TEST Engineering & Management

January - February2020
ISSN: 0193-4120 Page No. 12065 - 12074

The Mediation Effect of Management Information Systems on the Relationship between Big Data Quality and Decision making Quality

Yazeed Alkatheeri[1]*,Ali Ameen [*1], Osama Isaac [1]Ahmed Al-Shibami[1],Mohammed Nusari[1]
[1]Lincoln University College, Selangor, Malaysia
[*] Correspondence: ali.ameen@aol.com

Article Info
Volume 82
Page Number: 12065 - 12074
Publication Issue:
January-February 2020

Article History
Article Received*: 18 May 2019*
Revised*: 14 July 2019*
Accepted*: 22 December 2019*
Publication*: 23 February 2020*

Abstract
In the quest to improve decision making quality, attention has been directed at new innovative ideas. It must be emphasized that the dire need for better public services has led to several technology frameworks in various global regions. General Directorate of Residency and Foreigners Affairs in Dubai and the Telecommunications Regulatory Authority, UAEare the focus of this paper, where an innovative approach is applied to assess the impact of big data and management information system on decision making quality, in addition to the mediating role of management information system. The data was collected from 398 employees of General Directorate of Residency and Foreigners Affairs in Dubai and the Telecommunications Regulatory Authority, analysed using structural equation modelling (SEM) via SmartPLS 3.0. The results proved that there is a significant impact of big data quality on management information system which in turn affects decision making quality, and it also proved the significant mediating role of management information systems in the model. The proposed model explained 45% of the variance in decision making quality.

Keywords:*Big data quality; management information systems; decision making quality.*

I. Introduction

The potential of new technologies to 'disrupt' the management of organisations, including at the most senior levels, has recently been noted by many scholars (e.g. Abbasi, Sarker, & Chiang, 2016; Evans, 2017; Valentine & Stewart, 2013). One striking example of this disruptive effect is the challenging role played by 'Big Data' (BD) for directors and decision-makers (Janssen, van der Voort, & Wahyudi, 2017). The sudden rise of BD as a new knowledge source has prompted corporate decision-makers to make decisions more rapidly and to shape their capabilities to proactively address environmental changes (Fosso Wamba, Akter, Edwards, Chopin, & Gnanzou, 2015).

Despite considerable research on making strategic (important, novel and resource hungry) decisions and the characteristics of these processes (Hickson, Butler, Cray, Mallory, & Wilson, 1986; Whittington, Cailluet, & Yakis-Douglas, 2011), there is little research on how big data has influenced the way decisions are made, on the impact of data proliferation on strategic responsibilities (Chari, Katsikeas, Balabanis, & Robson, 2012; Quinn, Dibb, Simkin, Canhoto, & Analogbei, 2016), or on how these data are handled at board level (Nutt & Wilson, 2010). A

previous empirical study (Hickson, Miller, & Wilson, 2003) has identified the 'knowledge base' used by UK senior managers to inform their strategic decision-making as the single most important factor in the decision's success. However, while this was a large study with 55 UK cases, it mainly spanned a period where information for decisions was largely well-known (extant knowledge), available in hard copy as reports (explicit knowledge), or resided in

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managers' heads based on their experience or judgement (implicit or tacit knowledge)(Alkatheeri, Yazeed; Ameen, Ali; Al-Shibami, 2017; Alkatheeri et al., 2020; Baharuden, Isaac, & Ameen, 2019; Haddad et al., 2020; Yazeed, Ali, & Al- Shibami, 2018).

While theUnitedArab Emirates (UAE) is one of the leading countries that produce large amounts of data, the ability to harness this [big] data remains a challenge. This research will examine the direct impact of big data quality on management information systems and the indirect impact on decision making quality.

