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The Usage of Internet of Things (IoT) in an Effective Fighting of Covid-19

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Governments all over the world have been fighting COVID-19 virus with the hope of putting an end to it; however, the virus has continued to spread with many new cases and several deaths. Fighting Covid-19 requires a proactive approach which many felt government is yet to do. The proactive approach therefore warrants the use of Internet of Things (IoT) which enables the government to identify, track and monitor patients with Covid-19 in any location, thereby reducing the spread. It is based on that the present study investigates the relationship between IoT and effective fighting of Covid-19. In other words, the study investigated how IoT can be used to effectively fight Covid-19 in Jordan. For this reason, a cross-sectional survey design was employed on the population of the study which consists of doctors, health workers and health informatics specialists from different healthcare facilities in Jordan as earlier used by (Suleiman et al., 2020). Copies of survey questionnaires were sent out through emails to all participants, however, only 90 email survey questionnaires were returned filled. The data being primary in nature were analyzed using multiple analytical tools-SPSS version 21 and STATA version 15. First, the finding revealed that IoT generally affects the effectiveness of how government fights Covid-19. Specifically, the findings show that both government decision making, and health information system are statistically significantly related to the effective fighting of Covid-19 in Jordan. Additional finding equally revealed no statistical differences between the statistical tools used in analyzing the data. Thus, it is concluded that IoT including government decision making and health information system are significant in fighting Covid-19 in Jordan. Several implications of the findings are discussed in the study.

Keywords: *Internet of things, Government decision-making, Health Information System, Covid-19, Jordan*

1.1 Introduction

Coronavirus disease of 2019 code named COVID-19 is a pandemic that is devastating the world. To some, it is a new type of virus (Suleiman et al., 2020) while to others it is one of those old viruses that exist. It is a virus that has the potential to cause severe respiratory disease. A virus believes to have originated from the city of Wuhan in China, in December 2019. Ever since the outbreak of the virus, it has spread almost all over the world. Currently, according to the World Health Organization (WHO), as of July 2020, there are more than 11,489,616 Cases with 535,340 deaths across the world (Abiola, 2020b). Just like other part of the world, the current approach has failed to track those who have contact with the virus. In fact, some who have contacted the virus still hid themselves in their homes, and failed to report their status, eventually spreading it the more. This no doubt has a way of rendering the efforts of the government in terms of decision making and obtaining relevant data from the Health Information System (HIS) ineffective in fighting the virus.

Furthermore, effective fighting of COVID-19 requires that the government must redouble their efforts. Doing this means that it should adopt a different approach that can track and monitor people with COVID-19 even when they fail to report themselves to the isolation centres provided by the government. One technology that can do is Internet of Things (IoT). Alqudah (2019) suggested the introduction of automation of Internet of Things (IoT) in nearly all fields especially the fields that affect human life directly such as the health care sector. The study claimed that the technology offers fantastic answers to series of application including health care and telemedicine. However, it is strongly noted that medical health care and telemedicine are fundamental to the application of IoT (Bandyopadhyay & Sen, 2011; Gigli & Koo, 2011). It is argued that the decision to apply IoT in the health field because of its aptitude to provide answers to such as telemonitoring, chronic disease management, fitness care and elderly care (Diaz, Juan, Lucas, & Ryuga, 2012; Suciu, Suciu, Halunga, & Fratu, 2015). It goes a long way in provision and management of medication particularly at home by experts. Similarly, due to the importance of IoT, Dziak, Jachimczyk, and Kulesza (2017) equally advocated for the introduction of IoT in healthcare sector. The study states that with IoT, health management of a population can be understood better. Apart from that, IoT is very visible in all industry even in businesses within healthcare.

Academically, it has been observed that the healthcare application of IoT has continued to attract the attention of researchers (Alqudah, 2019), still only very few studies have attempted to do so.

Apart from that, current studies are yet to relate IoT with Covid-19. Rghioui, Oumnad, and Engineering (2018) observed that IoT has the capacity to transform the health care sector in terms of operational efficiency and clinical trials enhancement with quality monitoring of patents. The present study relates IoT to effective fighting of COVID-19 which no study has attempted as of the time of this research work. Thus, the major objective of this study is to examine the relationship between IoT and effective fighting of COVID-19 with particular interest on Jordan.

