INVESTIGATING E-SUPPLY CHAIN ISSUES IN INTERNET OF MEDICAL THINGS (IOMT): EVIDENCE FROM THE HEALTHCARE

Sasho Guergov

Technical University of Sofia, Bulgaria

Sguergov@tu-sofia.bg

ABSTRACT

The E-supply chain in the Internet of Medical Things is plagued by a number of problems. These problems include failing to meet patient expectations, keeping services and equipment affordable, and lacking adequate infrastructure management, cyber security, and network dependability. The research suggests various remedies that might be beneficial for these problems. In this study, the past literature is discussed in order to provide a general picture of the subject. The majority of the survey responses, which were used to run an SPSS test, agreed with the research hypotheses. The research is based on five hypotheses, and the SPSS test found empirical evidence respectively.

***Keywords*:** E-Supply chain, Internet of Medical Things (IoMT), Healthcare.

1. INTRODUCTION

The Internet of Medical Things refers to a collection of medical applications and medical devices that connect to IT systems in healthcare through computer networks. Some wi-fi-equipped medical devices that allow machine-to-machine communication is the base of the IoMT [1]. IoMT is also known as Healthcare IoT. The e-Supply chain is used in the healthcare industry for various reasons, such as supporting and monitoring the medicine flow, medical equipment and supplies and providing the medical-related services from the Manufacturer to patients where IoMT plays a crucial role [2], [3]. The e-supply chain which is used in the medical industry contains some issues [4]. The issues are matching the expectation of the patients, keeping the service and the equipment cost-effective and Inadequacy in the infrastructure management [5]. In addition to this, the E-supply chain must face various

technical challenges in the healthcare industry, such as challenges related to cyber security and reliability in the network [6], [7].

All these issues are significant for the healthcare industry. If there are some issues in the management and the requirements of the customers are not met, the treatment would not be in the proper way, the application of the e-supply chain is a costly process [8], so it is a big challenge for the e-supply chain management to keep the service cost-effective to the patient [9]. On the other hand, as the E-supply chain is fully dependent on the internet, the management must provide cyber security to the patients. Nowadays, cyber security issues are a big challenge [10], [11]. Also, the network from which the service is being availed should be reliable to the customers; in most cases, the management fails to provide network reliability to the patients [12].

1.1 Problem Definition

In this part of the paper, the problems of the E-Supply chain in the IoMT will be elaborated on in brief. Matching the expectation of the patients- Sometimes, it is very difficult to meet the patients' expectations through the E-supply chain. As it is said earlier, the usage of e-commerce is increasing in the IoMT [13]. Many patients are unfamiliar with e-commerce and the Internet of Things, which creates issues in meeting patients' requirements. In the healthcare industry, a patient's requirement is considered as the most important factor.

Keeping the system cost-effective- as it is said earlier, the implementation of the e-supply chain in the healthcare industry is a costly process which makes the services and equipment costs for the patient [14]. Now it is a big challenge for the service provider to provide a cost-effective service to the patients. This issue is important because it is hard to afford such costly services for patients from lower economic segments. To make the service available to all the patients, it must keep cost-effective [15].

Inadequate Infrastructure Management- In each service, the infrastructure is considered the most important factor [16]. If the infrastructure is not good, the service could not be satisfactory. Sometimes patients could not avail the Internet of Medical Things due to inadequate infrastructure management [17].

Cyber security is one of the biggest issues around the world. Especially for those services which are provided through the internet, cyber security is very much important. E-supply chain management relies on the transmission of a vast array of data [18]. The E-Supply chain in the healthcare industry is a long chain of services from the manufacturers to the

patients. In the whole chain, there are various steps to be covered which opens the chances of security breaches [19]. There are various security issues which could arrive in the whole process. In the case of IoMT, the main challenge is to keep the patients' data secret [20]. The hackers could access the patients' data, such as their bank details and many more, which could be threatful to the patient [21].

Network reliability- The network reliability is another technical issue related to the E-Supply chain management [22], [23]. The e-supply chain in the IoMT depends on reliable information transmission from all factors of the e-supply chain; this process depends on reliable broadband access [24]. If the network is not reliable to the patients, the patients would not be able to avail of the service through the E-Supply Chain.

1.2 Proposed Solution

Solutions related to the problem of matching the expectation of the patients- The only way to meet the expectation and requirements of the patients is to deliver exactly those products or services that are promised [25]. Similarly, if the manufacturers or the service providers could lower the delivery time, the patients get satisfied [26]. Besides these factors, product and service satisfaction is another important factor [27]. If a patient gets satisfactory output from the service provider and if the service provider treats the patient with care and appears with an amicable behaviour, the service provider could meet the patient's expectations [28].

Solutions related to the problem of cost-effectiveness- To keep the service cost-effective, the service provider could take a just-in-time delivery model [29]. In this process, the manufacturers would manufacture only the ordered quantity. On the other hand, the service provider should try to reduce the internet cost to keep the service cost-effective to the patients [30]. Solutions related to the problem of inadequacy in infrastructure management- As it is said earlier, infrastructure management plays a crucial role in the E-Supply chain. If the manufacturers do not manage their infrastructure, it will not work. Especially for the IoMT, infrastructure is very important [31]. To solve the problems related to infrastructure management, the manufacturers could introduce the Warehouse Management Systems, which will help to manage the warehouse. Similarly, the service providers should develop the software to provide proper and promised service to the patients [32].

Solutions related to the problem of cyber security- E-supply chain systems can be affected by hackers at any time [33], [34]. The patients make payments through their cards which could be hacked. To prevent the cyber-attack, organizations take various steps, such as

employing solutions that have the power of behavioral-based analysis. Indicators of Attacks (IOAs) could be the solution to it [35]. The IOAs will mitigate the risk of cyber-attacks. Another solution could be Threat Intelligence [36], [37]. Threat Intelligence could help the service providers when the entire system could be hacked [38]. Also, it will help to understand the types of attacks [39]. Falcone is an automated threat analysis tool that could be used for this purpose [40].

Solution related to the issue of network reliability- The issue of network reliability is another big issue in the E-Supply chain in IoMT [41], [42]. In order to fix the network reliability issue, the service provider could adopt some steps, such as- the can evaluate their current network setup so that it becomes smooth and fast [43], identifying the opportunities for up-gradation so that their network gets upgraded when it is required and preparing the network for future needs so that their network always remain available to the patients.

2. LITERATURE REVIEW

2.1 Issues related to infrastructure management

As identified in pas studies, there are various issues related to infrastructure management in the E-Supply chain system. According to Almalki, the supply chain infrastructure is at high risk, and it could lead to loss of the customer service, financial losses and many more [44]. A warehouse which is planned strategically could be a solution to this issue. The mobile apps of the company need to be developed and ensured it is working flawlessly [45], [46].

2.2 Issues related to the patient's requirements

The entire process of the supply chain has been re-shaped, and the competition in the market is increasing [47]. In this situation, meeting the expectation of the customers is necessary for the manufacturers [48]. Regarding the E-supply chain in IoMT, the manufacturers and the service providers must be cautious about those matters, and they should take such steps so that their service and the medical product can meet the requirements of the patients [49].

