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THE IMPACT OF ICT ON CORONAVIRUS CRISIS MANAGEMENT

CASE STUDY: NATIONAL CENTER FOR SECURITY AND CRISES MANAGEMENT IN JORDAN

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ABSTRACT

This research identifies the impact of the ICT dimensions (*readiness of ICT infrastructure*, *human resource skills and knowledge*, and *financial capabilities*) in managing the coronavirus crisis. A quantitative Likert-type questionnaire was administered to all workers in the upper and middle administrative levels who are involved in coronavirus crisis management at the National Center for Security and Crises Management in Jordan. The researchers adopted the descriptive analytical approach using SPSS version 19 for data analysis.

The research results show a presence of a statistically significant effect of ICT in the management of the coronavirus crisis in addition to other interesting results about areas that need improvements and attention in crises management centers. Furthermore, the research suggested a number of recommendations that all crisis management centers can benefit from.

KEYWORDS: *ICT, Coronavirus Crisis Management, National Center For Security And Crises Management, Covid-19, Jordan.*

1. INTRODUCTION

Countries today face rapid and sudden changes in their internal and external environment, as a result of political, economic, technological, cultural, or biological reasons which result in unforeseen crises that may threaten their structure, growth, and continuity of their activities. The modern globalized economy has increasingly unclear borders, and sometimes unpredictable events can occur in any process or location, affecting all countries without exception, regardless of their size or legal form, or the nature of their work or capabilities. This has been clearly demonstrated in the coronavirus crisis that the world is currently facing, and therefore effective and proper management of the crisis is the only way to minimize negative effects on the all states.

In light of the tremendous and accelerating development the world is witnessing in technology, the use of crisis management techniques and methods based on solid technological readiness has become extremely important to achieve effective administrative success in countries to mitigate the negative effects of the unprecedented corona crisis. This paper explores the management of the corona crisis in Jordan by analyzing the responses of employees at the National Center for Security and Crises Management (NCSCM).

2. LITERATURE REVIEW

Previous literature related to the subject of this research has been reviewed in order to provide the scientific background. To the best of the researchers' knowledge, no study has been conducted on the impact of ICT on coronavirus crisis management (CCM).

1.1. Coronavirus crisis and ICT

Coronavirus (Covid-19) is a new virus strain that has not been previously been identified in humans. Common symptoms of infection include respiratory symptoms, fever, cough, shortness of breath, and in more serious cases pneumonia, kidney failure, and even death[1] .

The World Health Organization [2] considers the emerging coronavirus a global pandemic, which has spread in at least 216 countries worldwide,

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infecting over 4 million people and causing 300,000 deaths, therefore there is an urgent need for a coordinated global response to prepare health systems to meet this unprecedented challenge [3] . The world is currently experiencing an unprecedented crisis with the spread of the virus in most regions of the world, which constitutes a challenge for countries in how to manage this crisis, and ICT will inevitably play a vital role with regard to social distancing policies (tracking and tracing) in terms of sustaining communication between departments managing the crisis. In light of this extraordinary reality that the world is experiencing today, ICT is more vital than ever before to maintain communication and coordination between public safety officials, vital institutions, and crisis management elements.

ICT has changed the ways people perform their work, reshaping methods of crisis management and enabling better use of resources. The importance of using information systems in crisis management has increased for several reasons, the most important of which is the increasing complexity of crises, the increasing role of knowledge, the geographical breadth of the interaction of crises, and the increased specialization and the degree of change in societies [4] . ICT is used in crisis management centers to facilitate the exchange of information, which helps in decision-making, as computer networks and information systems affect the efficiency, security, and continuity of information flow for the purpose of developing and making decisions in emergency situations. The modernization of communications and the use of special information technology tools will contribute to improving the reliability of information exchange between elements responsible for national security [5] .

2.

A lot of research in the last five years has studied the importance of a global design for information and communications technology used in crisis management [6] ;[7] ;[8] ;[9] ;[10] ;[11] ;[12] ;[13];[14] . Based on these studies, it turns out that there are some challenges where global design is not taken into account when developing technology to support the different stages of crisis management.