2. Literature Review

2.1 Internet of Things (IoT)

The concept of interne of things (IoT) is often credited to Kevin Ashton in 1999 (Rouse, 2020). Although there is no agreed definition of IoT, however, it is described as the linking of network connectivity and computing capability to objects, sensors and everyday items that are not linked to computers, giving room for the devices to generate, exchange and consume data with minimal human intervention. The concept is still considered novel with technical, social, and economic significance. According to Internetsociety.Org.(2015), it is a technology that allows virtually everything in the world to connect. For example, imaging whereby every object is being joined with internet connectivity and powerful data analytic capabilities that change the way we work, live, and play.

Also, it is also referred to as the global connection of physical devices to the internet, where all of these will collect and share data (Rouse, 2020). According to McClelland (2020), it is defined as the extension of the internet activities beyond computers and smartphones to many other things including the processes and environments. Here's everything you need to know. To describe the concept of IoT, Rouse (2020) reported that IoT deals with interconnected computer activities including animals and people which provide them with unique identifiers (UIDs) with data transferring ability over a network in the absence of human-to-human or human-to-computer interaction (Rouse, 2020). The contributors of this definition noted that a thing on the internet of things may represent a person a monitoring device implanted in the person's heart, or a farm animal with a biochip transponder or built-in sensor in automobiles etc. It also includes any man-made or natural object with an Internet Protocol (IP) address with the ability of data transferring over a network. According to Alqudah (2019) states that Internet of things (IoT) represents idea linking several things via any network at anything, anywhere, any place and anytime. It is a collection of smart interrelated and identifiable devices or objects via internet, especially with 4G wireless internet technology.

Al Otaibi (2019) believes that Internet of Things (IoT) is one of those emerging and trending technologies in the information revolution as part of the birth of internet. IoT is a massive, intelligent network that links billions of objects, that interact through the internet with the purpose of exchanging information and integrating devices with one another via standard protocols. Its major objective is to "smartly" identify, locate, track, monitor, and manage things. It is part of network based on the Internet which supports the connections to be made between humans as well as between objects. (Pasha & Shah, 2018; Ranger, 2018) defined IoT as that technology that uses the preestablished infrastructure of networks to ensure its validity. A similar definition by Fruhlinger (2020) described IoT as is a network of connected smart devices providing rich data, but it can also be a security nightmare.

2.3 Models of IoT

There appear to be several models on attempting to explain IoT even though the area is still considered new. For better insight, this study will examine some of the models relevant to this study. First among the models is the Rouse (2020) Model of IoT. Rouse (2020) presented a model of IoT system with contributions from Alexander Gillis, Linda Rosencrance, Sharon Shea and Ivy Wigmore. In Figure 1, the model demonstrated that IoT starts from collection of data and proceed to collate and transfer the data and then finally analyses the data while taking actions. In essence, the model sees IoT as data collection and analysis device with sensor, antenna and microcontroller that enable the transfer of information.

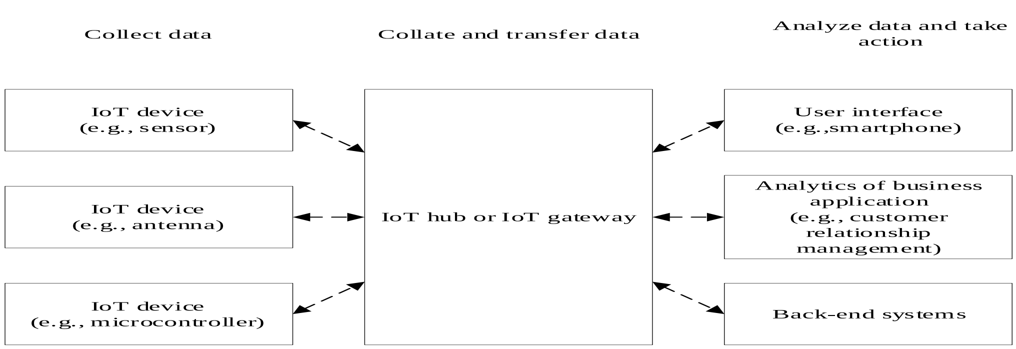

Figure 1. IoT System (Rouse, 2020)

Another model by Alqudah (2019) presented the model of recent trend in IoT as in Figure 2. The model identified four key variables such as patients, doctors, hospital and communication and security in the IoT trend of the healthcare. The model demonstrates that patients are determined by chronic disease and telemonitoring and teleservices, the doctors need to do early diagnosis and decision support including electronic health record (HER), hospital should monitor patients through medication management and resources localization and finally communication and security should investigate developing new and secure methods and protocols. Figure 3 shows the real-time monitoring of patient health through IoT.