2.3 Issues related to cyber security

As it is discussed in the paper, the e-supply chain in the IoMT consists of the risk of cyber-attacks. As cited by various authors, there are various ways to perform web-attacks; those

are- Trojans, potentially Unwanted Applications, fraudulent advertising, web spam, redirection of the browser and many more [50], [51]. In the case of IoMT, the patients could be attacked in these ways. These vulnerabilities could be prevented by securing the website and employing various tools [52].

2.4 Issues related to network reliability

According to prior investigation, the business which is employed with the e-commerce supply chain depends on reliable access to a broadband connection [53]. Any network downtime and power outages could lead to serious issues in the entire supply chain [54]. To mitigate these issues, the service providers need to fix the reliability of the network and the connection [55], [56].

This research paper would define the issues and provide a proposed solution and a survey report according to the issues related to the e-supply chain in the IoMT.

- **H^0**: Meeting the requirements of the patients is one of the issues for the e-supply chain in IoMT.
- **H^1**: Cost-effectiveness of e-supply chain implementation is another issue for IoMT.
- **H^2**: Inadequate Infrastructure management is a crucial issue for the E-Supply chain in the IoMT.
- **H^3**: Cyber security threat is a problem in implementing the e-supply chain in the IoMT.
- **H^4**: If there is no reliability in the network, Issues could arise in the e-supply chain for the IoMT.

3. RESEARCH METHODOLOGY

In the research method, there are five Hypothesis was tested; those are- Meeting the requirements of the patients is one of the issues for the e-supply chain in IoMT, Cost-effectiveness of e-supply chain implementation is another issue for IoMT, Inadequate Infrastructure management is a crucial issue for the E-Supply chain in the IoMT, Threat to Cyber security is a problem in implementing the e-supply chain in the IoMT, If there is no reliability in the network, Issues could arise in the e-supply chain for the IoMT.

As the research methodology, a quantitative data analysis method has been used. This provides the statistical data. In this research method, there are one independent variable and

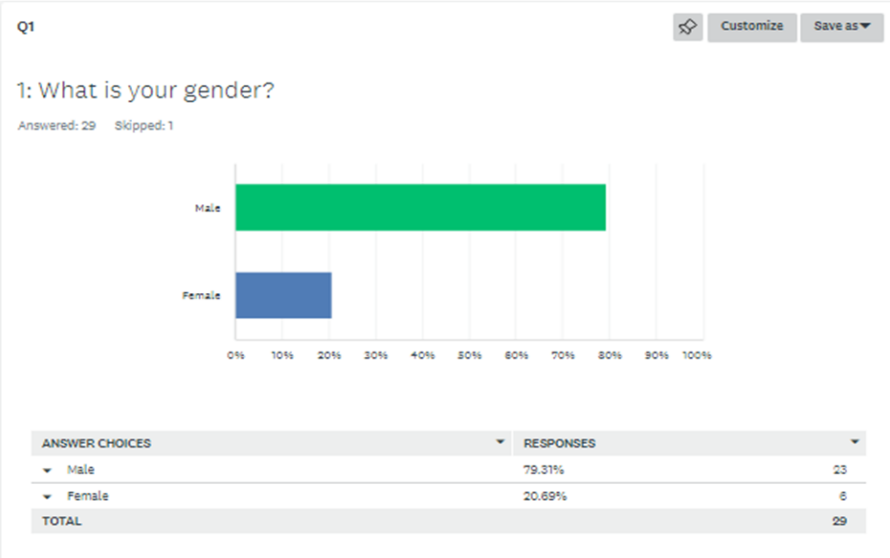
two dependent variables. The independent variable is the E-Supply Chain Issues on Internet of Medical Things (IoMT), and two dependent variables are- Impact of the patients' satisfaction and the Impact of the Infrastructure management.

In the path of conducting this research, a random survey is done. A questionnaire consisting of 10 questions was presented to 30 random people associated with the healthcare sector in the UAE. The ten questions of the questionnaire related to the hypothesis. Using this survey method, 30 different reactions of people from different age groups have been collected . This survey helped to understand the impact and significance of the issues. If the qualitative data analysis method through some interviews could have been used, it would only get the reaction and opinions of those persons. On the other hand, through the survey method, the research has been able to achieve the reaction of 30 different people. It can be said that the survey method is fruitful for such research, and through the survey method, the hypotheses are tested strategically.

4. DATA ANALYSIS

4.1 Survey Result

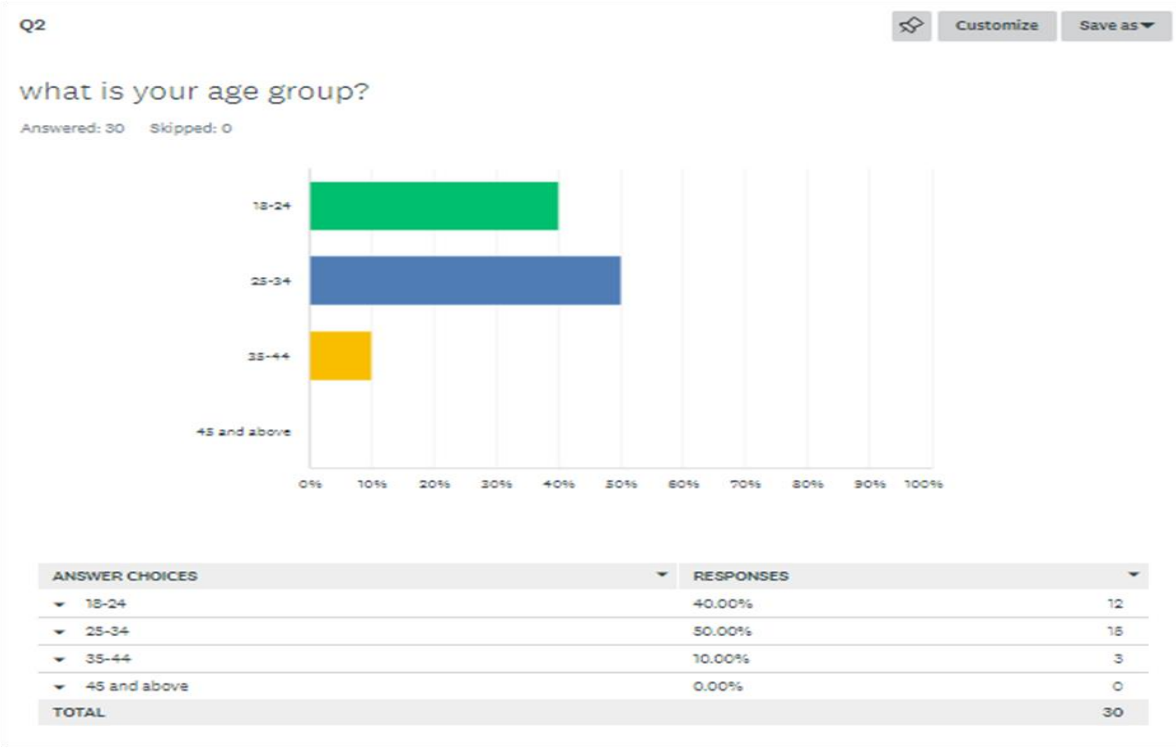
1: What is your gender?



ANSWER CHOICES	RESPONSES	
Male	79.31%	23
Female	20.69%	6
TOTAL		29

In this question, it is seen that almost 80 per cent of the people are male . Most of the reaction is collected from males.

