researchers. The results were saved in excel files. Then, two excel files were combined in expert panel meetings that were held by two researchers. Unresolved disagreements were discussed with a third researcher. The instrument was validated by an expert panel with CVI: 0.92 and CVR: 0.89. The overall Cronbach’s alpha value of the instrument was determined as 0.81, representing high reliability.

Participants

All public and private organizations were in Mashhad and had an IT unit, were included in the current study. The empirical data were collected from IT staffs with experience in using various software who worked in the included organizations. The researches met all IT staffs in person and invited them to participate in the study. Questionnaires were provided to IT staffs who agreed to participate in the

study.

Data analysis

The IBM SPSS version 21 was used to analyze the data. Statistical significance for all of the analysis was defined as $p \leq 0.05$. Data screening was performed for missing data. Missing data were excluded from the

analysis. Descriptive statistics were used to summarize the demographic characteristics of the IT staffs, knowledge level, attitude and, challenges. Chi-square test and t-test were used to compare the differences in knowledge and attitude within the demographic characteristics. As well, the relationship between the knowledge levels and the attitude were assessed by Chi-square test.

Table 1: Questionnaire sections and questions

Sections	Questions	Response scale
Knowledge	What is the definition of big data analytics?	Multiple-choice
	What is the focus of big data analytics?	Multiple-choice
	What are the advantages of big data analytics?	Multiple-choice
	What are the disadvantages of big data analytics?	Multiple-choice
	What are the big data resources?	Multiple-choice
	What is the most important necessity of big data analytics?	Multiple-choice
	What item is not characteristic of big data?	Multiple-choice
	What is the last phase of big data analytics?	Multiple-choice
	Which of the following items is true about big data analytics?	Multiple-choice
Attitude	Which items is not one of the applications of big data analytics?	Multiple-choice
	How much do you agree with the necessity of big data management in the country?	5-Likert scale
	How much do you think that to recruit a specialist with expertise in big data analytics is necessary for your organization?	5-Likert scale
	How much do you think that using big data analytics has many advantages for organization managers?	5-Likert scale
	How much do you think using big data analytics can increase workload in your organization?	5-Likert scale
	How much do you think holding the in-person training courses about big data analytics can increase the application of big data analytics in your organization?	5-Likert scale
	How much you feel IT managers do not resist the adoption of big data analytics?	5-Likert scale
	How much do you think IT staffs can improve their big data analytics skills using the current education materials in Persians books?	5-Likert scale
	How much do you think IT staffs can improve their big data analytics skills with using educational websites?	5-Likert scale
	Do How much do you think the Iranian specialist can hold effective big data analytics courses?	5-Likert scale
	Do How much do you think to recruit foreign specialists is a good idea for training big data analytics?	5-Likert scale
	In your opinion, how the percentage of IT staffs have big data analytics skills in the country?	Multiple-choice
	In your opinion, in which fields we encounter more big data compared to the others?	Multiple-choice
Which one of the tools would you prefer for big data analytics?	Multiple-choice	
Barriers and challenges	In your opinion, how we can motivate IT managers to use big data analytics on their organizations?	Multiple-choice
	In your opinion, why is the application of big data analytics so low in the country?	Multiple-choice
	In your opinion, how many years later Iran would reach the level of developed countries in the field of big data analytics?	Multiple-choice
	In your opinion, what are the challenges and barriers of the application of big data analytics the country?	open-ended question

RESULTS

Participants

Out of a total of 70 public organizations and private organizations in Mashhad, 48 were included in the present study. Some of the included organizations were social security insurance, hospitals, transportation organization, and governorate. The

researchers met with 250 targets IT staffs, among which 123 individuals agreed to participate in the study and finally, 120 valid questionnaires were analyzed. Table 2 demonstrates the characteristics of the participants. Over two-thirds of the participants were men. The age range of users was 20 to 64 years, and most of the participants were aged 25-34. The majority of participants were computer specialists and 69% of all participants had more than 6 years of work experience. The majority of the participants had

a Bachelor's and a Master's degree (94%).