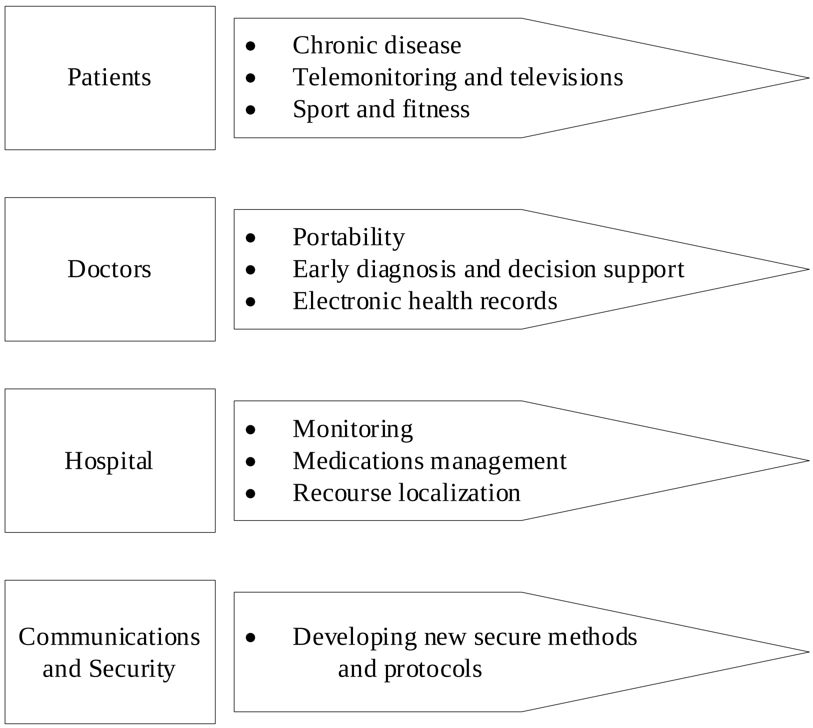

Figure 2. Trend in IoT (Alqudah, 2019)

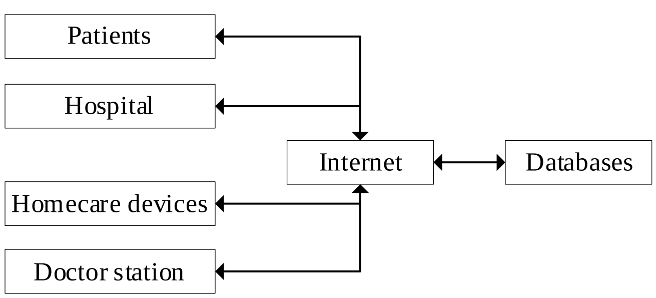

Figure 3. Real-time monitoring of patient health through IoT

Furthermore, a tracking and monitoring model of objects and person was presented by Rghioui et al. (2018). The model has five elements such as patient, gateway, medical central unit, internet and computer monitoring device. The model explains that monitoring performs the task of identifying of a person or an object in motion (Kim, Seo, & Engineering, 2016). In healthcare sector there is need to track and monitor patient flow for the purpose of improving the workflow in the hospitals and motion tracking through choke points, such as access to designated areas. With IoT, materials can equally be tracked also be in order to avoid problems during surgery. Additionally, IoT would assist the doctors to respond quickly in situation of emergencies and allow them to cooperate with international hospitals to track the status of a patient.

Figure 4: IoT Healthcare monitoring System

2.3 The Relationship between Internet of Things (IoT) and fighting of the COVID-19

Alqudah (2019) examined the IoT in healthcare sector and its application. The paper being conceptual in nature, aims at discussing among others the changes confronting the application of IoT in healthcare. The paper presented a survey on broad views of IoT in Architecture, Current and Future Applications, Mobile Application, and Security in the healthcare. It argued that IoT possess a huge importance to every sector of the economy across the world including researchers, healthcare practitioners etc. toward the development of IoT based systems.

