Analyzing and Measuring the Impact of the Digital Economy on International Trade, the Case of Jordan for the Period (1990-2020)

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ABSTRACT

The digital economy is defined as the economy that relies mainly on the economics of information and informatics technology that is based on digital technology. The sectors of information, communication and informatics technology have become one of the most important sectors driving economic growth in the developed countries now, because of the great potential they contain in various fields of the modern economy. The research aims to study the impact of the digital economy on international trade. Descriptive, as a general introduction to the various concepts of the digital economy and its role in international trade, as well as relying on the statistical quantitative analytical approach to analyze the results obtained. The research concluded many results and proposals.

Keywords- digital economy, international trade.

I. INTRODUCTION

Contemporary development was able to sweep the entire world and did not stop at certain borders. Rather, it sought rapid development as a natural reflection of the growing curve of development, coinciding with its introduction of many innovations represented by qualitative and accelerated leaps that have clear effects on the economies of the world, which were not confined to a closed space, but rather became An essential part and an active participant in a number of fields, including the economy. Digital developments have influenced the emergence of the so-called digital economy based on the Internet, communications and information technology, which is the current and upcoming power for all countries. This has contributed to the expansion of the circle of economic transactions between the countries of the world, and the world has become in A wide competitive electronic market, and it has become a fertile field for countries to benefit from it as a modern means to achieve higher growth rates in their successive economies in the field of international

economic policies in changing many of its components, and its influence through the Internet to carry out financial transactions such as buying shares and trading currencies with minimal effort and cost. It extended to economic systems and became a factor in economic growth, as the integration of the digital economy with human societies appears in a set of manifestations that are almost not confined to a specific spot, including electronic commerce as the modern and most modern form of international trade, and includes electronic marketing that promotes the sale of goods through The World Wide Web, and electronic investment is one of the available tools and capabilities.

II. LITERATURE REVIEW

The digital economy can also be defined as that economy that is associated with the concept of the information society, which expresses future visions of the world in which information is the basic pillar of the economy and human relations as a whole, which is embodied in a high digital infrastructure that guarantees

the achievement of this in various fields of life, based on information technology. Digital and the use of knowledge data and information in its management and considering it as a new resource of wealth and a source of innovation, creativity and development. The digital economy is based primarily on the technological and informational development, which increases the opportunities for the growth and development of products and services, especially those that can be traded digitally through information networks (Al-Sayed, 2019). Three main components, which are computers, information, communications, and human elements, whether they are producers or consumers of digital goods and services, depending on the resource of frequencies allocated to communication networks, information, and inexhaustible electronic technologies (Al-Mousawi, 2016).

The digital economy and changes in the structure and form of international trade.

The digital economy seeks to include many products, especially services, in the digital field, and this process is developing very quickly and includes commercial, professional and technical services. As a result, the revenue from the sale of digital products is greater than the revenue from the direct services of professionals. With regard to international trade, this is primarily due to the digitization of goods, which in turn will increase the number of services sold (in the field of technological, intellectual, informational, audiovisual, and similar services); Secondly, the partial redistribution of services in traditional sectors (the influx and entry of specialists into the country as a result of the development of tourism, education, medical services, etc.), and provides a large number of digital solutions for modern sectors; Third: The volume and scope of cross-border deliveries in the sale of services in digital form will depend on the ability to agree by notification and be acceptable to transaction participants in practice. All this plays a special role in the rapid development of outsourcing services on the Internet and the increase in participation in digital commerce. Changes in production technologies and configurations related to digitization and the emergence and proliferation of new business models may slow down cross-border activities due to the movement of goods and people. This is facilitated, firstly, by the formation of a sales circle close to the buyer. As a result, intercity transportation, including container transit used for consumer purposes, has declined sharply; second, EDI replaces physical supply chains and leads to changes in the entire supply chain; Third, digital solutions eliminate the need to send specialists abroad to provide or consume services in many situations (Ahmedov, 2020,5).

Foundations of the digital economy.

The acceleration of technical progress and the integration of information and communication technology into the economy has led to the emergence of the digital economy as a new system based on a set of foundations and pillars, which can be summarized as follows:

A- The law of digital assets and the economy of high speed: Digital assets are not similar to physical assets and are not consumed when used. Companies can create value from the use of these assets in an infinite number of deals, which requires changing the competitive mechanism in its field. In fact, the company bears only the cost of the initial preparation of the information, so that the additional cost of its reproduction becomes closer to zero. This expresses the law of increasing returns in the field of digital assets as opposed to the law of diminishing returns in relation to physical assets or goods (Jasim, 2010).