Table 2: Individual characteristics of the participants in this study (n=120)

Characteristics	Sub groups	Frequency (%)
Age	18-24 year	19(15.4)
	25-34 year	61(49.6)
	35-44 year	36(29.3)
	45-54 year	6(4.9)
	55-64 year	1(0.8)
Sex	Male	80(65.6)
	Female	40(32.5)
Work experience (years)	<1	27(22.5)
	1-5 year	24(20.0)
	5-10 year	35(29.2)
	>10	34(28.3)
Discipline	Computer science	77(64.2)
	Information technology	23(19.2)
	Telecommunications (Electricity)	12(10.0)
	Accountancy	3(2.5)
	Medical informatics	1(0.8)
	Health information system	2(1.7)
Education level	Bachelor's	60(50)
	Master's	53(44.2)
	General practitioner	4(3.3)
	PhD	2(1.7)
Average number of scientific study hours per week	<1 hour	17(14.2)
	1-3 hour	34(28.3)
	3-4 hour	19(15.8)
	>5 hour	49(40.8)
Average number of nonscientific study hours per week	<1 hour	31(25.8)
	1-3 hour	45(37.5)
	3-4 hour	22(18.3)
	>5 hour	20(16.7)

IT staffs' knowledge level about big data analytics

Table 3 shows the knowledge levels of participants in big data analytics. Knowledge levels were low, moderate, and high in 35.0%, 33.3%, and 31.7 % of the participants, respectively. The knowledge s' score most of the participants were from scores of 3 to 5. Results (Table 4) of chi-square tests showed that the two factors most affecting the knowledge level of participants were age groups (p=0.040, Chi-square value=13.167) and sex (p=0.009, Chi-Square value=9.445). A significantly higher level of knowledge was observed in the age group of 25-34 years. There was no significant difference between the knowledge level and other users' characteristics including work experience, discipline, education level, the average number of scientific study hours per week, and, the average number of nonscientific

study hours per week.

Table 3: IT staffs' knowledge level of big data analytics

Category	Score	Frequency %
Low	0	4(3.3)
	1	4(3.3)
	2	11(9.2)
Moderate	3	23(19.2)
	4	22(18.3)
	5	18(15.0)
High	6	16(13.3)
	7	14(11.7)
	8	5(4.2)
	9	3(2.5)
Total	0-9	120(100.0)

Table 4: The participants' knowledge level in the age and sex groups

Question no.	Age groups (year)	Knowledge levels			Total (n,%)
		Low (n, %)	Moderate (n, %)	High (n, %)	
QK1	18-24	13 (30.2)	4 (9.8)	2 (5.1)	19 (15.4)
	25-34	18 (41.9)	22 (53.7)	21 (53.8)	61 (49.6)
	35-44	9 (20.9)	14 (34.1)	13 (33.3)	36 (29.3)
	45-54	3 (7.0)	1 (2.4)	3 (7.7)	7 (5.7)
	Total	43 (100)	41 (100)	39 (100)	123 (100)
QK2	Male	31 (73.8)	31 (77.5)	18 (47.4)	80 (66.7)
	Female	11 (26.2)	9 (22.5)	20 (52.6)	40 (33.3)
	Total	42 (100)	40 (100)	38 (100)	120 (100)

IT staffs' attitude toward the big data analytic

IT staffs' attitude toward the big data analytics in Likert-Scale questions

93.4% (n=112) of the participants believed that big data management is necessary for the country. Around 74.2% (n=89) of the participants agreed that big data analyzes can provide many advantages to organization managers. As well, 98.3%, (n=18) of the participants feel that IT managers do not resist the adoption of big data analytics. 74.2% (n=89) of the participants think that to recruit a specialist with expertise in big data analytics is necessary for their organization. Out of all participants, 91.9% (n=110) and 64.2% (n=77) believed that they cannot improve their big data analytics skills using the current education materials in Persians books; online courses and educational websites, receptively. And also, 60.8% (n=73) believed that the Iranian specialist

cannot hold effective big data analytics courses. 62.5% (n=75) of the participants agreed that holding the in-person training courses about big data analytics can increase the application of big data analytics in their organization. Table 5 draws IT staffs' attitude toward big data analytics in Likert-Scale questions.