To explore the concept of IoT, Al Otaibi (2019) examined Internet of Things (IoT) in Saudi Arabia Healthcare Systems with particular interest on the State-Of-The-Art, Future Opportunities and Open Challenges. The study adopted which utlised qualitative approach with 10 informants from the healthcare sector found that the State-of-the-art IoT technologies have not been applied in the medical cities of Riyadh, Saudi Arabia. Further study revealed other IoT technologies challenges such as patient's privacy and security with the safety, reliability, and accessibility of the technology. It is on this note that the study concluded that the need for infrastructure of health information systems is very crucial in most of Saudi medical cities that fit with IoT. Also, the need to promote the application of IoT in health care through the initiation of real project is highly encouraged. In a related development, Pasha, Shah, and Computing (2018) presented a framework for E-health systems in IoT-Based environments. Its objective is to offer a specialized framework for an IoT-based smart health system. In doing this, the web technologies, communication protocols, and hardware design were utilsed through the protocols and standards within the framework. This was done in order to ensure fulfillment and confidence of the model and its requirements. From the findings, it is possible to achieve among others interoperability between different IoT devices. Like earlier stated, the purpose of this study was to advance a framework but not to test a relationship among variables on like what the present study intends to do. A similar study by (Rghioui et al., 2018) explored the challenges and opportunities of Internet of Things in Healthcare in Morocco. The major aim of the paper is to provide a general idea of IoT, how it is being applied in the healthcare including trends in health care system development. The study listed adherence monitoring, limited and prospective time, integration of multiple devices and protocols and security as the major challenges of IoT. It argued that these challenges are key and essential to IoT across the world particularly in Morocco. The paper concludes that Internet of Things would play a very significant role in health management of a population particularly those patients having chronic care diseases.

Suleiman et al., (2020) examined the how the frontline health practitioners prepare in line with healthcare facilities to COVID-19 Outbreak in Jordan. Towards this end, a survey questionnaire approach was adopted and was used to assess the transmission and protective measures of the virus and their preparation towards it. The survey covered 308 doctors from different healthcare facilities. It was revealed that correlations with knowledge score, adherence to PPE (Personal Protective Equipment) score, and psychological impacts were investigated. Also, the study revealed several challenges confronting frontline doctors' preparedness. However, the study only descriptive in nature and lacks the capacity to predict relationship among the variables in the study.

Further study by Dziak et al. (2017) investigated the application of IoT-Based information system in the healthcare via the design methodology approach. It proposes IoT-based information system for indoor and outdoor use. The study claimed that previous studies on IoT lack methodological approaches to the design process. Hence, the study advocated for the introduction of a Design Methodology (DM), a design approach that examines issues from the perspective of the stakeholders, contracting authorities and potential users. The study claimed that the real-life scenarios validated the high robustness of the proposed solution. Finally, the finding shows that both stakeholders and future users were satisfied with the test results which then guarantee further cooperation with the project.

2.4 Conceptual Model

The conceptual model developed in this study visually represents the theoretical basis of the various relationships hypothesized in this study. The model identified one major independent variable (Internet of Things (IoT)) with two dimensions namely, Government Decision- Making and Health Information System (HIS) and one dependent variable named Fighting COVID-19. It shows that IoT through Government Decision- Making and Health Information System (HIS) affects the fighting of Covid-19 by the government. The reason being that IoT would help the government to produce fast and good decision and then strengthened the HIS to effectively fight covid-19. It is demonstrated that dependent variable- FIGHTING COVID-19 is directly predicted by IoT. Apart from that, it is equally predicted by Government Decision-Making and Health Information System (HIS).

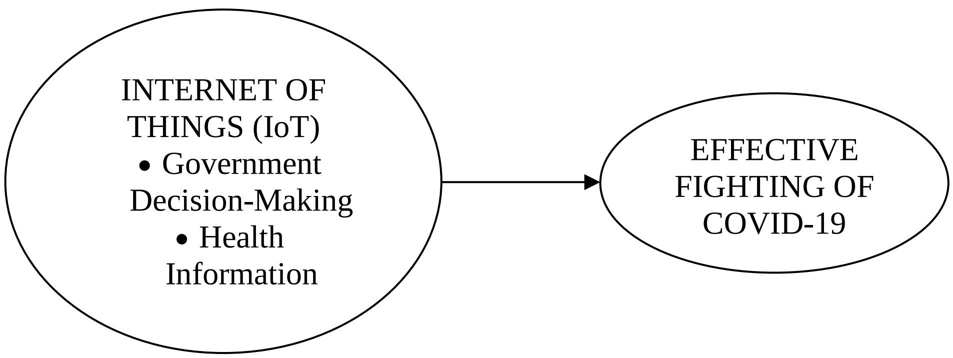

Figure 5: Research Model

Hypotheses Development

H1: There is a significant positive relationship between Internet of things (IoT) and the likelihood of fighting Covid-19 in Jordan