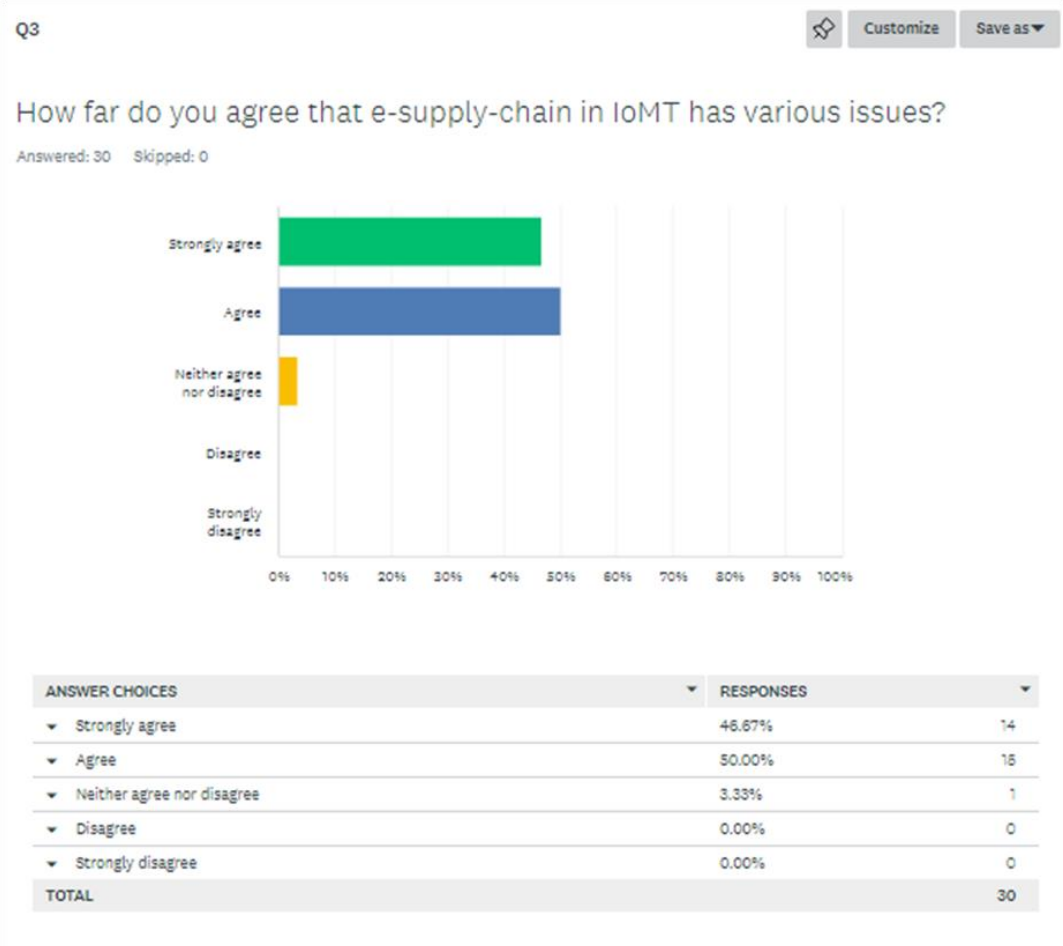
2: What is your age group?



ANSWER CHOICES	RESPONSES	
18-24	40.00%	12
25-34	50.00%	15
35-44	10.00%	3
45 and above	0.00%	0
TOTAL		30

In this survey, the respondents are from multiple age groups and through this it is understood that people of various age groups are aware about this, mainly the younger generation.

3: How far do you agree that the supply chain in IoMT has various issues?



ANSWER CHOICES	RESPONSES	
Strongly agree	46.67%	14
Agree	50.00%	15
Neither agree nor disagree	3.33%	1
Disagree	0.00%	0
Strongly disagree	0.00%	0
TOTAL		30

In question no. 3; almost 46 per cent of people strongly agreed, and 50 per cent of the people agreed that the e-supply chain has several issues in the IoMT. The e-supply chain has a real issue with the IoMT.

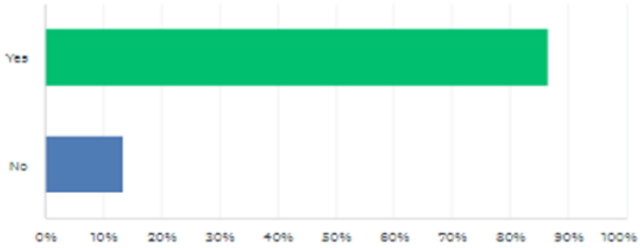
4: Do you think that the e-supply chain in IoMT has a problem in matching the expectation of the patients?

Q4

Customize Save as

Do you think that e-supply chain in IoMT has problem in matching the expectation of the patients?

Answered: 30 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	86.67%	26
No	13.33%	4
TOTAL		30

Among 30 people, 26 people think that the E-supply chain fails to match the customers' expectations in the IoMT.

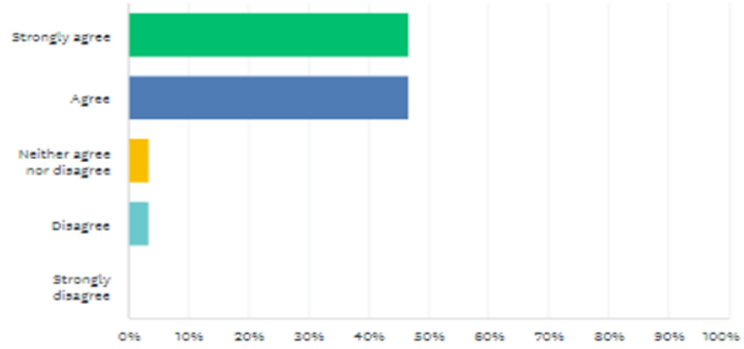
5: How far do you agree that it can cause a negative impact in the entire process?

Q5

Customize Save as

How far do you agree that it can cause negative impact in the entire process?