1.2. The National Center for Security and Crises Management (NCSCM)

This study has been applied to the NCSCM as it is the authority responsible for crisis and disaster management in Jordan, providing for all necessary requirements for effective and efficient management of any crisis or disaster. The Center is equipped with advanced technological infrastructure and experienced and efficient staff. Furthermore, the NCSCM is considered a center of leadership and control during the confrontation of the corona crisis, and it works in harmony with all national capabilities to manage this crisis with all professionalism and competence.

The NCSCM was opened in 2015 according to international technical and operational standards and specifications. Its mission is to coordinate and unify all the efforts of the national institutions to enable them to face national crises of various forms in order to achieve strategic adjustment and secure a safe and stable national environment. It achieves this through harnessing national capabilities and uniting the efforts of the relevant national institutions in order to reach professionalism in the areas of preparedness and response to national crises with minimal effort, time, cost, and possible losses [15] .

CCM in Jordan has been managed by the NCSCM with great success, by taking strict measures. These included closing national borders, and measures were taken to prohibit partial and total curfews and the establishment of quarantine and isolation areas throughout the entire country, in addition to activating the defense law, and then reducing the closure in a gradual way, after controlling the epidemiological situation [16] .

3. RESEARCH METHODOLOGY

The research adopted the descriptive analytical approach in terms of describing the research variables and demographic characteristics of the respondent sample, and the use of statistical tools in data processing and analysis.

2.1. Research model

The research model is designed to give an initial picture of the relationship between the study variables, as shown in Figure 1.

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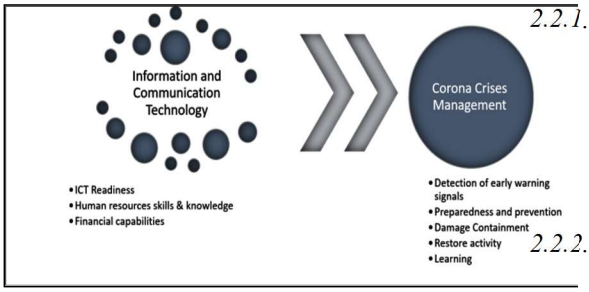

Figure 1: Study Model

Source: Prepared by the researcher based on the works cited in Table 1.

Table 1 : Sources And Dimensions Of Variables

Dimensions	Model	Variable
ICT infrastructure, human resource skills and knowledge, and provision of financial capabilities.	[17]	Independent variable (ICT)
Technological readiness, economic readiness, human resource readiness, educational readiness, administrative readiness, environmental readiness, cultural readiness, and legal readiness.	[18]	
Early warning signs detected, preparedness and prevention, containment of damage, restoration of balance and activity, and learning.	[19]	Dependent variable (Corona crisis management/ CCM)

2.2. Hypotheses

To achieve the objectives of the research by studying the impact of ICT in the NCSCM CCM response, a major hypothesis has been adopted from which three sub-hypotheses are explained below, as the study model illustrates in Figure 1.

2.2.1. Main hypothesis

H_O1: There is no statistically significant effect at the significance level ($\alpha \leq 0.25$) for ICT in its dimensions (ICT infrastructure readiness, human resource skills and knowledge, financial capabilities) in the CCM at the NCSCM.

2.2.2. Sub-hypothesis

The following sub-hypotheses are derived from this:

H_O1-1: There is no statistically significant effect at the significance level ($\alpha \leq 0.05$) for the readiness of ICT infrastructure in the NCSCM at the CCM

H_O1-2: There is no statistically significant effect at the level of significance ($\alpha \leq 0.05$) of human resources skills and knowledge in the NCSCM at CCM

H_O1-3: There is no statistically significant effect at the level of significance ($\alpha \leq 0.05$) of the financial capabilities in the NCSCM at CCM.

2.3. Research strategy and sample

The case study strategy was adopted through a comprehensive survey of all employees who have a direct relationship with information technology and CCM at the NCSCM, numbering 62 employees in total. Given the small size of the study community, the intentional (meaningful) sample method was used. The researcher distributed 62 questionnaires to all employees, of which 57 forms were retrieved and analyzed, equating to a 92% response rate.

The analysis unit consists of workers in the supervisory and control positions in the upper and middle administrative levels in the NCSCM who occupy the positions of consultant, director, and head of department, as well as other administrative and technical staff members, and administrators from the center and the official institutions involved in the CCM. These participants are directly experienced in the subject of ICT and the CCM, and have the ability to respond to the questionnaire in a way that leads to realistic results in diagnosis, analysis, interpretation, and formulation of recommendations. Table 2 shows the sample distribution.