H2: Government Decision-Making is positively related to the effective fighting of Covid-19 in Jordan.

H3: There is a significant relationship between Health Information System (HIS) and the effective fighting of Covid-19 in Jordan.

3. Methods

The study employed a cross-sectional survey design as suggested by (Hair, Money, Samouel, & Page, 2007). The population of the study consists of doctors, health workers and health informatics specialists from different healthcare facilities in Jordan (Suleiman et al., 2020). A survey email questionnaire was sent to the entire population of the study. The variables are operationally defined accordingly. For example, IoT was operationally defined as Government Decision Making and Health Information System while Effective Fighting of Covid-19 defined as all government efforts in fighting Covid-19 in Jordan. All items were measured using 1- 5-point Likert scale with 1 being strongly disagree to 5 being strongly agree. Furthermore, primary data source specifically questionnaire was employed and was also used to collect the data through the email procedure. Out of all the copies of questionnaires sent out, only 90 returned filled. The data was analysed using multiple analytical tools such as the SPSS version 20and STATA version 15. All instruments were validated, and items were found reliable using the reliability test measure of internal consistent and Crobach alpha coefficient score above 0.6.

4. Data analysis result

4.1 Descriptive analysis result

Table 1 shows the descriptive analysis result obtained from the descriptive analysis. It summarizes the data of the respondents who participated in the study. For example, it shows that for gender, 46 of them are females while 44 are males accounting for both 48.9% and 51.1% accordingly. Also, it revealed for age variable that many of the respondents are less than 38 years accounting for 42.2%, 20 of them are between age bracket of 36-40 years representing 22.2%, 15 of them are within 31-35 old accounting for 16.7% while the remaining of 17 of them are within 41 years and above representing 18.9%. The marital status of the participants revealed that 50 them are females while the rest 40 are males representing 55.6% and 44.4% respectively.

For the nature of their work, the result shows that majority of them numbering 50 are nurses representing 56.7%, 26 of them fall under other accounting for 28.8%, just 11 of them are doctors accounting for 12.2% while rest are both medical technologist and Lab. Analyst accounting for 1.1% each. The hospital work for by the participants revealed that 30 of them fall under others, 17 of them work for government hospital, 15 of them work for Islamic hospital, 8 of them work for King Abdullah hospital, 5 of them also Albasheer hospital while the rest 3 and 2 of them worked for both Alrhibat Alwrdeh hospital and Albaqa Applied, respectively.

Table 1. descriptive analysis result obtained

Variables	Frequency	Percentage
Gender:		
Male	44	48.9
Female	46	51.1
Age:		
Less Than 30	38	42.2
31-35	15	16.7
36-40	20	22.2
41 And Above	17	18.9
Marital Status:		
Single	40	44.4
Married	50	55.6
Nature of Work:		
Doctors	11	12.2
Nurses	51	56.7
Medical Technologist	1	1.1
Lab. Analyst	1	1.1
Others	26	28.9
Hospital Work For:		
Islamic Hospital	15	16.7
Government Hospital	17	18.9
Specialized Hospital	10	11.1
King Abdullah	8	8.9
Hospital	3	3.3
Alrhibat Alwrdeh	5	5.6
Hospital	2	2.2
Albasheer Hospital	30	33.3
Albaqa Applied	90	100.0
Others		
Total		