II. Literature Review

2.1Decision Making Quality (DMQ)

The decision-making process is significant administrative processes but it must be stressed here that not every process requires a decision, but each process requires a different kind of information than other processes; Given the importance of decision-making in management and the importance of information, attention has been paid to this work(Al-Ali, Ameen, Issac, Nusari, & Ibrhim Alrajawi, 2018; Al-Obthani & Ameen, 2019b, 2019a; Alameria, Isaac, Ameenc, & Bhaumik, 2019; Albreiki, Ameen, & Bhaumik, 2019; Albreki, Ameen, & Bhaumik, 2019; Alghawi, Ameen, & Bhaumik, 2019; Alhefiti, Ameen, & Bhaumik, 2019b, 2019a). Decision-making is an important issue affecting the functioning of organizations and has a significant impact on the management of human resources(Abdulbaqi Ameen & Ahmad, 2011; Ameen & Ahmad, 2012, 2013; Ameen, Almari, & Isaac, 2018, 2019). Where the mechanism of decision-making and taking of the subjects of great importance that occupied the social scientists and researchers, especially those involved with sociology or management, because of its direct impact on the human element in organizations and businesses. (Hall, 2007).

2.2Big Data Quality (BDQ)

Big Data represents a wide range of relatively large and complex data as it becomes very difficult to process using known information systems even so it needs a huge database that does not process data using traditional applications and software. The challenges faced by operators for large data also include access to information, the time required for storage, storage capacity, and search and transport difficulties. (Alejandra, 2012) As well as demand for large data applications has increased, especially in the last decade, with the evolution of information technology and the Internet, the need to analyze a wide range and in one large bundle of data which compared to the smaller groups and smaller discrete data, dealing with them is very complex things. (Reichman et al, 2011). At present, large data is one of the most important sources of information in governmental and non-governmental organizations. It is also a source of basic economic values and a source of innovation. It is expected to be a vital and sensitive source of security for all countries in the world(Alshamsi, Ameen, Isaac, Khalifa, & Bhumic, 2019; Alshamsi, Ameen, Nusari, Abuelhassan, & Bhumic, 2019; Mohammad, Nusari, Khalifa, Ameen, & Issac, 2019; Mona Saeed Mohamed et al., 2018). The control of large data is in many vital and economic areas, research in large data has allowed for the discovery of commercial and core linkages, legal, where large-scale data applications are currently used to combat crime and terrorism and to determine the flow of security data at the right time and in real time. (Magoulas&Lorica, 2017).Consequently, the following hypotheses are proposed:

H1:Big data qualityhas a positive effect on management information systems.

2.3 Management Information Systems (MIS)

Management information system refers to a set of interrelated elements that interact to

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perform a specific function, to achieve a particular goal, or group goals, but remains named Information Systems. Moreover, an information system based on an organization's computer systems includes components of hardware, software, data, communications and similar interrelated elements, which works to achieve the objectives of the organization. (Kandilji, 2008).Nowadays, work is highly dependent on cutting-edge scientific methods and modern theories, therefore, the work is going through the systems and clear policies that rely on systems, as well as the system can generally be defined as a set of elements or parts that are integrated and controlled by specific relationships and mechanisms and within a specific scope with a view to achieving a particular objective. (Al-Hassania, 2002).Consequently, the following hypotheses are proposed:

H2:Management information systemshas a positive effect on decision making quality.

H3:Management information systemsmediate the relationship betweenBig data quality anddecision making quality.

III. Research Method

3.1 Overview of the Proposed Conceptual Framework

Based on the above literature, the proposed model in figure 1 consists of big data quality (data quality, data relevance, data sharing, data storage), management information systems (organizing data, information retrieval speed, incentive regulation, system quality), decision making quality (identify the problem, gather information, identify the alternatives, take action).