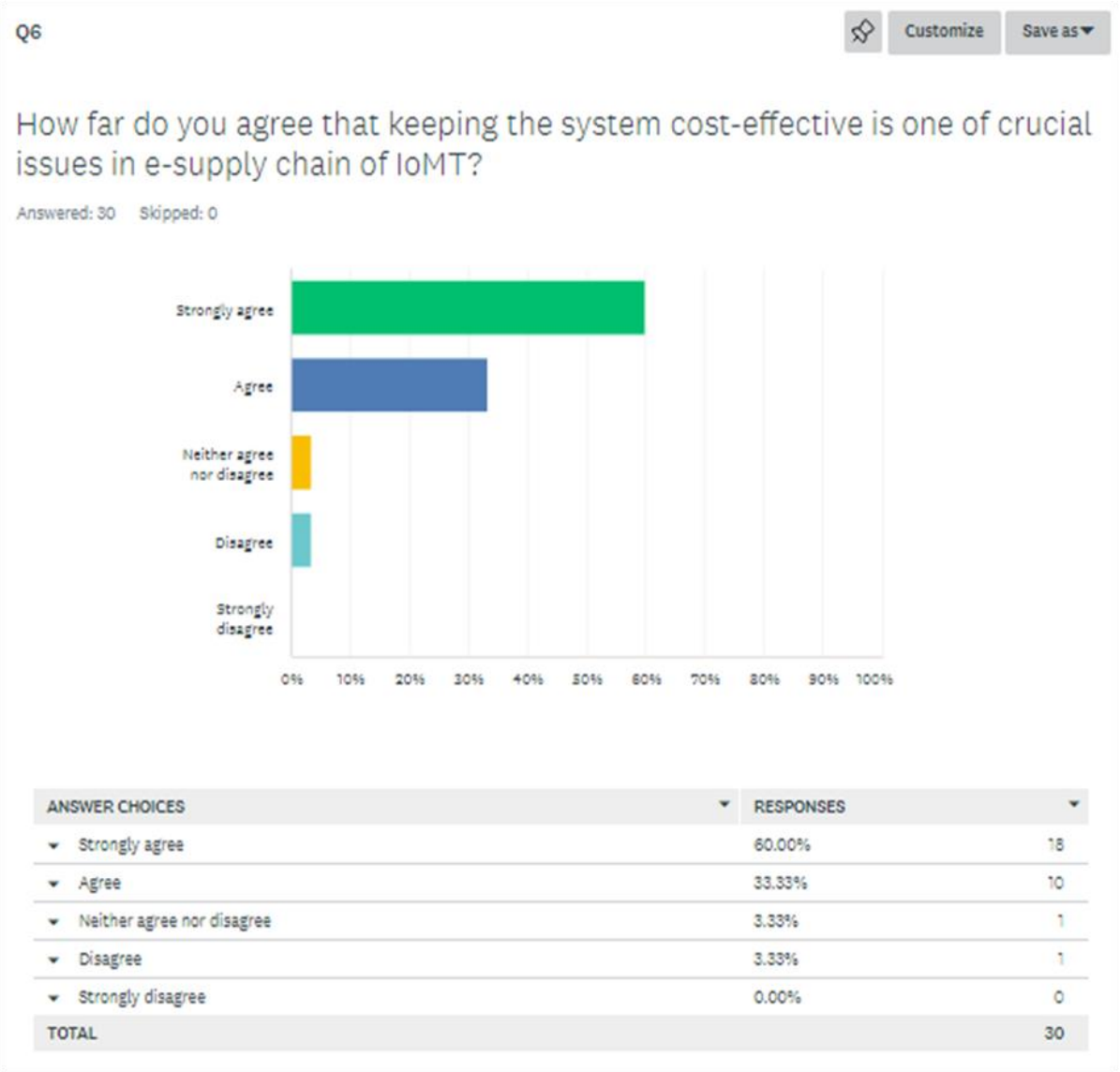
Answered: 30 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	46.67%	14
Agree	46.67%	14
Neither agree nor disagree	3.33%	1
Disagree	3.33%	1
Strongly disagree	0.00%	0
TOTAL		30

In this question, it is being seen that most people strongly agree and agree with the matter that failing to meet customers' expectations will leave a bad impact on the entire process.

6: How far do you agree that keeping the system cost-effective is one of the crucial issues in the e-supply chain of IoMT?



ANSWER CHOICES	RESPONSES	
Strongly agree	60.00%	18
Agree	33.33%	10
Neither agree nor disagree	3.33%	1
Disagree	3.33%	1
Strongly disagree	0.00%	0
TOTAL		30

Sixty per cent of the people strongly agreed with the matter that cost-effectiveness is the crucial issue in the e-supply chain in the IoMT.

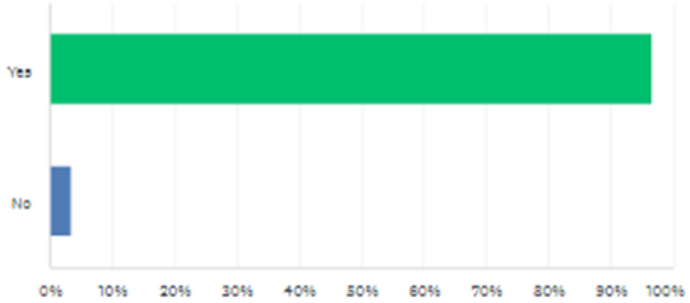
7: Do you think inadequate infrastructure management is another problem in e-supply chain in IoMT?

Q7

Customize Save as

Do you think inadequate infrastructure management is another problem in e-supplychain in IoMT?

Answered: 30 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	96.67%	29
No	3.33%	1
TOTAL		30

Inadequate infrastructure is very significant for the e-supply chain management. Most of the respondents have expressed positive reaction to this.

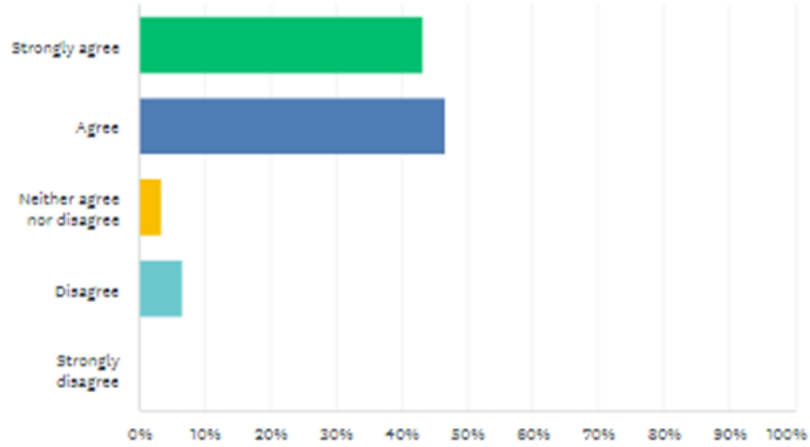
8: How far do you agree that cyber security as an issue can harm the e-supply chain in IoMT?

Q8

Customize Save as

How far do you agree that cyber security as an issue can harm the e-supplychain in IoMT?

Answered: 30 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	43.33%	13
Agree	46.67%	14
Neither agree nor disagree	3.33%	1
Disagree	6.67%	2
Strongly disagree	0.00%	0
TOTAL		30

Here in the survey, most of the respondents have stated that they are agreed that cyber security is a major issue, and it can harm the e-supply chain in IoMT.

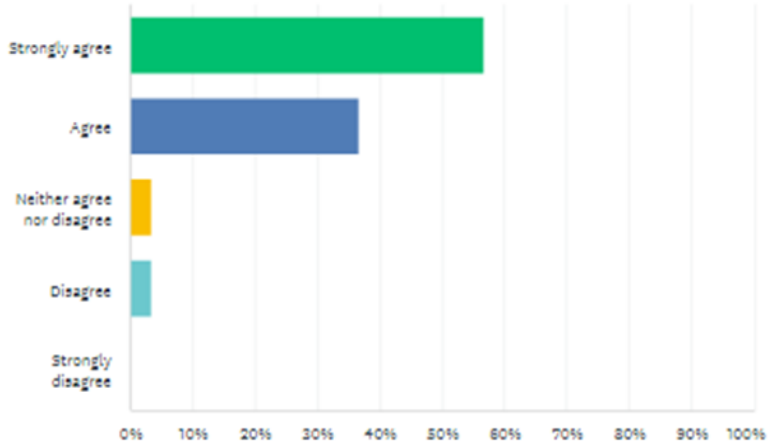
9: How far do you agree that network reliability is an issue in the e-supply chain in IoMT?