Source: Field Survey

4.2 Validity, Reliability and Correlations Analysis Results

The validity for the questionnaire items were measured using the construct validity through the Kaiser-Meyer-Olkin (KMO) values above 0.6 as a threshold. In Table 2, the result revealed that all items were valid having produced KMO score of .83(Internet of Things), .79 (Government Decision Making), .68 (Health Information System), and .92(Effective Fighting of Covid-19). Also, the result for the reliability test through the internal consistent measure of Cronbach alpha coefficient revealed that all items are valid having produced Cronbach alpha coefficient values of .89 (Internet of Things), .89 (Government Decision Making), .79 (Health Information System), and .94 (Effective Fighting of Covid-19). The Pearson correlation was used to determine the direction and strength of the correlation between the independent (Internet of Things, Government Decision Making and Health Information System) and dependent (Effective Fighting of Covid-19) variables. The correlation result shows that all the predictor variables (Internet of Things, Government Decision Making and Health Information System) are well correlated with the outcome variable (Effective Fighting of Covid-19). For example, there is a significant moderate positive correlation between Internet of Things and Effective Fighting of Covid-19 at r=.515** and p<0.01. Also, there is significant moderate positive association between Government Decision Making and Effective Fighting of Covid-19 at r=.436** and p<0.01. Finally, it shows a significant moderate positive correlation between Health Information System and Effective Fighting of Covid-19 at r=.535**and p<0.01. The implication is that all the three predictor variables have one positive association or other with the outcome variable-Effective Fighting of Covid-19.

Table 2. Validity, Reliability and Correlations Analysis Results

Variables	KMO	Cronbach alpha	Correlation Effective Fighting of Covid-19	Decisions
Internet of Things	.83	.89	.515**	Significant positive Highly correlated
Government Decision Making	.79	.89	.436**	Significant positive Moderate correlation
Health Information System	.68	.79	.535**	Significant positive Highly correlated
Effective Fighting of Covid-19	.92	.94		

**. Correlation is significant at the 0.01 level (2-tailed).

4.3 Hypothesis testing Result

A linear regression analysis technique was applied to test the three hypotheses in this study. First, as shown in Table 3, the regression result for the relationship between IoT and effective fighting of Covid-19 revealed that there is a statistically significant relationship between IoT and effective fighting of Covid-19 with R-square = .265 accounting for 26.5% variability in the dependent variable at p<0.001. The result established that IoT could statistically significantly predict effective fighting of Covid-19 in Jordan. Secondly, the regression result established that government decision making could statistically significantly predict effective fighting of Covid-19 in Jordan, F (1,88) = 20.62, p<0.01, while government decision-making account for 19% (R Square =.190) of the explained variability in effective fighting of Covid-19.

Finally, the result revealed that HIS statistically significantly predict effective fighting of Covid-19 in Jordan, F (1,87) 34.948, p<0.01, while HIS accounts for 28.7% (R Square =.287) of the explained variability in effective fighting of Covid-19. The beta values of the independent variables show that IoT and HIS exhibit larger beta coefficient scores (.515(IoT); .535(HIS), meaning that they both have better and higher contributions on the dependent variable- effective fighting of Covid-19. It suggests that both HIS and IoT made the best contribution in explaining the dependent variable, when the variance explained by all other variables in the model is controlled for.

Table 3. Result of Regression analysis

Variables	R	R Square	Beta	T	F value	Sig. Value	Decisions
Internet of Things	.515[a]	.265	.515	5.600	31.366	.000	Supported
Internet of Things- government decision making	.436[a]	.190	.436	4.540	20.616	.000	Supported
Internet of Things-HIS	.535[a]	.287	.535	5.912	34.948	.000	Supported

a. Dependent Variable: Effective Fighting of Covid-19

4.4 Result of the STATA analysis Technique

The study employed Ordinary Least Square (OLS) technique examine the various relationships and effects the independent variables on the dependent variable as proposed. Table 4 depicts the relationship between IoT and EFC. It shows that the overall model for the relationship is statistically significant as indicated F(1,87)=31.53, p>0.001; Prob. > F =0.0000. The variability in the effective fighting of Covid-19 as explained by IoT is represented by the R square which is

0.2660 accounting for 26.6%. The estimation of the effect of the size is considered strong as indicated by the Adjusted R Square 0.2576 (25.76%). The result implies that IoT is a significant predictor of effective fighting of Covid-19.