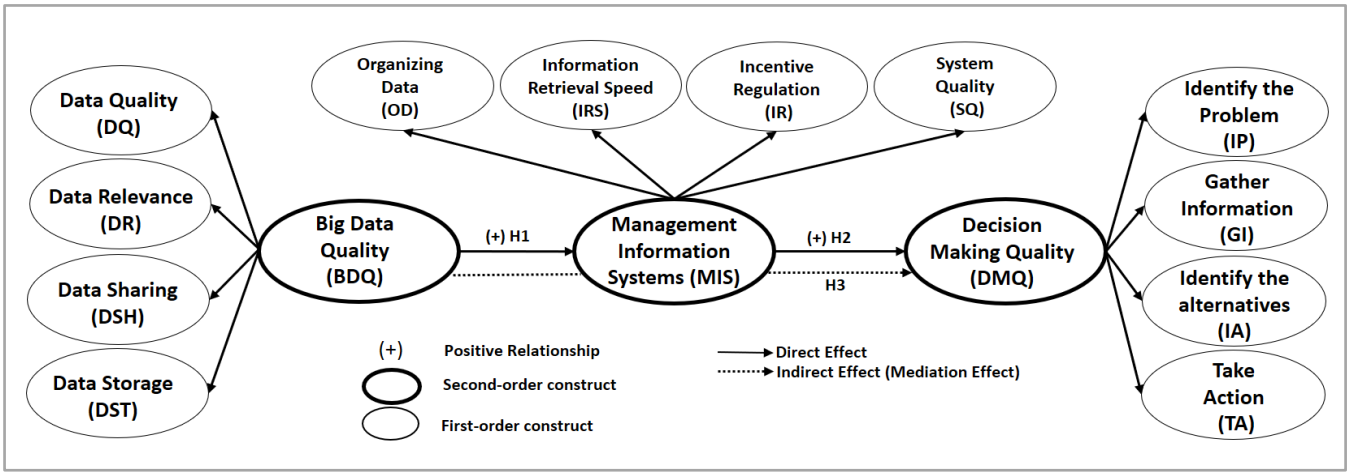

Figure 1:The proposed conceptual framework

3.2. Development of Instrument and Data collection

In this study, the researchers developed the questionnaire tool which consisted of 60 questions. Variables were measured using a Likert Scale which recommended in the previous studies (Isaac, Aldholay, Abdullah, & Ramayah, 2019; Isaac, Abdullah, Ramayah, & Mutahar, 2018).This information was collected by delivering the self-managed questionnaire 'in-person' to the employees in the General Directorate of Residency and Foreigners Affairs in Dubai and the Telecommunications Regulatory Authority, UAE, in the period between March 2018 and April 2019. Out of the 500 questionnaires that were distributed, 398 responses were seen to be suitable for analysis. This sample size was sufficient as stated by Krejcie and Morgan (1970) and Tabachnick and Fidell (2012).

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IV. Data Analysis and Results

PLS (Partial Least Squares) SEM-VB (Structural Equation Modelling-Variance Based) was employed to assess the research model by utilizing the software SmartPLS 3.0 (Ringle, Wende, & Becker, 2015). The main reasons for choosing SEM as a statistical method for this study is that SEM offers a simultaneous analysis which leads to more accurate estimates (Isaac, Abdullah, Aldholay, & Ameen, 2019; Isaac, Abdullah, Ramayah, & Mutahar, 2017; Mutahar, Daud, Thurasamy, Isaac, & Abdulsalam, 2018).

4.1Measurement Model Assessment

The individual Cronbach's alpha, the composite reliability (CR), The average variance extracted (AVE), and the factor loadingsexceeded the suggested value (Kline, 2010;Hair, Black, Babin, & Anderson, 2010)as illustrated in Table 1.Further, discriminant validity through Fornell-Larcker (see table 2) was found adequate as recommended by(Fornell & Larcker, 1981; Chin, 1998).

Table 1: *Measurement model assessment*

Constructs	Item	Loading (> 0.7)	M	SD	α (> 0.7)	CR (> 0.7)	AVE (> 0.5)
Data Quality (DQ)	DQ1	0.870	3.87	0.95	0.914	0.935	0.744
	DQ2	0.881					
	DQ3	0.864					
	DQ4	0.848					
	DQ5	0.848					
Data Relevance (DR)	DR1	0.897	4.03	0.95	0.944	0.958	0.819
	DR2	0.921					
	DR3	0.934					
	DR4	0.939					
	DR5	0.831					
Data Sharing (DSH)	DSH1	0.888	3.89	0.94	0.906	0.934	0.781
	DSH2	0.898					
	DSH3	0.877					
	DSH4	Deleted					
	DSH5	0.871					
Data Storage (DST)	DST1	0.882	3.90	0.96	0.892	0.926	0.758
	DST2	0.910					
	DST3	0.907					
	DST4	0.776					
	DST5	Deleted					
Organizing Data (OD)	OD1	0.909	3.90	0.87	0.950	0.961	0.833
	OD2	0.923					
	OD3	0.917					
	OD4	0.902					
	OD5	0.912					
Information Retrieval Speed (IRS)	IRS1	0.856	3.73	0.96	0.919	0.939	0.755
	IRS2	0.905					
	IRS3	0.864					
	IRS4	0.878					
	IRS5	0.841					
Incentive Regulation (IR)	IR1	0.907	3.86	0.94	0.944	0.957	0.818
	IR2	0.930					
	IR3	0.893					
	IR4	0.898					
	IR5	0.894					
System Quality	SQ1	0.911	3.64	0.92	0.931	0.948	0.787
	SQ2	0.916					