Table 5: Participant' attitudes toward the big data analytics in Likert-Scale questions

Questions	Negative attitude (%)	Positive attitude (%)
How much do you agree with the necessity of big data management in the country?	8 (6.7)	112 (93.3)
How much do you think that to recruit a specialist with expertise in big data analytics is necessary for your organization?	35 (29.2)	85 (70.8)
How much do you think that using big data analytics has many advantages for organization managers?	31 (25.8)	89 (74.2)
How much do you think using big data analytics can increase workload in your organization?	60 (50.0)	60 (50.0)
How much do you think holding the in-person training courses about big data analytics can increase the application of big data analytics in your organization?	45 (37.5)	75 (62.5)
How much do you feel IT managers do not resist the adoption of big data analytics?	21 (1.7)	118 (98.3)
How much do you think IT staffs can improve their big data analytics skills using the current education materials in Persians books?	110 (91.7)	10 (8.3)
How much do you think IT staffs can improve their big data analytics skills with using educational websites?	77 (64.2)	43 (35.8)
Do How much do you think the Iranian specialist can hold effective big data analytics courses?	73 (60.8)	47 (39.2)
Do How much do you think to recruit foreign specialists is a good idea for training big data analytics?	57 (47.5)	63 (52.5)

IT staffs' attitude toward the big data analytics in multiple-choice questions

As shown in Table 5, 50% (n=60) of the participant believed that less than 10% of IT staffs have big data analytics skills. On participants' point of view, three fields including 'financial and insurance activities'; 'professional, scientific, and technical activities'; and 'administrative activities'; and support services

were faced with more big data, respectively.

Table 6 showed IT staffs' attitude toward big data analytics. Most of the participants prefer to use from "Spark" and "R" software for big data analytics. As well, the results showed 26.7% (n=32) of the participants believed that only one software could be used for big data analytics, 46.7% (n=56) selected two software, 17.5% (21) selected three software, and 9.2% (n=11) selected more than three software (Table 6).

Table 6: Participant' attitudes toward the big data analytics in multiple-choice questions

Questions	Items (n, %)
In your opinion, how percentage of the IT staffs have big data analytics skills in the country?	x <10% (60,50) 10%≤ x <30% (36,30) 30%≤ x <50% (20,17) 50%≤ x (4,3)
In your opinion, in which fields we encounter more big data compared to the others?	Agriculture, forestry, fishing (6,0.5) Industry and mining (16,13.3) Information and communication (14,11.7) Energy supply and its consumption management (9,7.5) Transportation and warehousing (0,0) Education (11,9.2) Professional, scientific, and technical activities (24,20) Financial and insurance activities (36,30) Administrative activities and support services (17,14.2) Activities related to human health and social assistance (6,5) Other cases(61,50.8)
Which one of the tools would you prefer for big data analytics?	R (33,27.5) Matlab (19,15.8) Python (6,5.5) Hadoop (29,24.2) Spark (41,34.2) F-link (8,6.7) SPSS Modeler (6,5.0) Weka (27,22.5) Rapid minder (1,0.8) SQL (5,4.2)

The relation between knowledge levels and attitude in the IT staffs

The results of assessing relations between the knowledge level and attitudes toward big data analytics are shown in Table 7. The results showed that there was a statistically significant difference between the positive attitude toward the necessity of big data management in the country (QP1) and

knowledge level. As well, the same difference observed between the increasing workload in the organizations due to the application of big data analytics and knowledge level (QP9) (Table 7). Participants with a higher knowledge level believed that the application of big data analytics can increase workload (QP9) (Table 7). Table 8 shows the significant difference between the participants' knowledge levels and attitude.

Table 7: The relation between participants' knowledge levels and attitude in all attitude questions

Questions	Chi-Square value	P-value
QP1 ^a	22.046	.005
QP2 ^b	10.584	.230
QP3 ^b	5.737	.22
QP4 ^b	.721	.949
QP5 ^b	.54	.973
QP6 ^b	5.871	.438
QP7 ^b	4.418	.11
QP8 ^b	1.295	.523
QP9 ^a	8.346	.015
QP10 ^b	1.356	.508
QP11 ^b	4.056	.398
QP12 ^b	2.197	.901
QP13 ^b	2.376	.667
QP14 ^b	1.901	0.754
QP15 ^b	3.953	.412
QP16 ^b	6.649	.156

Note: The significant results within each group of users are indicated by letters a and b ,values not sharing a common letter differ significantly (P < 0.05)

The challenges of big data analytics

The results showed about two thirds (68.3%) of the participants believed that more than 5 years later Iran would reach the level of developed countries in the field of big data analytics.