Q9

Customize Save as

How far do you agree that network reliability is an issue in e-supplychain in IoMT?

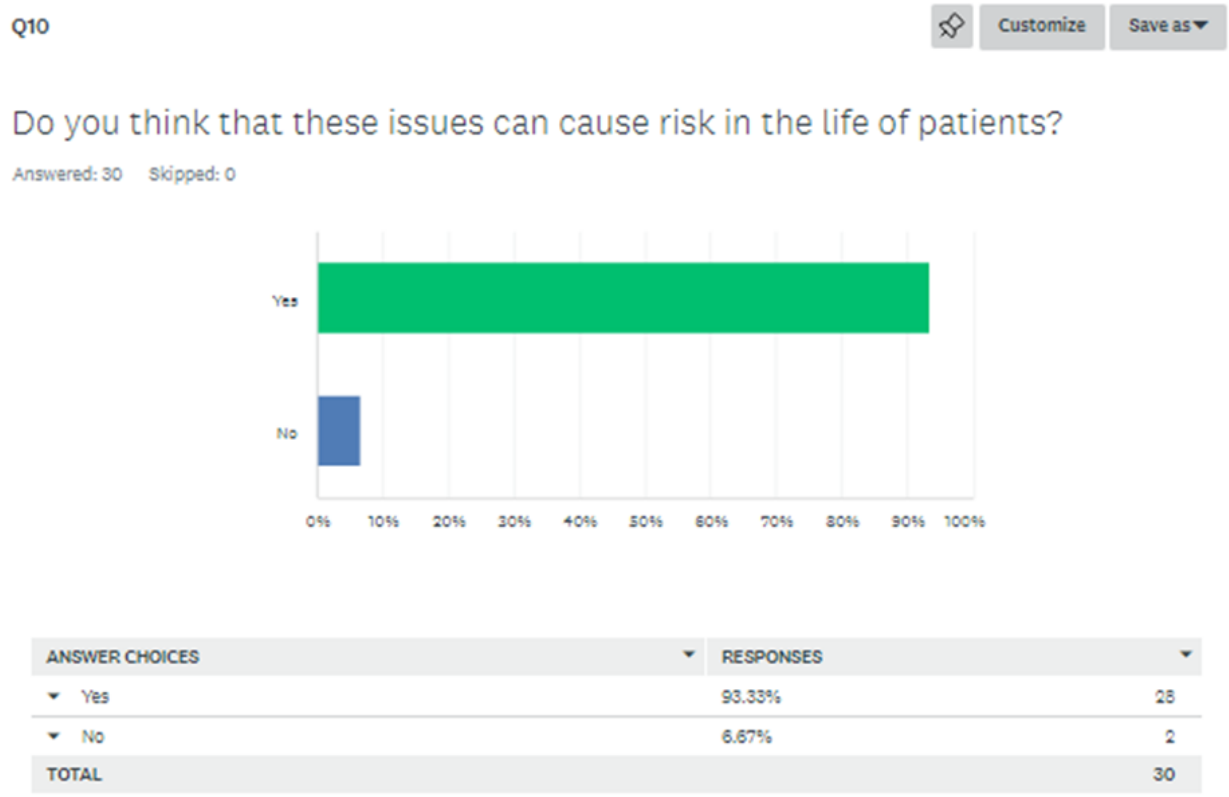
Answered: 30 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	56.67%	17
Agree	36.67%	11
Neither agree nor disagree	3.33%	1
Disagree	3.33%	1
Strongly disagree	0.00%	0
TOTAL		30

Network reliability is considered as the major issue in the e-supply chain for IoMT as 56 per cent of people strongly agreed with the matter.

10: Do you think that these issues can cause risk in the life of patients?



ANSWER CHOICES	RESPONSES	
Yes	93.33%	28
No	6.67%	2
TOTAL		30

Out of this, it is understood that most of the respondents are aware that it can cause a serious risk in the life of the patients.

4.2 Statistical Analysis (SPSS)

4.2.1 Descriptive Statistics

The mainly purpose of descriptive analysis assisted to evaluate the survey results that shows multiple results for each question asked by the respondents. Descriptive statistics results summary is given in table 1.

Table 1:

Descriptive Statistics			
	Mean	**Std. Deviation**	**N**
How far do you agree that e-supply-chain in IoMT has various issues?	1.5517	.57235	29
1: What is your gender?	1.2069	.41225	29
what is your age group?	1.6897	.66027	29
Do you think that the e-supply chain in IoMT has a problem in matching the expectation of the patients?	1.1379	.35093	29
How far do you agree that it can cause a negative impact in the entire process?	1.6207	.72771	29

How far do you agree that keeping the system cost-effective is one of the crucial issues in the e-supply chain of IoMT?	1.4828	.73779	29
Do you think inadequate infrastructure management is another problem in e-supply chain in IoMT?	1.0345	.18570	29
How far do you agree that cyber security as an issue can harm the e-supply chain in IoMT?	1.7241	.84077	29
How far do you agree that network reliability is an issue in e-supply chain in IoMT?	1.5172	.73779	29
Do you think that these issues can cause risk in the life of patients?	1.0690	.25788	29

4.2.2 Regression Analysis

To evaluate the significance and construct relationship and dependability of each construct of the research a regression analysis helps to identify the dependability and agreeableness to a question. Table 2 is summarized with regression analysis results.

Table 2:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.953[a]	.908	.864	.21120

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.325	9	.925	20.737	.000[b]
	Residual	.848	19	.045		
	Total	9.172	28			

Out of this ANOVA, the significant value shows the hypothesis significance level that support our research hypothesis and also valid for the survey questionnaire asked by the respondents. Thus, it is understood that all the variables are strongly correlated and highly dependable to each other.

4.2.3. Regression Coefficients

Table 3:

Coefficients						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
	(Constant)	.346	.365		.949	.354
	1: What is your gender?	-.239	.158	-.172	-1.514	.147
	what is your age group?	.312	.105	.360	2.965	.008
	Do you think that the e-supply chain in IoMT has a problem in matching the expectation of the patients?	-.152	.181	-.093	-.843	.410
	How far do you agree that it can cause a negative impact in the entire process?	.539	.146	.685	3.694	.002
	How far do you agree that keeping the system cost-effective is one of the crucial issues in the e-supply chain of IoMT?	-.135	.115	-.173	-1.173	.255
	Do you think inadequate infrastructure management is another problem in e-supply chain in IoMT?	.337	.310	.109	1.088	.290

	How far do you agree that cyber security as an issue can harm the e-supply chain in IoMT?	.126	.098	.185	1.285	.214
	How far do you agree that network reliability is an issue in e-supply chain in IoMT?	-.031	.127	-.040	-.242	.811
	Do you think that these issues can cause risk in the life of patients?	-.050	.289	-.023	-.174	.864

4.2.3 Overall Statistics

Table 4:

Group Statistics					
	How far do you agree that e-supply-chain in IoMT has various issues?	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Do you think that the e-supply chain in IoMT has a problem in matching the expectation of the patients?	Strongly agree	14	1.1429	.36314	.09705
	Agree	15	1.1333	.35187	.09085
How far do you agree that it can cause a negative impact in the entire process?	Strongly agree	14	1.0000	.00000	.00000
	Agree	15	2.1333	.51640	.13333
How far do you agree that keeping the system cost-effective is one of the crucial issues in the e-supply chain of IoMT?	Strongly agree	14	1.0714	.26726	.07143
	Agree	15	1.9333	.79881	.20625
Do you think inadequate infrastructure management is another problem in e-supply chain in IoMT?	Strongly agree	14	1.0714	.26726	.07143
	Agree	15	1.0000	.00000	.00000
How far do you agree that cyber security as an issue can harm the e-supply chain in IoMT?	Strongly agree	14	1.2143	.80178	.21429
	Agree	15	2.2000	.56061	.14475
How far do you agree that network reliability is an issue in e-supply chain in IoMT?	Strongly agree	14	1.0000	.00000	.00000
	Agree	15	2.0000	.75593	.19518
Do you think that these issues can cause risk in the life of patients?	Strongly agree	14	1.0000	.00000	.00000
	Agree	15	1.1333	.35187	.09085

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
			Sig.		f	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Do you think that the e-supply chain in IoMT has a problem in matching the expectation of the patients?	Equal variances assumed	021	887	072	7	943	.00952	.13279	-.26294	.28199
	Equal variances not assumed			072	6.716	943	.00952	.13294	-.26338	.28243
How far do you agree that it can cause a negative impact in the entire process?	Equal variances assumed	.319	047	8.202	7	000	-1.1333	.13818	1.41686	-.84980
	Equal variances not assumed			8.500	4.000	000	-1.1333	.13333	-1.4193	-.84736

How far do you agree that keeping the system cost-effective is one of the crucial issues in the e-supply chain of IoMT?	Equal variances assumed	.419	.045	3.838	27	.001	-.86190	.22459	-1.3227	-.40109
	Equal variances not assumed			3.949	7.292	001	-.86190	.21827	-1.3218	-.40199
Do you think inadequate infrastructure management is another problem in e-supply chain in IoMT?	Equal variances assumed	.043	033	.036	7	309	.07143	.06892	-.06997	.21283
	Equal variances not assumed			.000	3.000	336	.07143	.07143	-.08288	.22574
How far do you agree that cyber security as an issue can harm the e-supply chain in IoMT?	Equal variances assumed	059	810	3.859	7	001	-.98571	.25544	-1.5098	-.46160
	Equal variances not assumed			3.812	3.104	001	-.98571	.25859	-1.5205	-.45091
How far do you agree that network reliability is an issue in e-supply chain in IoMT?	Equal variances assumed	.586	026	4.944	7	000	-1.0000	.20228	-1.4150	-.58496

	Equal variances not assumed			5.123	4.000	000	-1.0000	.19518	-1.4186	-.58138
Do you think that these issues can cause risk in the life of patients?	Equal variances assumed	1.203	002	1.416	7	168	-.13333	.09416	-.32653	.05986
	Equal variances not assumed			1.468	4.000	164	-.13333	.09085	-.32819	.06152

Out of this, it is found that most of the sig (2 tailed) values are higher than 0.5 can be summarized as significant and accepted to this research, it can be understood that all the hypotheses are valid and supported in current analysis.

5. DISCUSSION

The development of interconnected medical devices have transformed the fundamentals of healthcare operations owing to trying to cut technological developments. As both a result, data security for medical equipment has received much interest. The health care industry will experience a total change in terms of the adaptation of innovative communication technology, including such 5G networks. They shall have seen a new paradigm in the healthcare sector as a result of the rapid advancement of communications technology. Miscommunication problems, modern, trying to cut healthcare frameworks will be unable to perform telesurgery. Ambulance crews will indeed be superseded by 5G, and new tech will be reinvented. Furthermore, since of improved technology, this platform is exposed to various security flaws, which might present a serious risk to the security and privacy of patients. As both a consequence, current safety issues have prompted researchers to investigate various medical device vulnerabilities. Furthermore, proper control methods which can preserve the integrity and security of IoMT systems is crucial since security is a critical component of ensuring the dependability of IoMT devices and for the successful implementation of this technology into medical systems.

6. CONCLUSION AND FUTURE RECOMMENDATIONS

In conclusion, it can be claimed that the e-supply chain in the IoMT is overwhelmed by a number of problems. Meeting consumer expectations, inadequate infrastructure, cost-effectiveness, cyber security, and network dependability are some causes of these problems. The service provider of the IoMT's e-supply chain may find some of the solutions provided in this research that can have ultimate impact on healthcare strategic management and other managerial areas.

Future research might focus on the question of how the solution could be implemented in the IoMT more successfully, the roles of the medical personnel in relation to the problems, and how the workers at the ground level could be trained in this area to effectively reduce the likelihood of cybercrime.

REFERENCE

[1] H. M. Alzoubi *et al.*, "Securing Smart Cities Using Blockchain Technology," in *2022 1st International Conference on AI in Cybersecurity (ICAIC*, 2022, pp. 1–4. doi: 10.1109/icaic53980.2022.9896971.

[2] M. El Khatib, A. Al Mulla, and W. Al Ketbi, "The Role of Blockchain in E-Governance and Decision-Making in Project and Program Management," *Adv. Internet Things*, vol. 12, no. 03, pp. 88–109, 2022, doi: 10.4236/ait.2022.123006.

[3] F. Del and G. Solfa, "IMPACTS OF CYBER SECURITY AND SUPPLY CHAIN RISK ON DIGITAL OPERATIONS: EVIDENCE FROM THE UAE PHARMACEUTICAL INDUSTRY Federico Del Giorgio Solfa," *Int. J. Technol. Innov. Manag. (IJTIM), 2(2).*, vol. 2, no. 2, pp. 18–32, 2022.

[4] G. Kanagavalli and R. Azeez, "Logistics and E- Logistics Management: Benefits and Challenges," *Int. J. Recent Technol. Eng.*, vol. 8, no. 4, pp. 12804–12809, 2019, doi: 10.35940/ijrte.d7179.118419.

[5] P. S. Ghosh, S., & Aithal, "BEHAVIOUR OF INVESTMENT RETURNS IN THE DISINVESTMENT," *Int. J. Technol. Innov. Manag. (IJTIM), 2(2).*, vol. 2, no. 2, pp. 65–79, 2022.

[6] A. Yeboah-Ofori *et al.*, "Cyber Threat Predictive Analytics for Improving Cyber Supply Chain Security," *IEEE Access*, vol. 9, no. Ml, pp. 94318–94337, 2021, doi: 10.1109/ACCESS.2021.3087109.

[7] H. M. Alzoubi *et al.*, "Digital Transformation and SMART-The Analytics factor," in *2022 International Conference on Business Analytics for Technology and Security, ICBATS 2022*, 2022, pp. 1–11. doi: 10.1109/ICBATS54253.2022.9759084.

[8] B. Amrani, A. Z., Urquia, I., & Vallespir, "INDUSTRY 4.0 TECHNOLOGIES AND LEAN

PRODUCTION COMBINATION: A STRATEGIC METHODOLOGY BASED ON LINKS QUANTIFICATION Anne Zouggar Amrani, Ilse Urquia Ortega, and Bruno Vallespir," *Int. J. Technol. Innov. Manag. (IJTIM), 2(2).*, vol. 2, no. 2, pp. 33–51, 2022.