Table 4. The relationship between IoT and EFC

Source	SS	df	MS			
				Number of obs	=	89
				F(1, 87)	=	31.53
Model	15.125282	1	15.125282	Prob > F	=	0.0000
Residual	41.7308978	87	.479665491	R-squared	=	0.2660
				Adj R-squared	=	0.2576
Total	56.8561798	88	.646092952	Root MSE	=	.69258

EFC	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
IOT	.58851	.1048024	5.62	0.000	.3802038	.7968161
_cons	1.691358	.4389576	3.85	0.000	.8188817	2.563833

$EFC = 1.691358(C) + \beta_1 .58851(IoT) + \mu$

Also, Table 5 revealed a statistical significant model in the relationship between GDM and EFC with the: $F(1,88)=20.62$, $p>0.001$; Prob. > F =0.0000; R square which is 0.1898 accounting for 18.98%. The estimation size as given by Adjusted R Square is 0.2791 (27.9%). The result suggests a statistically significant effect of GDM on EFC.

Table 5. The relationship between GDM and EFC

Source	SS	df	MS			
				Number of obs	=	90
				F(1, 88)	=	20.62
Model	11.2096486	1	11.2096486	Prob > F	=	0.0000
Residual	47.8466014	88	.54371138	R-squared	=	0.1898
				Adj R-squared	=	0.1806
Total	59.05625	89	.663553371	Root MSE	=	.73737

EFC	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDM	.4295378	.0945997	4.54	0.000	.2415409	.6175348
_cons	2.361076	.3918604	6.03	0.000	1.582336	3.139817

$EFC = 2.361076(C) + \beta_1 .4295378 (GDM) + \mu$

Table 6 revealed a statistical significant model in the relationship between HIS and EFC with the: $F(1,87)=35.08$, $p>0.001$; Prob. > F =0.0000; R square which is 0.2877 accounting for 27.9%. The estimation size as given by the Adjusted R Square is 0.2791 (27.9%). The result suggests a statistically significant effect of HIS on EFC.

Table 6. The relationship between HIS and EFC

Source	SS	df	MS			
				Number of obs	=	89
				F(1, 87)	=	35.08
Model	16.336137	1	16.336137	Prob > F	=	0.0000
Residual	40.5200428	87	.465747618	R-squared	=	0.2873
				Adj R-squared	=	0.2791
Total	56.8561798	88	.646092952	Root MSE	=	.68246

EFC	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
HIS	.6040448	.1019929	5.92	0.000	.4013229	.8067667
_cons	1.584924	.4343788	3.65	0.000	.7215494	2.448299

$$EFC = 1.584924(C) + \beta_1 .6040448\ (HIS) + \mu$$

The study attempts to compare the statistic results obtained from two analytical tools; STATA and SPSS as depicted in Table 7. The comparison revealed an interesting result, demonstrating that there is no difference between both analytical tools. The parameters such as F statistics, R Square, Adjusted R Square and t statistics used in judging the comparison proved the same. Indeed, the same result was obtained. For example, R Square values for both STATA and SPSS are 0.2660 and 0. 265 respectively, showing no difference. Also, the t statistics for both tools are 4.54 and 4.540 respectively again showing no difference. Again, the Adjusted R Square scores are the same 0.181 and .181 respectively. Hence, the study failed to find any difference in the results between STATA and SPSSS.

Table 7. Comparison of Results Between STATA and SPSS

PARAMETERS	**STATA**	**SPSS**
F statistics	F(1,87)=31.53	31.366
R Square	0.2660	.265
Adjusted R Square	0.2576	0.257
t statistics	5.62	5.60
Sig. Value	0.000	0.000
F statistics	F(1,88)=20.62	20.616
R Square	0.1898	.190
Adjusted R Square	0.1806	0.181
t statistics	4.54	4.540
Sig. Value	0.0000	0.000
F statistics	F(1,87)=35.08	34.948

R Square	0.2873	.287
Adjusted R Square	0.2791	0.278
t statistics	5.92	5.912
Sig. value	0.0000	0.000

5. Discussion of findings

The study examined the effect of IoT on the effectiveness of fighting Covid-19 by the government. In other words, it examined how IoT can be used to effectively fight fighting Covid-19 by the Jordan government. Apart from that, government decision-making and Health Information System were equally used to regress the dependent variable-effective fighting of Covid-19 to determine how affect they affect the effective fighting of Covid-19. To achieve this, a multiple analytical tool such as Statistical Package for Social Science (SPSS) version 20 and STATA version 15 techniques were used to analyze the data.