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Table 2 : NCSCM Employees In Upper And Middle Levels And Dimensions Of Variables

Number	Job title
4	Consultant
7	Director (directorate, unit)
11	Head of the Department
40	Other (other administrative and technical staff)
62	Total

The survey instrument used a five-point Likert scale [20] , to give more flexibility to the sample members in the selection process. Its values were: 5 = strongly agree, 4 = ok, 3= neutral, 2 = disagree, 1 = strongly disagree. When drafting the questionnaire clauses, clarity of questions and their sequence and the absence of difficulties during the filling were taken into account, so this questionnaire was adopted as a valid tool for study, and importance measure was defined according to the following formula:

Category Length = Maximum Substitute - Minimum Substitute / Number of levels

Category Length = 5-1/3=1.33

Based on the previous formula, there are three importance levels for the five-step scale, which has values range from 1-5:

- Any value from 1 to less than or equal to 2.33 represents a low level of importance
- Any value from 2.34 to less than or equal to 3.66 represents an intermediate level of importance
- Any value from 3.67 to less than or equal to 5 represents a high level of importance

The questionnaire items were derived from previous studies (Table 1) in English, and were translated into Arabic by a professional translator. The Arabic versions were then back-translated by a different professional translator into English, to ensure they matched with the original meanings, and no significant variances were found. The questionnaires were administered in Arabic, the national language of all NCSCM employees. Their own contributions were numerical (via the Likert scale), while the analysis undertaken in this study is in English.

4. RESULTS

4.1. Normal distribution test

Kolmogorov Smirnov Test was performed to verify the availability of the normal distribution of data which, if not available, can negatively affect the results of the study hypothesis test, showing, at the level of significance ($\alpha > 0.05$), that the ICT and crisis management variables are normally distributed. The statistical significance of the values of the normal distribution of the main study variables was greater than (0.05), which means that statistical and hypothesis testing can be performed.

4.2. Sample characteristics

Based on the results of describing and analyzing the characteristics of the study sample, it is evident that most of the sample members were of the middle-aged male category, with a bachelor's degree, having experience and competence in their work from various administrative levels. The study sample mainly covered supervisory positions in the NCSCM, all of which gives a positive indication of their ability to accurately answer the questions of the questionnaire in a way that serves the objectives of the study.

4.3. Research variables description

4.3.1. ICT dimensions

To describe ICT dimensions, means, standard deviations (SDs) and paragraph importance were used, as shown in Table 3. The means ranged between (3.582 - 4.267) with a total average of (3.967), which indicates the high effect of ICT on CCM.

Human resources skills and knowledge dimension had the highest mean of (4.267) and an SD of (0.544). All statements related to this dimension had a high level of importance. Within this dimension, the paragraph (Awareness of senior management of the important role of ICT in CCM) achieved a high level of importance and came in first place, while the paragraph (The Center provides training plans to train and qualify workers to use ICT technologies) also achieved a high level of importance, but came in last place. This indicates the importance of the human element as a major component in ICT.

Financial capabilities dimension came second, achieving a high level of importance with a mean of (4.146) and an SD of (0.732). Furthermore, ICT infrastructure readiness had intermediate

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importance and the last rank, with a mean of (3.582) and an SD of (0.566).

In the ICT infrastructure readiness dimension, the paragraph (The Center provides the latest technology used in the field of networks, systems, devices and equipment in order to improve and ease the application of technological readiness to deal with crises in general and the CCM in particular) achieved a high level of importance and came in the first place, while the paragraph (A comprehensive and updated national database and information about available resources to be used during crises in general and the CCM in particular is available at the Center) achieved an intermediate level of importance and came in the last rank.

Table 3 : Mean, SD, and importance level

ICT	*Mean*	*SD*	*Importance level*	*Rank*
ICT infrastructure readiness	3.582	.566	Intermediate	3
Human resources skills and knowledge	4.267	.544	High	1
Financial capabilities	3.976	.521	High	2

4.3.2. CCM dimensions

To describe the CCM variable dimensions (discovering early warning signs, preparedness and prevention, containing damage, restoring activity, learning), means, SD, and paragraph importance were used. The means ranged between (3.621 - 4.064), with a total average of (3.800), as shown in Table 4.