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(SQ)	SQ3	0.899					
	SQ4	0.900					
	SQ5	0.804					
Identify the Problem (IP)	IP1	0.876	3.87	0.83	0.933	0.949	0.788
	IP2	0.869					
	IP3	0.878					
	IP4	0.910					
	IP5	0.905					
Gather Information (GI)	GI1	0.874	3.88	0.85	0.939	0.954	0.805
	GI2	0.908					
	GI3	0.925					
	GI4	0.916					
	GI5	0.862					
Identify the alternatives (IA)	IA1	0.882	4.13	0.91	0.940	0.954	0.807
	IA2	0.923					
	IA3	0.922					
	IA4	0.933					
	IA5	0.827					
Take Action (TA)	TA1	0.891	4.25	0.91	0.951	0.963	0.837
	TA2	0.950					
	TA3	0.937					
	TA4	0.895					
	TA5	0.901					

Note: M=Mean; SD=Standard Deviation, α= Cronbach's alpha; CR = Composite Reliability, AVE = Average Variance Extracted.
Key: DQ: Data Quality, DR: Data Relevance, DSH: Data Sharing, DST: Data Storage, OD: Organizing Data, IRS: Information Retrieval Speed, IR: Incentive Regulation, SQ: System Quality, IP: Identify the Problem, GI: Gather Information, IA: Identify the alternatives, TA: Take Action

Table 2: *Fornell-Larcker criterion*

	DQ	*DR*	*DSH*	*DST*	*GI*	*IA*	*IP*	*IR*	*IRS*	*OD*	*SQ*	*TA*
DQ	0.862											
DR	0.674	0.905										
DSH	0.738	0.729	0.884									
DST	0.756	0.700	0.742	0.870								
GI	0.450	0.474	0.478	0.472	0.897							
IA	0.431	0.626	0.476	0.470	0.731	0.898						
IP	0.442	0.458	0.464	0.466	0.782	0.721	0.888					
IR	0.457	0.522	0.514	0.451	0.601	0.566	0.628	0.904				
IRS	0.433	0.496	0.468	0.431	0.580	0.567	0.607	0.801	0.869			
OD	0.470	0.527	0.498	0.484	0.532	0.505	0.572	0.747	0.733	0.913		
SQ	0.413	0.422	0.415	0.394	0.342	0.360	0.401	0.489	0.457	0.525	0.887	
TA	0.422	0.448	0.432	0.437	0.624	0.741	0.631	0.471	0.468	0.426	0.347	0.915

Note: Diagonals represent the square root of the average variance extracted while the other entries represent the correlations.

Key: DQ: Data Quality, DR: Data Relevance, DSH: Data Sharing, DST: Data Storage, OD: Organizing Data, IRS: Information Retrieval Speed, IR: Incentive Regulation, SQ: System