[9] H. M. Alzoubi, A. U. Rehman, R. M. Saleem, Z. Shafi, M. Imran, and M. Pradhan, "Analysis of Income on the Basis of Occupation using Data Mining," in *2022 International Conference on Business Analytics for Technology and Security, ICBATS 2022*, 2022, pp. 1–4. doi: 10.1109/ICBATS54253.2022.9759040.

[10] H. M. Alzoubi, A. Ali, A. W. Septyanto, I. Chaudhary, H. A. Hamadi, and Z. F. Khan, "Applied Artificial Intelligence as Event Horizon Of Cyber Security," in *2022 International Conference on Business Analytics for Technology and Security (ICBATS*, 2022, pp. 1–7. doi: 10.1109/ICBATS54253.2022.9759076.

[11] Nasim, S. F., M. R. Ali, and U. Kulsoom, "Artificial Intelligence Incidents & Ethics A Narrative Review. International Journal of Technology, Innovation and Management," *Int. J. Technol. Innov. Manag.*, vol. 2, no. 2, pp. 52–64, 2022.

[12] F. Ma, T. Sun, L. Liu, and H. Jing, "Detection and diagnosis of chronic kidney disease using deep learning-based heterogeneous modified artificial neural network," *Futur. Gener. Comput. Syst.*, vol. 111, pp. 17–26, Oct. 2020, doi: 10.1016/j.future.2020.04.036.

[13] H. M. Alzoubi and R. Yanamandra, "Investigating the mediating role of Information Sharing Strategy on Agile Supply Chain in Supply Chain Performance," *Uncertain Supply Chain Manag.*, vol. 8, no. 2, pp. 273–284, 2020.

[14] H. Alzoubi and M. & Alnazer, N., Alnuaimi, "Analyzing the Appropriate Cognitive Styles and its effect on Strategic Innovation in Jordanian Universities," *Int. J. Bus. Excell.*, vol. 13, no. 1, pp. 127–140, 2017.

[15] H. Alzoubi and G. Ahmed, "Do TQM practices improve organisational success? A case study of electronics industry in the UAE," *Int. J. Econ. Bus. Res.*, vol. 17, no. 4, pp. 459–472, 2019, doi: 10.1504/IJEBR.2019.099975.

[16] S. Goria, "A DECK OF CARDS TO HELP TRACK DESIGN TRENDS TO ASSIST THE," *Int. J. Technol. Innov. Manag. (IJTIM), 2(2).*, vol. 2, no. 2, pp. 1–17, 2022.

[17] H. M. Alzoubi, G. Ahmed, A. Al-Gasaymeh, and B. Al Kurdi, "Empirical study on sustainable supply chain strategies and its impact on competitive priorities: The mediating role of supply chain collaboration," *Manag. Sci. Lett.*, vol. 10, no. 3, pp. 703–708, 2020, doi: 10.5267/j.msl.2019.9.008.

[18] H. M. Alzoubi, S. Joghee, and A. R. Dubey, "Decisions effectiveness of FDI investment biases at real estate industry: Empirical evidence from Dubai smart city projects," *Int. J. Sci. Technol. Res.*, vol. 9, no. 3, pp. 3499–3503, 2020.

[19] A. A. Kashif, B. Bakhtawar, A. Akhtar, S. Akhtar, N. Aziz, and M. S. Javeid, "Treatment Response Prediction in Hepatitis C Patients using Machine Learning Techniques," *Int. J. Technol. Innov. Manag.*, vol. 1, no. 2, pp. 79–89, 2021, doi: 10.54489/ijtim.v1i2.24.

[20] H. M. Alzoubi, M. Alnuaimi, D. Ajelat, and A. A. Alzoubi, "Towards intelligent organisations: An empirical investigation of learning orientation's role in technical innovation," *Int. J. Innov. Learn.*, vol. 29, no. 2, pp. 207–221, 2021.

[21] A. Akhtar, S. Akhtar, B. Bakhtawar, A. A. Kashif, N. Aziz, and M. S. Javeid, "COVID-19 Detection from CBC using Machine Learning Techniques," *Int. J. Technol. Innov. Manag.*, vol. 1, no. 2, pp. 65–78, 2021, doi: 10.54489/ijtim.v1i2.22.

[22] H. M. Alzoubi, M. Vij, A. Vij, and J. R. Hanaysha, "What leads guests to satisfaction and loyalty in UAE five-star hotels? AHP analysis to service quality dimensions," *Enlightening Tour.*, vol. 11, no. 1, pp. 102–135, 2021.

[23] T. Eli, "Students` Perspectives on the Use of Innovative and Interactive Teaching Methods at

the University of Nouakchott Al Aasriya, Mauritania: English Department as a Case Study," *Int. J. Technol. Innov. Manag.*, vol. 1, no. 2, pp. 90–104, 2021, doi: 10.54489/ijtim.v1i2.21.

[24] S. Akhtar, A., Bakhtawar, B., & Akhtar, "EXTREME PROGRAMMING VS SCRUM: A COMPARISON OF AGILE MODELS Asma Akhtar, Birra Bakhtawar, Samia Akhtar," *Int. J. Technol. Innov. Manag. (IJTIM), 2(2).*, vol. 2, no. 2, pp. 80–96, 2022.

[25] N. Alsharari, "Integrating Blockchain Technology with Internet of things to Efficiency," *Int. J. Technol. Innov. Manag.*, vol. 1, no. 2, pp. 01–13, 2021, doi: 10.54489/ijtim.v1i2.25.

[26] H. M. Alzoubi *et al.*, "Modelling supply chain information collaboration empowered with machine learning technique," *Intell. Autom. Soft Comput.*, vol. 30, no. 1, pp. 243–257, 2021, doi: 10.32604/iasc.2021.018983.

[27] T. Eli and Lalla Aisha Sidi Hamou, "Investigating the Factors That Influence Students` Choice of English Studies As a Major: the Case of University of Nouakchott Al Aasriya, Mauritania," *Int. J. Technol. Innov. Manag.*, vol. 2, no. 1, p. 1, 2022, doi: 10.54489/ijtim.v2i1.62.

[28] S. S. Aljameel, I. U. Khan, N. Aslam, M. Aljabri, and E. S. Alsulmi, "Machine Learning-Based Model to Predict the Disease Severity and Outcome in COVID-19 Patients," *Sci. Program.*, vol. 2021, 2021, doi: 10.1155/2021/5587188.

[29] T. Mehmood, "Does Information Technology Competencies and Fleet Management Practices lead to Effective Service Delivery?," *Empir. Evid. from E-Commerce Ind.*, vol. 1, no. 2, pp. 14–41, 2021.

[30] H. M. Alzoubi and R. Aziz, "Does emotional intelligence contribute to quality of strategic decisions? The mediating role of open innovation," *J. Open Innov. Technol. Mark. Complex.*, vol. 7, no. 2, p. 130, 2021, doi: 10.3390/joitmc7020130.

[31] D. Miller, "The Best Practice of Teach Computer Science Students to Use Paper Prototyping," *Int. J. Technol. Innov. Manag.*, vol. 1, no. 2, pp. 42–63, 2021, doi: 10.54489/ijtim.v1i2.17.