Damage containment had the highest mean (4.064) and an SD of (0.498). Within this dimension the paragraph (The NCSCM is a national command and control center that enables decision-makers to make informed decisions based on accurate and temporal information during the CCM) had the highest mean with a high level of importance, while the paragraph (There is joint cooperation between the Center and the other centers and institutions concerned with managing the CCM at the regional and international level to exchange experiences and information to quickly respond to this crisis) came last, with a medium level of importance.

Preparation and prevention dimensions came in the second place with a mean of (3.785) and an SD (0.520). Within this dimension the paragraph (The Center's administration conducts fake and real exercises consistent with the nature of the tasks assigned to teams dealing with potential crises) came in the first place and gained a high level of importance, while the paragraph (There are unification, cohesion, coordination, harmony and integration among all directorates, units and divisions in the Center to achieve strategic goals) came in the last rank with an intermediate level of importance.

Learning diminution came in third place with a mean of (3.777) and an SD of (0.539). Within this dimension the paragraph (The Center provides recommendations related to the CCM in all respects to the concerned parties during all its stages) achieved a high level of importance and came in first place, and the paragraph (The management of the Center is keen on tabulating the results of crises within the memory of its organizers, which can be easily retrieved and taking lessons and lessons for future use) achieved an intermediate level of importance, and came in last place.

Restoring the activity dimensions came in fourth place, with a mean of (3.628) and an SD of (0.550). Within this dimension, the following two paragraphs achieved high level of importance and came in joint first place: (The Center works to transmit a state of reassurance, hope, motivation and psychological support among medical and service cadres who deal directly with infected cases); (The Center's administration is keen to adopt a method of incentives to reward workers during crises in general and during the CCM in particular). On the other hand, the paragraph (The Center initiates in cooperation with the concerned authorities to conduct awareness and guidance campaigns to deal with the consequences of the effects of the CCM on the infected people and their families) achieved an intermediate level of importance and came in last place.

The discovery of early warning signals dimension came in fifth place, with a mean of (3,621) and an SD of (0.626). Within this dimension, the paragraph (The techniques used in other national institutions help the Center to discover early

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warning signs of a crisis) achieved a high level of importance and came in the first place, and the paragraph (The Center's management has an effective warning system with a view to preventive forecasting of potential crises) achieved an intermediate level of importance and ranked last.

Table 4 : Mean, SD, and significance level for the CCM variable

CCM	*Mean*	*SD*	*Importance level*	*Rank*
Detection of early warning signals	3.621	.626	Intermediate	5
Preparedness and prevention	3.785	.520	High	2
Damage containment	4.064	.498	High	1
Restore activity	3.628	.550	Intermediate	4
Learning 3.777.539 High 3	3.777	.539	High	3
Average	3.80	.448	High	

5. STATISTICAL ANALYSIS AND HYPOTHESIS TESTING

5.1. Main hypothesis testing

The results shown in Table 5 indicate that the correlation coefficient of the regression model was 0.834. This indicates that the independent variables are strongly correlated with the dependent variable, and the value of R- Squared indicates that the independent variables explain the change in the dependent variable by 0.695, which is an appropriate explanatory value. The results of variance test (F) reached 125,522, which indicates that the model is valid for measuring the influence of ICT in crisis management. The value of t (11.204) and its statistical significance (0.000) indicates the rejection of the null hypothesis and acceptance of the alternative, therefore, ICT affects CCM at the NCSCM at a significance level of ($\alpha \leq 0.05$).

Table 5 : Main hypothesis testing results

DV	*IV*	*R*	*R-Squared*	*F*	*Sig*	*Beta*	*t. value*	*Sig*	*Decision*
Crisis MGMT	ICT	0.834	0.695	125.552	0	0.834	11.204	0	Supported

These results are consistent with [21] , who concluded that ICT has a positive impact on crisis and disaster management by organizations, and [22] , who recommended the need to support sources and infrastructure of ICT and the need to provide sufficient information before and after the occurrence of crises. They also support [23] , who concluded that the effectiveness of the crisis response process comes through optimal use of information technology, and [24] , who concluded that when preparing teams for response to societal crises, electronic readiness for relevant ICT is highly effective.