B- New economies of scale and scope. The average cost in economies of scale for physical products tends to decrease with an increase in the volume of production until it reaches a point where the fixed cost increases in addition to new production facilities or machines. With new economies of scale for digital products, this rule does not apply. Preparing the first copy requires a large fixed cost to produce it, but the cost of reproducing it after that is almost non-existent, no matter how much the volume produced is increased. The digital economy has changed economies of scale as well; The business space and the provision of services through digital assets not only provide service to everyone at the same time in the field of a specific market, but also enable the provision of service in different and disparate fields and markets (Obaid, 2014).

C- Cost pressure for each transaction and market rebalancing: With the Internet and new business models, the cost of transactions has become very small, which leads to an unprecedented doubling of the total volume of activity. This reduces the cost pressure per transaction; We find, for example, that traditional companies used to avoid small deals because the cost of performing them may be greater than the return resulting from them, but in light of the digital economy, deals are made at the click of a mouse and the cost of conducting them has touched zero. Also, in the digital economy, there is an increasing shift from a line of focus based on supply to a line of focus based on demand, so the company's priority based on the operational system or guessing what the customer wants has changed to market priority and interaction in real time with what the customer wants, and this means that there are capabilities and capacity A surplus that makes supply in its various forms characterized by abundance, and that demand, despite its distinction and wide scope with the Internet across the world, is characterized by scarcity (Jasim, 2010).

D- The cost of the digital product Efficiency and leverage: The costs of the digital product are characterized by unique characteristics in it. Digital products are characterized by a different cost structure and behavior than physical products. As the production of the first copy is often very expensive compared to the

production of other copies, which is very cheap. The fixed cost of the digital product has two basic advantages: the first is that it is very high, and the second is that it is not guaranteed and not covered, i.e. it cannot be compensated when stopping or stumbling; Since when investing in building a new factory and in the middle of the work, it is decided to abandon the project, and accordingly the building can be sold and most of the costs can be recovered if no profit is achieved from that, either according to digital products, for example, writing a book or producing a movie, because if the project is not completed, the product cannot be sold and benefited from him. As for the variable cost of the digital product, it also has two special advantages. The first is that it is very low, and the second is that it does not increase no matter how much the volume of it is produced, as the unit cost of additional copies is almost non-existent. Information and communication technology, especially the Internet, has created high efficiency through the large and increasing activity in the use of advanced technology through computers and the Internet (Jasim, 2010).

III. DATA AND METHODOLOGY

Both the independent and dependent variables in the study form were derived from time series data representing the research sample. Many governmental and non-governmental organizations' websites, such as World Bank Data and International Monetary Fund publications, have been consulted as trusted resources for this research. The following is the general form of the econometric model that has to be tested and examined during the course of the research.

$$Y = f(X_1, X_2, X_3, X_4) + ei$$

since:
Y: the dependent variable expressing foreign trade in relation to the gross domestic product.
X1, X2, X3, X4, the independent variables respectively (economic globalization, foreign direct investment in relation to the gross domestic product, registered patents for residents, human development).
ei: the random variable.

Unit root test:

It is considered one of the most common tests to determine the stability or instability of time series of economic variables, by applying the statistical method of this test to understand the number of differences required to study the series, which in turn is more than the traditional method, if we have variables (Yt), the relationship is as follows:

$$Yt = BY_{t-1} + ut$$

The unit root is used to illustrate one of the OLS assumptions, the random error ut (also known as the white noise error component in the equation). This gets a passing grade (B). The economic variable Yt has a unit root and is unstable if and only if its value is equal to the proper value (B = 1). The equation for this phenomenon is known as the random walk to error. The unit root test is based on the following assumptions, which are similar to those of the test by (B) in that they ask if the value is greater than or equal to one:Null hypothesis or null hypothesis (B: H1 = 0), which means that it is equal to zero and B is equal to one. Therefore, the null hypothesis means that the time series has a unit root and is therefore an unstable sequence. The null hypothesis H0 is rejected in favor of the alternative hypothesis H1:B1:H0, where B is a negative number less than zero. Since there is no unit root, the alternative hypothesis argues that the string is stable. There are a number of ways to check for the presence of a unit root; we used the Phillips-Peron test in this investigation.

Phillips-Perron Test (PP):

A more accurate and powerful statistical test, notably in terms of sample size in fewer instances, the Phelps-Perron test was employed in (1988). It differs from the extended Dickie-Fuller test in that it does not include the late values of the difference. Many statisticians agree that the PP test is superior than the ADF test when conducted using conventional techniques, and that the PP test yields more trustworthy findings.