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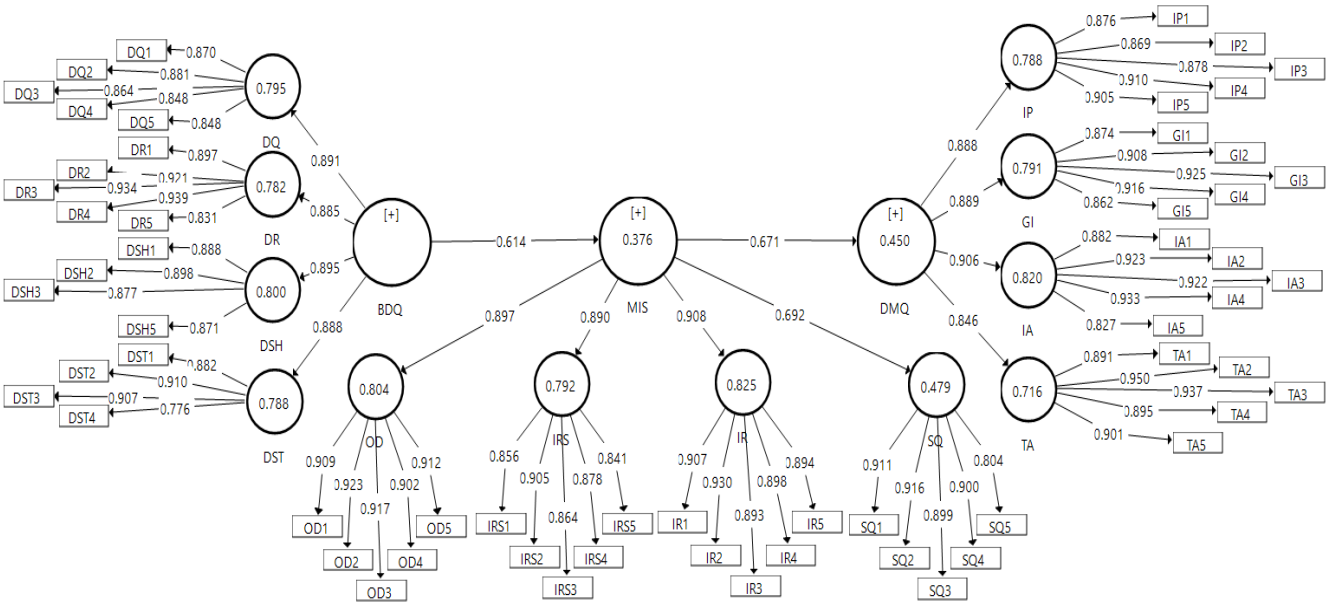
Quality, IP: Identify the Problem, GI: Gather Information, IA: Identify the alternatives, TA: Take Action.

4.2 Structural Model Assessment

The structural model can be tested by computing beta (β), R^2, and the corresponding *t*-values via a bootstrapping procedure with a resample of 5,000 (Hair, Hult, Ringle, & Sarstedt, 2017).



Key: BDQ: Big Data Quality, DQ: Data Quality, DR: Data Relevance, DSH: Data Sharing, DST: Data Storage, MIS: Management Information Systems, OD: Organizing Data, IRS: Information Retrieval Speed, IR: Incentive Regulation, SQ: System Quality, DMQ: Decision Making Quality, IP: Identify the Problem, GI: Gather Information, IA: Identify the alternatives, TA: Take Action

Figure 2:PLS algorithm results

Figure 2 and Table 3 depict the structural model assessment, showing the resultsof the hypothesis tests. Big data qualitypositivelyinfluence management information systems.Hence, H1 is accepted with (□□ □ □ □ □ □□□□ □□ □ t□ □□ □ □ □ □ □□□□ p <0.001).Management information systemspositivelyinfluencedecision making quality.Hence, H2 is accepted with (□□ □ □ □ □ □ □ □ □ □ □ t□ □ □ □ □ □ □ □ □ □ p <0.001).

The researchers also applied the Preacher and Hayes (2004; 2008) method for bootstrapping all indirect effects for testing the mediation hypothesis, H3. The results showed that the management information systems mediated the relationship between the big data qualityand decision making quality. Thus, the H3was accepted and showed the values of(□□ □ □ □ □ □ □ □ □ □ □ t□ □□ □□ □ □ p<0.00 1).

Big data quality explains thirty-eight percent of the variance in management information systems. In addition, management information systems explainsforty-five percent of the variance in decision making quality. The values of R^2 have an acceptable level of explanatory power, indicating a substantial model (Cohen, 1988;Chin, 1998).