5.2. Sub-hypotheses derived from the main hypothesis testing

5.2.1. Hypothesis HO1-1

Results of the first sub-hypothesis test, demonstrated below in Table 6, show that the correlation coefficient of the regression model was 0.796, which indicates that the independent variables are strongly correlated to the dependent variable. The value of R-squared indicates that the independent variables explain the change in the dependent variable by 0.637, which is an appropriate explanatory value.

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Table 6 : First sub-hypothesis testing results

DV	IV	R	R-Squared	F	Sig	Beta	t.value	Sig	Decision
Crisis MGMT	ICT readiness	0.796	0.634	95.229	0	0.796	9.759	0	Supported

The results of variance test (F) reached 95,229, which indicates that the model is valid for measuring the effect of the independent variable, ICT readiness in crisis management. The value of t, which amounted to 9.759, and its statistical significance (0.000), indicate the rejection of the null hypothesis and acceptance that the readiness of ICT infrastructure affects crisis management at the NCSCM at a significance level (α≤0.05).

5.2.2. *Hypothesis HO1-2*

Results of the second sub-hypothesis test demonstrated below in Table 7 show that the correlation coefficient of the regression model was 0.738, which indicates that the independent variables are strongly related to the dependent variable. The value of R-squared indicates that the independent variables explain the change in the dependent variable by 0.545, which is an appropriate explanatory value.

Table 7 : Second sub-hypothesis testing results

DV	IV	R	R-Squared	F	Sig	Beta	t.value	Sig	Decision
Crisis MGMT	HR knowledge and skills	0.738	0.545	65.957	0	0.738	8.121	0	Supported

The results of variance test (F) reached 65,957, which indicates that the model is valid for measuring the effect of HR skills and knowledge in the dependent variable crisis management. The value of t, which amounted to 8.121, and its statistical significance (0.000), indicate the rejection of the null hypothesis and acceptance of the alternative that human resource skills and knowledge affect the management of crisis at the NCSCM at a significance level of (α≤0.05).

5.2.3. *Hypothesis HO1-3*

Results of the third sub-hypothesis test demonstrated below in Table 8 show that the correlation coefficient of the regression model was 0.585, which indicates that the independent variables are strongly correlated with the dependent variable, R-squared indicates that the independent variables explain the change in the dependent variable by 0.342, which is a relatively low explanatory value. However, the value of variance test (F) reached 28,609, which indicates that the model is valid for measuring the effect of the independent variable physical capabilities on the dependent variable crisis management.

Table 8 : Third sub-hypothesis testing results

DV	IV	R	R-Squared	F	Sig	Beta	t.value	Sig	Decision
Crisis MGMT	Physical capabilities	0.585	0.342	28.609	0	0.585	5.349	0	Supported

The value of t, which reached 5.349, and its statistical significance (0.000), indicate the rejection of the null hypothesis and acceptance that physical capabilities affect crisis management at the NCSCM at a significance level of (α≤0.05).

6. CONCLUSION

6.1. Conclusions regarding the independent variable (ICT)

A. The level of ICT in the NCSCM was high, as the Center provides the latest information technology used in the field of networks, systems, devices and

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equipment to improve the technological readiness to deal with crises in general and CCM in particular.

B. There is a clear interest on the part of senior management in the issue of ICT, as the level of importance is high for the higher management's awareness of the important role of ICT in managing the CCM.
C. The databases of the NCSCM are not adequate, which causes confusion and shortcomings in dealing with crises due to the lack of all the data necessary to deal with crises efficiently and effectively. The level of importance was average for the availability of a comprehensive and updated national database, and information about the resources available to be used during the crises in general, and CCM in particular.
D. Attention to lessons learned from previous crises do not meet the expected level, as the level of importance came as intermediary for having a database containing lessons learned from previous crises to benefit from during facing the current and future crises.
E. Attention to communication during CCM is not enough, as the level of importance is intermediary for the availability of effective and flexible communication systems that meet needs during a crisis in the Center.