On the participants' point of view, the most important motivation for using bid data analytics by IT managers was training and workshop, encouragement, coercion, and advertising, receptively. As well, 39.2% (n=47) of the participants believed that the most important reason for low the application of big data analytics was the complex analysis of this type of data. Absent of bid data in the country, lack of skilled specialists, and expensive equipment were other reasons, receptively. Table 9 shows the results of open-end questions about the facilitators and barriers of big data analytics based on IT staffs' point of view.

Out of a total of 120 participants, 53 responded to the open-ended question. 35 challenges were identified of the big data analytics which covered 12 groups. these groups were as follows: lack of knowledge and attitude of managers and policymakers, lack government policies and plans, lack of knowledge and attitude of IT managers, lack of educational resources and courses, low data quality, weakness in

data management, dispersion of information and lack of an aggregation standardized, lack of expert staff, inadequate equipment, lack of successful implemented big data analytics projects, cost, and shortage and inadequate research (Table 10).

Table 8: The significant difference between the participants' knowledge levels and attitude

Attitude groups		Knowledge levels			Total
		Low (%)	Moderate (%)	High (%)	
QP1	Positive attitude	36 (83.7)	40 (97.6)	39 (100)	115 (93.0)
	Negative attitude	7 (16.3)	1 (2.4)	0 (0)	8 (6.5)
Total		43 (100)	41 (100)	39 (100)	123 (100)
QP9	Positive attitude	17 (47.2)	29 (75.5)	16 (42.1)	62 (54.4)
	Negative attitude	19 (52.8)	11 (27.5)	22 (57.9)	52 (45.6)
Total		36 (100)	40 (100)	38 (100)	114 (100)

DISCUSSION

In the current study, a questioner was proposed to evaluate knowledge, attitude, and challenges of big data analytics based on the IT staffs' point of view. It was found to have a high rate of validity and reliability. This can be in future studies. As well, the association between the knowledge level, attitude toward big data analytics, and users' characteristics such as age, gender, and education level were investigated. The present study was conducted in one of the largest cities in Iran. The results of the present study highlight the characteristics and opinions IT staffs about big data analytics in a developing country. The most important findings of the study will be discussed in following paragraphs.

The perceptions of the Health Informatics Scientists about big data technology in Healthcare were evaluated in the study by Minou et al. Based on their findings, 86.7% of scientists had knowledge of big data. As well, 100% of the participants believed that big data technology can be implemented in Healthcare [22]. Our results reveled that knowledge level in most of the participants was low or moderate. It was lower than the knowledge level reported in the study by Minou et al. [22]. And also, our findings indicated that just 5% of participant believed health care face with big data. Results of this showed that there was a significant difference between age group and knowledge level. A significantly higher level of knowledge was observed in the age group of 25-34 years. Given that this age group is considered the young workforce in the organizations. It seems to learn of big data analytics coming to a change.

Table 9: Barriers of the big data analytics based on IT staffs' point of view

Questions	Items (n, %)
In your opinion, how many years later Iran would reach the level of developed countries in the field of big data analytics?	1 year later (2,1.7) 2-3 years later (7,5.8) 4-5 years later (20,16.7) More than 5 years later (82,68.3)
In your opinion, how we can motivate IT managers to use big data analytics on their organizations?	Training and workshop (64,53.3) Advertising (10,8.3) Coercion (13,10.8) Encouragement (35, 29.2)
In your opinion, why is the application of big data analytics so low in the country?	Big data analytics equipment is so expensive (13,10.8) The process of big data analytics is very complex (47,39.2) There are not skilled specialists(18,15) There are not big data in our country(36,30)