Co-integration methodology using ARDL autoregressive distributed time lag model:

In this study, we will use a modern approach, which is the ARDL approach, as the only condition for applying this test is that the time series is not integrated to the degree (2). The ARDL model test includes the first test to see if there is a long-term balance relationship between the model variables, and if we confirm the existence of Such a relationship, we begin to estimate the long-run parameters as well as the short-run parameters of the independent variables. To this end, we compute the F statistic by means of the Wald test, which tests the null hypothesis that there is no cointegrator relationship between model variables (there is no long-run equilibrium relationship, that is, in contrast to the alternative hypothesis, which indicates the existence of a long-run cointegrator between levels of Model variables After the Wald test, we compared the statistic (F) with the tabular values developed by Perasan et al. (2001), and the upper and lower critical values can be found at the significant limits to test the possibility of co-integration between the variables of the study, if the calculated value (F) is greater than The proposed upper critical value, we reject the hypothesis that there is no long-run equilibrium relationship, i.e. study the alternative hypothesis that there is a cointegration relationship between the variables, but if the calculated value is less than the minimum value of the critical value, then we accept the assumption of equilibrium relationships that do not exist in the long run (Faryal, 2018).

Diagnostic tests:
A- Testing the normal distribution of the rest of the model Because the error correction vector model is used to determine the short-term and long-term relationships between economic variables, the model has multiple delay periods for the explanatory variables in the causality equation, and certain guidelines must be adopted to determine the appropriate time with regard to the delay of the test variable, which It should be included in the error correction model to ensure that it gives the best estimate, and in order to determine the optimal hypothetical duration (Jarque & Bera, 1980, 257).

B- Testing the model's absence from the autocorrelation problem in the values of the residuals In dynamic models, the Dren-Watson test is not very reliable, especially when there are variables with slow gaps. One of the alternative tests is the Breusch-Pagan test. The null hypothesis here states that the remaining values are not automatically correlated, while the alternative hypothesis states that this is not the case. The probability value of the test is compared to the significance level (65%), and if the probability value is greater than the significance level, the null hypothesis is accepted and the remainder is automatically unrelated. But if the probability value is less than the significance level, accept the alternative hypothesis that the remainder is automatically related, in which case the problem should be solved (Brusch, 1978, 342).

IV. EVALUATE PROCEDURES AND RESULTS

Estimating the impact of the digital economy on international trade, Jordan as a model:
Unit root test: To ensure the stability of the variables during the study period, the Phillips-Peron (PP) test was used, and the results were that they were stable at the first difference.

Table 1: The results of the unit root test - Phillips Peron for the study variables the impact of the digital economy on international trade in Jordan for the period (1990-2020)

UNIT ROOT TEST TABLE (PP)						
Null Hypothes is: the variable has a unit root At Level						
		Y	X1	X2	X3	X4
With Constant	t-Statistic	-0.7320	-1.7404	-1.9949	-2.3965	-4.5394
	Prob.	*0.8235*	*0.4015*	*0.2873*	*0.1511*	*0.0011*
		n0	n0	n0	n0	***
With Constant & Trend	t-Statistic	-1.3999	-0.6859	-1.8262	-2.8755	-2.6062
	Prob.	*0.8403*	*0.9651*	*0.6667*	*0.1839*	*0.2803*
		n0	n0	n0	n0	n0
Without Constant & Trend	t-Statistic	-1.5948	0.6744	-1.3195	-0.7324	1.3997
	Prob.	*0.1030*	*0.8561*	*0.1688*	*0.3908*	*0.9563*
		n0	n0	n0	n0	n0
At First Difference						
		d(Y)	d(X1)	d(X2)	d(X3)	d(X4)
With Constant	t-Statistic	-4.1944	-4.9619	-5.4833	-5.0552	-6.8328
	Prob.	*0.0028*	*0.0004*	*0.0001*	*0.0003*	*0.0000*
		***	***	***	***	***
With Constant & Trend	t-Statistic	-4.1156	-5.3756	-5.5212	-4.9897	-8.6467
	Prob.	*0.0156*	*0.0008*	*0.0005*	*0.0020*	*0.0000*
		**	***	***	***	***
Without Constant & Trend	t-Statistic	-3.9984	-4.9228	-5.5824	-5.1554	-6.4882
	Prob.	*0.0003*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
		***	***	***	***	***
Notes:(*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1% and (no) Not Significant.						

Source: **Prepared by the researcher based on the statistical program (EViews.10).**

Results of testing the ARDL autoregressive model in Jordan: After we tested the rest of the time series, the following table shows the results of the ARDL test:

Table 2: Results of applying the ARDL model to study the variables impact of the digital economy on international trade in the long and short terms in Jordan for the period (1990-2020)