The study produced interesting results, first revealing that IoT generally affects the fighting of Covid-19. This implies that there is statistical and significant relationship between IoT and the effective fighting of Covid-19 at significant level of $p<0.01$. The 26% variability explained by the IoT in the fighting of Covid is an indicative of the effect of a strong impact of the use of IoT in fighting Covid-19. Thus, the linear regression established that IoT could statistically significantly predict the fighting of Covid-19by the government, $F(1, 87)=0.01$ while IoT accounted for 26% variability explained by the IoT in the fighting of Covid-19. The estimation of the effect of the size is considered strong as indicated by the Adjusted R Square 25.76 (25.8%). IoT would perform several functions such as identification, tracking and monitoring of patients. For example, Alqudah (2019) noted that in the healthcare sector, there is need to track and monitor patient flow in order to improve the workflow in hospitals and motion tracking through choke points, such as access to designated areas, and the only device that can do that is IoT. The implication is that Covid-19 themselves for quarantine and treatment. With IoT government identify them in their various homes or locations and pick them up for treatment.

Further finding on the government decision-making through IoT revealed that government decision-making is statistically significant with the effective fighting of Covid-19 at < 0.01. That is, government was able to make fast and easy decisions on how to effectively fight Covid-19. Thus, there is significant connect between government decision making and effective fighting of Covid-19. This becomes possible through IoT which provide all information about people with Covid-19. For example, it provides every detail you need to know about Covid-19 patient, their location, and the current stage of the disease itself. With IoT, government may not need to conduct any further test on Covid-19 patient because IoT does it faster and easier. With this information, government can then make their decision on how best this disease can be fought.

Also, the study found a statistically significant effect of HIS on the effective fighting of Covid-19 at $p<0.01$, meaning that HIS significantly predicts effective fighting of Covid-19. It further suggests that HIS through IoT would play a significantly assist in fighting Covid-19. For example, once HIS is linked to IoT, everyone suspected to have symptom of Covid-19 would be dictated no matter your location. This study collaborates the Previous studies by Suleiman et al. (2020) and Dziak et al. (2017) reported that there is significant linked between healthcare facilities and the detection of diseases among the patients. For example, Suleiman et al. (2020) linked frontline doctors' preparedness through IoT to the fighting of Covid-19. Also, Dziak et al. (2017) demonstrated that the application of Internet of Things (IoT)-based information system for indoor and outdoor use in the healthcare sector.

5.2 Conclusions and Implications

Based on the findings obtained in this study, the study deduced that IoT is indispensible in the effective fight against Covid-19, meaning that IoT would play a very crucial role in government effort to effectively fight Covid-19 in Jordan. To make effective and meaningful decisions about Covid-19, government needs information that is, real-time information. Thus, IoT is statistically significantly related to the effective fighting of Covid-19. The study offers some implications particularly to the government as well as to the healthcare sector across the globe. First, it shows that with IoT, government can make effective decisions that are capable of combating Covid-19 through identification, tracking and monitoring of Covid-19 patients. Also, the frontline doctors' preparedness can be enhanced through IoT to the fighting of Covid-19. Also, the hospitals in general can track and monitor patient flow in order to improve the workflow in hospitals and motion tracking through choke points, such as access to designated areas, and the only device that can do that is IoT. The application of IoT in Covd-19 situation is because it has the ability of providing solutions to identifying of patients with specific diseases, telemonitoring chronic disease management, fitness care and elderly care. It also has the capacity to deal with the provision and management of medication at home by specialized people is another dilemma that must be considered (Alqudah, 2019). Furthermore, the application of IoT in Covid-19 is expected to reduce the cost and increase the quality of health services and life in addition to enriching the collected health data that can be used by the government to make important decisions.

5.3 Limitations and suggestion for future studies

The study sample size appears small. For example, Pallant (2020) advocated for a more larger sample size like say 150 and above that would enable wider generalization of findings. The study only made use of 90 sample size, and this could affect the generalization of the findings obtained. Subsequent studies of this nature may want to increase the sample size with the aim of increasing the generalization of the findings. Secondly, language appears to be a barrier to the study as many of the respondents preferred the Arabic language to English language used in the survey questionnaires. For this reason, there is a need for survey questionnaire that would adapt Arabic language for easy understanding and reading by the participants. This would not doubt improve the responses of the respondents thereby providing additional robust findings on the issue being investigated.

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