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Table 3: *Results of Hypothesis testing*

Hypothesis	Relationship	Std Beta	Std Error	t-value	p-value	Decision	R^2
H1	BDQ→MIS	0.614	0.058	10.539	0.000	Supported	0.38
H2	MIS →DMQ	0.671	0.047	14.395	0.000	Supported	0.45
H3	BDQ→MIS→DMQ	0.411	0.059	6.939	0.000	Supported	

Key: BDQ: Big Data Quality, MIS: Management Information Systems, DMQ: Decision Making Quality

V. Discussion

In this study, the researchers noted that big data quality influence could positively affect management information system amongst the employees working in General Directorate of Residency and Foreigners Affairs in Dubai and the Telecommunications Regulatory Authority, UAE. A similar observation was noted earlier (Ghasemaghaei & Calic, 2019; Pugna, Dut, & Georgiana, 2019; Shamim, Zeng, Shariq, & Khan, 2018; Taleb, Serhani, & Dssouli, 2018). The finding implies that big data quality is influencing the management information systems of public sector in the UAE represented by General Directorate of Residency and Telecommunications Regulatory Authority.This suggests that public sector organizations may want to pay attention to big data quality to improve the management information systems. The higher quality of big data the better management information systems will be.

The results also indicated that management information system showed a positive effect on decision making quality of the employees working in General Directorate of Residency and Foreigners Affairs in Dubai and the Telecommunications Regulatory Authority, UAE, as shown earlier (Ada & Ghaffarzadeh, 2015; Berisha - Shaqiri, 2014; Bharu, 2010; Hakimpoor & Khairabadi, 2018; Samer & Rawan, 2018). This was based on the fact that public sector organisations may need to put more attention on the management information systems, in order to enhance decision making quality. Generally, the better the management information systems of a public sector institution, the better its organisational performance.

Furthermore, management information systems were found to significantly mediate the relationship between big data quality and decision-making quality among employees within General Directorate of Residency and Telecommunications Regulatory Authority in the UAE. This impact is supported by previous studies (Ada & Ghaffarzadeh, 2015; Berisha - Shaqiri, 2014; Bharu, 2010; Hakimpoor & Khairabadi, 2018; Samer & Rawan, 2018), and is explained by the fact that the better data quality, data relevance, data storage, data sharing, the better problem will be identified, information gathered, identify the alternatives , and take action given that organizing data, information retrieval speed, incentive regulation, and system quality.

VI. Implications

The concept of big data quality is not a newly emerging concept, and yet, until now, it is not fully understood by most organizations in the UAE or the Arab world. This study represents a major foundation in elevating this concept within the Emirates public sector. Therefore, this study has provided a comprehensive illustration of how the role of big data quality, and knowledge management quality toward the decision-making quality. Moreover, this study has provided many benefits for General Directorate of Residency and Foreigners Affairs, and Telecommunications Regulatory Authority in the UAE and public sector in general to view big data quality and knowledge

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management quality as a catalyst for the different types of decision-making quality.

One of the limitations of this study is that the data gathered was cross-sectional rather than longitudinal in nature. The longitudinal method might improve the understanding of the associations and the causality between variables (Isaac, Abdullah, Ramayah, Mutahar, & Alrajawy, 2017; Isaac, Abdullah, Ramayah, & Mutahar Ahmed, 2017). Future research should be conducted to investigate the relationship between variables by conducting cross-cultural studies as recommended by previous studies (Isaac, Abdullah, Ramayah, & Mutahar, 2017a; Isaac, Masoud, Samad, & Abdullah, 2016).

VII. Conclusion

This research attempted to expand the knowledge in the area of big data quality, knowledge management quality, and management information systems and decision-making quality in the United Arab of Emirates, specifically, the General Directorate of Residency and Telecommunications Regulatory Authority. By examining the comprehensive model in the UAE, this study added valuable knowledge to the area of public sector as well as academic research. Moreover, this study added to the understanding on the importance of the moderating effect of management information systems in the public organizations, in the UAE. In regards, this finding highlighted the finding that related to the identified objectives, as well as research contribution to different parties. Furthermore, the independent variables could explain 45% of the variation noted in the decision making quality.