[32] A. Garcia-Perez, J. G. Cegarra-Navarro, M. P. Sallos, E. Martinez-Caro, and A. Chinnaswamy, "Resilience in healthcare systems: Cyber security and digital transformation," *Technovation*, no. August 2021, p. 102583, 2022, doi: 10.1016/j.technovation.2022.102583.

[33] H. M. Alzoubi, J. Hanaysha, and M. Al-Shaikh, "Importance of Marketing Mix Elements in Determining Consumer Purchase Decision in the Retail Market," *Int. J. Serv. Sci. Manag. Eng. Technol.*, vol. 12, pp. 56–72, 2021, doi: 10.4018/IJSSMET.2021110104.

[34] Vorobeva Victoria, "Impact of Process Visibility and Work Stress To Improve Service Quality: Empirical Evidence From Dubai Retail Industry," *Int. J. Technol. Innov. Manag.*, vol. 2, no. 1, p. 1, 2022, doi: 10.54489/ijtim.v2i1.59.

[35] John Kasem and Anwar Al-Gasaymeh, "a Cointegration Analysis for the Validity of Purchasing Power Parity: Evidence From Middle East Countries," *Int. J. Technol. Innov. Manag.*, vol. 2, no. 1, p. 1, 2022, doi: 10.54489/ijtim.v2i1.60.

[36] A. Hussain, R. Wenbi, A. L. Da Silva, M. Nadher, and M. Mudhish, "Health and emergency-care platform for the elderly and disabled people in the Smart City," *J. Syst. Softw.*, vol. 110, pp. 253–263, 2015, doi: 10.1016/j.jss.2015.08.041.

[37] Saad Masood Butt, "Management and Treatment of Type 2 Diabetes," *Int. J. Comput. Inf. Manuf.*, vol. 2, no. 1, p. 1, 2022, doi: 10.54489/ijcim.v2i1.71.

[38] G. M. Qasaimeh and H. E. Jaradeh, "THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE EFFECTIVE APPLYING OF CYBER GOVERNANCE IN JORDANIAN COMMERCIAL BANKS," *Int. J. Technol. Innov. Manag.*, vol. 2, no. 1, 2022.

[39] G. Ahmed and Nabeel Al Amiri, "the Transformational Leadership of the Founding Leaders of the United Arab Emirates: Sheikh Zayed Bin Sultan Al Nahyan and Sheikh Rashid Bin Saeed Al Maktoum," *Int. J. Technol. Innov. Manag.*, vol. 2, no. 1, p. 1, 2022, doi:

10.54489/ijtim.v2i1.58.

[40] H. M. Alzoubi *et al.*, "Fusion-based supply chain collaboration using machine learning techniques," *Intell. Autom. Soft Comput.*, vol. 31, no. 3, pp. 1671–1687, 2022, doi: 10.32604/IASC.2022.019892.

[41] H. M. Alzoubi, J. R. Hanaysha, M. E. Al-Shaikh, and S. Joghee, "Impact of Innovation Capabilities on Business Sustainability in Small and Medium Enterprises," *FIIB Bus. Rev.*, vol. 11, no. 1, pp. 67–78, 2022, doi: 10.1177/23197145211042232.

[42] N. Alsharari, "the Implementation of Enterprise Resource Planning (Erp) in the United Arab Emirates: a Case of Musanada Corporation," *Int. J. Technol. Innov. Manag.*, vol. 2, no. 1, p. 1, 2022, doi: 10.54489/ijtim.v2i1.57.

[43] Edward Probir Mondol, "the Role of Vr Games To Minimize the Obesity of Video Gamers," *Int. J. Comput. Inf. Manuf.*, vol. 2, no. 1, p. 1, 2022, doi: 10.54489/ijcim.v2i1.70.

[44] H. M. Alzoubi, H. Elrehail, J. R. Hanaysha, A. Al-Gasaymeh, and R. Al-Adaileh, "The Role of Supply Chain Integration and Agile Practices in Improving Lead Time During the COVID-19 Crisis," *Int. J. Serv. Sci. Manag. Eng. Technol.*, vol. 13, no. 1, pp. 1–11, 2022, doi: 10.4018/IJSSMET.290348.

[45] J. Almalki *et al.*, "Enabling Blockchain with IoMT Devices for Healthcare," *Information*, vol. 13, no. 10, p. 448, 2022, doi: 10.3390/info13100448.

[46] Asem Alzoubi, "Machine Learning for Intelligent Energy Consumption in Smart Homes," *Int. J. Comput. Inf. Manuf.*, vol. 2, no. 1, p. 1, 2022, doi: 10.54489/ijcim.v2i1.75.

[47] Nada Ratkovic, "Improving Home Security Using Blockchain," *Int. J. Comput. Inf. Manuf.*, vol. 2, no. 1, p. 1, 2022, doi: 10.54489/ijcim.v2i1.72.

[48] H. M. Alzoubi and R. Yanamandra, "Empirical Investigation of Mediating Role of Six Sigma Approach in Rationalizing the COQ in Service Organizations," *Oper. Supply Chain Manag. An Int. J.*, vol. 15, no. 1, pp. 2579–9363, 2022.

[49] K. F. Cheung, M. G. H. Bell, and J. Bhattacharjya, "Cybersecurity in logistics and supply chain management: An overview and future research directions," *Transp. Res. Part E Logist. Transp. Rev.*, vol. 146, no. July 2020, p. 102217, 2021, doi: 10.1016/j.tre.2020.102217.

[50] H. M. Alzoubi, M. In'airat, and G. Ahmed, "Investigating the impact of total quality management practices and Six Sigma processes to enhance the quality and reduce the cost of quality: the case of Dubai," *Int. J. Bus. Excell.*, vol. 27, no. 1, pp. 94–109, 2022, doi: 10.1504/IJBEX.2022.123036.

[51] Maged Farouk, "Studying Human Robot Interaction and Its Characteristics," *Int. J. Comput. Inf. Manuf.*, vol. 2, no. 1, p. 1, 2022, doi: 10.54489/ijcim.v2i1.73.

[52] M. Asif, S. Abbas, M. A. Khan, A. Fatima, M. A. Khan, and S. W. Lee, "MapReduce based intelligent model for intrusion detection using machine learning technique," *J. King Saud Univ. - Comput. Inf. Sci.*, no. xxxx, 2021, doi: 10.1016/j.jksuci.2021.12.008.

[53] H. M. Alzoubi *et al.*, "Empirical linkages between ICT, tourism, and trade towards sustainable environment: evidence from BRICS countries," 2022, doi: 10.1080/1331677X.2022.2127417.

[54] T. M. Ghazal *et al.*, "AI-Based Prediction of Capital Structure: Performance Comparison of ANN SVM and LR Models," *Comput. Intell. Neurosci.*, vol. 2022, pp. 1–13, 2022, doi: 10.1155/2022/8334927.

[55] S. Lancaster, D. C. Yen, and C. Y. Ku, "E-supply chain management: An evaluation of current web initiatives," *Inf. Manag. Comput. Secur.*, vol. 14, no. 2, pp. 167–184, 2006, doi: 10.1108/09685220610678613.

[56] Neyara Radwan, "the Internet'S Role in Undermining the Credibility of the Healthcare Industry," *Int. J. Comput. Inf. Manuf.*, vol. 2, no. 1, p. 1, 2022, doi: 10.54489/ijcim.v2i1.74.