6.2. Conclusions regarding the dependent variable (CCM)

A. The NCSCM is a national leadership and control center that gives decision-makers the ability to make informed decisions based on accurate and timely information during the CCM, where the level of importance of this is high.
B. The Center's interest in early warning and forecasting is not sufficient, as the level of importance is intermediary in terms of discovering early warning and forecasting signals that cause crisis situations effectively, and the availability of an effective warning system that causes preventive crises.
C. The Center's interest in the skills of collecting and analyzing indicators of crisis occurrence is not sufficient, as the level of importance is intermediary for the availability of qualified staff to carry out the skills of collecting and analyzing indicators of crises.
D. The Center's interest in developing and adjusting the National Plan for CCM did not meet expectations, as the level of importance came intermediary to follow up on the development and amendment of the National Plan through the Specialized Directorate.
E. Information sharing among all directorates about CCM for the purpose of obtaining comments, suggestions or recommendations was not sufficient. The level of importance came as intermediary for the following paragraph: unify and coherence efforts, coordinate, harmonize, harmonize and integrate all the directorates, units and divisions in the Center to achieve the strategic goals.
F. The level of importance was high for the necessity of establishing a coordination, unification and follow-up unit to achieve integration, harmony and cooperation between the directorates of the Center, and between the Center and the civil and military state institutions.
G. The interest level in virtual workshop and virtual conferences were insufficient during CCM. Furthermore, the level of importance was intermediary in regard to holding long-distance training workshops and courses on the field of crisis management during CCM.
H. Cooperation between the Center and the other centers concerned with CCM in other states is not at the expected level, as the level of importance was intermediary for the extent of joint cooperation between the Center and the other centers and institutions concerned with the CCM at the regional and international levels to exchange experiences and information to quickly respond to this crisis.
I. The Center's interest in coordination with the authorities concerned with the psychological aspects of people infected with coronavirus and their families was not sufficient. The level of importance was intermediary for the cooperation with the concerned authorities to conduct awareness and guidance campaigns to deal with the consequences of the psychological effects on infected people and their families.
J. Results show that the documentation and classification of the results of previous crises and the lessons learned were not sufficient, as the level of importance came as intermediary in regards to the Center's desire to classify the results of crises in an easy to retrieve way and take advantages of lessons learned.

6.3. Recommendations

A. The necessity of establishing national centers specialized in security and crises management
B. The need in every country to have a comprehensive database that includes all the crises that the country was exposed to, in addition to all the available resources to both public and

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private sector in order to help countries effectively managing similar crises.

C. More attention in crisis management centers should be given to the provision of effective and flexible communications systems that meet requirements during crises in general, and CCM-style pandemics in particular.
D. Promote joint cooperation between the Center and other centers and institutions concerned with managing the CCM at the regional and international levels to exchange experiences and information to quickly respond to this crisis.
E. Paying attention to the psychological aspects of those infected by the corona virus and their families, through conducting victim support campaigns.
F. Countries should document and classify crises' results in a crises national database and learn lessons for the future.
G. Countries should give more attention to early warning, forecasting and monitoring indicators of crises, and provide effective warning systems that enable preventive forecasting of potential crises.
H. Crisis management centers should conduct capacity-building programs for their employees to improve their skills in crisis data collection and analysis.
I. Establishing a coordination, unification and follow-up unit in crises management centers to promote integration, harmony, and cooperation between all units and between the Center and the civil and military state institutions.
J. The need to pay attention to encouraging and stimulating studies and scientific research and conducting more specialized field studies in the field of crisis management, in order to create an intellectual, knowledge, and scientific base for various aspects of crisis management.

6.4. Future research trends

In light of the objectives of this study, which sought to demonstrate the impact of ICT on managing the CCM, the researcher recommends studying the following topics:

A. The appropriate global design when developing technology to support the various stages in crisis management, and the study of ICT tools that allow international cooperation between the agencies responsible for crisis management in various countries to help them coordinate efforts to confront a global crisis similar to the CCM.
B. The impact of digital technology on the effective management of biological crises.
C. Global preparedness for epidemics in the context of a coordinated global response as a key to understanding the nature of this outbreak, within a comprehensive global mutually reinforcing strategy.
D. The effect of community awareness and commitment in facing CCM.
E. International and regional cooperation in facing global pandemics.

6.5. Research limitations

The main limitation of this study is absence of previous studies during the preparation of this research directly related to the topic of the relationship between ICT and CCM. The study is exploratory, given the rapid nature of the corona crisis that continues to be an on-going and critical global pandemic situation at the time of writing.

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