Appendix AInstrument for varibles

Varible	*Measure*
Data Quality (DQ)	DQ1: The data provided by the system is up to date. DQ2: The data provided by the system is error-free to serve the decision-making process. DQ3: The system transforms data into precise useful information used by decision makers. DQ4: Data reaches to decision makers and individuals in a timely manner. DQ5: The data provided by the system is perfectly complete.
Data Relevance (DR)	DR1: The information available from the system is commensurate with the type of decisions taken. DR2: Available information is comprehensive for the best alternatives and solutions. DR3: Current information cannot be dispensed with in the organizational decision-making process. DR4: There is a diversity of big data sources within the organization DR5: Big data is evaluated continuously.
Data Sharing (DSH)	DSH1: There is a diversity of data available for individuals and for decision makers within the organization. DSH2: Available databases help diagnose problems and solutions. DSH3: Information is disseminated in such a way that it is easy to use. DSH4: Big data is converted into useful information for decision makers. DSH5: Data dissemination depends on a large database within the organization.
Data Storage (DST)	DST1: Big data is stored through an advanced database. DST2: Data is updated continuously. DST3: Computers used in data storage are up-to-date. DST4: Big data is protected through sophisticated and up-to-date software. DST5: There is a sophisticated organizational structure to access data stored; quickly and accurately.

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Organizing Data (OD)	OD1: The system contains all the basic information about employees. OD2: The system classifies employees into specific categories depending on the post they occupy. OD3: The system contains courses and experiences the employee possess. OD4: The system stores applicants' data for any job even if they were not accepted. OD5: The system analysis staff data for reclassification.
Information Retrieval Speed (IRS)	IRS1: The system is continuously updating through its inputs and outputs. IRS2: The system is maintained periodically. IRS3: The system provides all the information required by the human resources. IRS4: There are no errors in the data operation, save, and review. IRS5: The system allows you to restore files if they are lost.
Incentive Regulation (IR)	IR1: The system calculates the turnover rate of the employee. IR2: The system makes the employee feels the job security. IR3: The current system is neutral and far from biased. IR4: The organization relies entirely on the system to identify incentives. IR5: The incentive system is in line with staff expectations.
System Quality (SQ)	SQ1: The information provided by the system contributes to the capacity to Forecasting In the future. SQ2: The system helps the decision maker to determine the nature the information which benefits the Process Decision making. SQ3: The system contains software that enables it to recover files if they are lost. SQ4: The system has a back-up of data that is used when needed. SQ5: The system updates information efficiently and systematically.
Identify the Problem (IP)	IP1: I make sure that there is a clear Problem that requires solving. IP2: I make sure that this problem in the range of my responsibilities. IP3: I contact all the related parties to the problem to identify its exact dimensions. IP4: I look for the Reason behind the problem and identify its effects IP5: I Determine the Parties of the problem Precisely And clearly.
Gather Information (GI)	GI1: Confidence in information is essential in decision making. GI2: Decisions making process depends on precise and accurate information in our organization. GI3: I prefer getting descriptive information continuously when making a decision. GI4: I depend on the information provided by our management information systems to make a decision. GI5: I always check the accuracy of the information given to me continuously.
Identify the alternatives (IA)	IA1: I assess each solution alternative separately To learn points Power And weakness in it. IA2: I specify expected results for every alternative solution. IA3: I specify Standards To evaluate Solutions for the problem that needs to be solved. And choose optimum alternative according to standards and considerations Objectively. IA4: I assess the Possibility to Implement the alternative solution by knowing Availability of resources. IA5: I know when is the proper time and circumstances to apply the alternative assessed solution.
Take Action (TA)	TA1: Importance of Integration and interdependence of the management information system and the administration to Expand the Horizon of Managers' knowledge about Decisions Which Will be done. TA2: Importance of Integration of the information to make Accurate solution. TA3: I rely on my powers in Making decisions without Participation of other Parties related to decision-making process. TA4: I sometimes make decisions depending On Intuition. TA5: I know the Response to decision Taken from the employees and how much they accept it.

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