Table 10: Challenges of the big data analytics based on IT staffs' point of view

Category	Items
1-Lack of knowledge and attitude of managers and policymakers	1-Lack of general awareness in organizations about big data analytics. 2-Low level of knowledge about big data analytics among organization managers and policy-makers. 3-Lack of awareness about importance, values, and advantages of big data analytics among organization managers and policy-makers.
2-Lack government policies and plans	4- Lack of priority of big data analytics implementation in strategies and plans. 5-Lack of priority of big data analytics projects implementation in private organization 6-Lack of government strategic focus to implement the big data analytics project 7-Lack of appropriate rules for data collection and management
3-Lack of knowledge and attitude of IT managers	8-Low level of knowledge about big data analytics among IT managers 9-Lack of awareness about the importance, values, and advantages of big data analytics among IT managers. 10-Lack of positive attitude toward big data analytics among Iranians IT specialists. 11-Lack of sufficient knowledge about the methods of big data analytics among Iranians IT specialists
4-Lack of educational resources and courses	12-Lack of Persian educational resources. 13-Inadequate training courses. 14-Lack of skilled specialist for holding big data analytics courses Lack interest or motivation in study and learning of big data analytics concepts
5-Low data quality	15-Lack of accurate, appropriate, and complete data in databases 16-The presence of wrong data in databases 17-The low-quality data in databases
6-Weakness in data management	18-Inadequate data management methods. 19-Not existing data warehouse. 20-Do not explore patterns and relationships between data.
7-Dispersion of information and lack of an aggregation standardized	21-Non-interoperable software and tools for data gathering 22-Inadequate standards for data aggregation. 23-Dispersion of data and information in the country.
8-Lack of expert staff	24-Lack of big data analytics specialists in the country. 25-Do not recruit current specialists of big data analytics in the organizations. Lack of practical experience big data analytics by current specialists.
9-Inadequate equipment	26-Lack of proper infrastructure hardware and network. 27-Lack of big data analytics software.
10-Lack of successful implemented big data analytics projects	28-Failure of big data analytics projects. 29-Lack of successful big data analytics projects.
11-Cost	30-High costs the application of big data analytics.
12- Shortage inadequate research	31-Lack of enough research about big data analytics. 32-Conducting studied about big data analytics in the small and local level. 33-Lack of large-scale, comprehensive projects of big data analytics. 34-Conducting studied about big data analytics by non-skilled specialists.

Evaluation knowledge level of specialists about big may help to understand their attitudes and behaviors [23]. The results of the current study support this finding. There was a statistically significant difference between the positive attitude toward the necessity of big data management and knowledge level. The participant acquired higher levels of knowledge considered big data analytics is essential.

Accordingly, those who had high knowledge believed that Big Data analyzes impose workload on authorities. It seems that these people are aware of the wide range of services in the Big Data area and the development of various methods and platforms, and it is thought that learning this field would lead to the increased responsibilities and workload.

The results of the study revealed that IT staffs hold a positive attitude toward big data analytics. Most of IT staffs believed that big data management is necessary for the country and they agreed that big data analyzes can provide many advantages to organization managers. But, they believed that the application of big data analytics faced a number of challenges such as lack of education materials in Persians books, lack of skilled specialists, and lack of effective training course.

The results showed that some identified challenges in the current study were common with developed countries. But, there was a number of different challenges. A short explanation of the findings was presented in the following paragraphs. An empirical investigation of challenges and risks about big data technologies in various companies were conducted by Raguseo [24]. In this study, the lack of information system and infrastructure support and minimal IT expertise was reported as big data technologies challenges. The results of the current study support this finding. As well, Raguseo points out a number of other challenges including privacy issues, security issues, capital outlay with no guarantee of likely returns, uncertainty about how to measure potential benefits, and uncertainty about how to measure the involved costs. In the present study, none of these challenges was reported. Participants declared different challenges such as shortage of skilled specialists, lack of educational material and resources, and lack of knowledge and attitude of

managers. The reason for the difference between the present study and their study is possibly a shortage of the application of big data analytics in the country. Most of the IT staffs had a low knowledge level of big data. Those had high knowledge level concerned with an initial investment for starting a project and adequate infrastructure.

CONCLUSION

Our results represented that the most critical areas requiring intervention lie in the area of awareness and education, recruiting skilled specialists, presentation big data analytics benefits to IT managers and policymakers, conducting research projects, developing a strategic plan at national and local levels. It is suggested that in future studies, the knowledge, attitude, and challenges of big data analytics based on students, IT managers, and policy makers be evaluated. As well, the impacts of education course on knowledge, attitude, and their performance can be investigated.

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AUTHOR'S CONTRIBUTION

EN, ZE, ZA, and HT designed the study, gathered and analyzed the data. The authors agree on this final form of the manuscript, and attested that all authors contributed in the final draft of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this study.

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