Dependent Variable: (Y)				
Method: ARDL				
Sample (adjusted): 1994 2020				
Maximum dependent lags: 5 (Automatic selection)				
Model selection method: Akaike info criterion (AIC)				
Dynamic regress ors (2 lag,automatic): (X1) (X2) (X3) (X4)				
Number of models evalulated: 405				
Selected Model: ARDL(4,2,2,0,2)				
Short Run Coef.				
Variable	Coefficient	Std. Error	t- Statistic	Prob.
Y(-1)	0.616914	0.168090	3.670140	0.0037
X1	4.532275	0.822553	5.510007	0.0002
X2	1.302500	0.397248	3.278805	0.0073
X3	-0.713177	0.129595	-5.503132	0.0002
X4	166.0989	124.3404	1.335840	0.2086
C	171.1381	146.4481	1.168592	0.2673
Long Run Coef.				
X1	-3.892549	1.193158	-3.262391	0.0076
X2	-2.919533	1.817241	-1.606574	0.1364
X3	2.351144	0.980204	2.398628	0.0353
X4	975.2041	1.2980085	3.075702	0.9810
EC=Y-(3.892*X1 +2.919 *X2 -2.351*X3 +975.204*X4)				
R-squared	0.963			
Adjusted R- squared	0.913			
F-statistic 19.19479				
Prob(F-statistic) 0.000009				
Prepared by the researcher based on the outputs 10.EViews. Note: p-values and any subsequent tests do not account for model selection.				

The following results are evident from Table (2):

a. Short Term Relationship::

- Economic globalization: directly and significantly affects international trade in the short term by (4.53%) and inversely in the long term by (-3.89%).

- Foreign Direct Investment: directly and significantly affects international trade in the short term by (1.30%) and in the long term by (2.91-%).

- Patents: have a negative and significant effect on international trade in the short term at a rate of (-0.71%), while in the long term they are significant and positive at a rate of (2.35%).

- Human development: directly and insignificantly affect international trade in the short and long terms.

Table 3: Co-integration test of the study variables the impact of the digital economy on international trade in Jordan for the period (1990-2020)

(Bound Test Approach)				
Test Stat	Value	Sign.	I(0)	I(1)
F-stat	5.6144	%10	2.68	3.53
K	4	%5	3.05	3.97

		%2.5	3.4	4.36
		%1	3.81	4.92

Source: **Prepared by the researcher based on the statistical program (EViews.10).**

- Test the normal distribution of random errors

It is clear from Figure (15) that the statistical value of the (JB) test was (0.292) with a significant level greater than (5%). Accordingly, we accept the null hypothesis, which indicates that the random errors are normally distributed in the estimated model in Algeria, with an average equal to (-2.82). And a standard deviation of (3.795634).
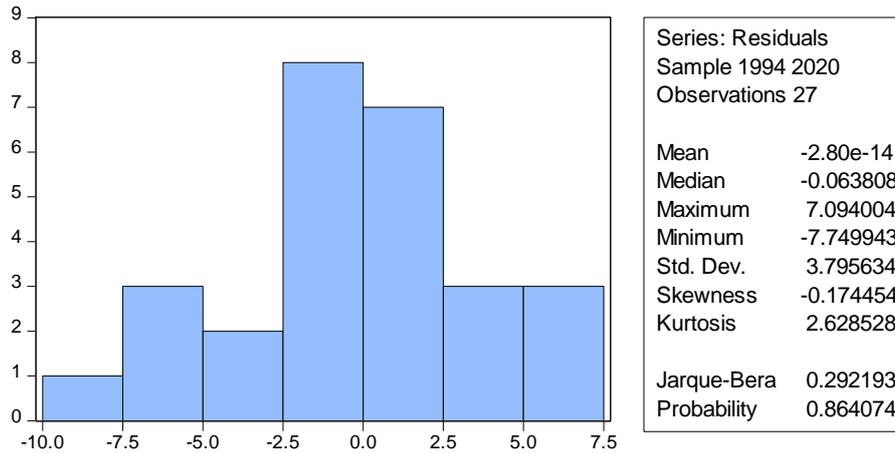

Series: Residuals	
Sample 1994 2020	
Observations 27	
Mean	-2.80e-14
Median	-0.063808
Maximum	7.094004
Minimum	-7.749943
Std. Dev.	3.795634
Skewness	-0.174454
Kurtosis	2.628528
Jarque-Bera	0.292193
Probability	0.864074

Figure 15: Testing the normal distribution of random errors of the model in Jordan
Source: Prepared by the researcher based on the statistical program (EViews.10).

Testing the autocorrelation problem:

It is clear from Table (20) that the statistical value of the (Breusch-Godfrey) test was (2.7391) with a significant level greater than (5%). Therefore, we accept the null hypothesis, which indicates that there is no problem of autocorrelation between the remainder in the estimated model in Jordan.

Table 4: Results of testing the autocorrelation problem between the residuals for Jordan variables for the period (1990-2020)

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	2.7391	Prob. F(2,24)	0.0848
Obs* R-squared	5.761157	Prob. Chi-Square	0.561

Source: **Prepared by the researcher based on the statistical program (EViews.10).**

- Testing the problem of contrast instability

It is clear from Table (21) that the statistical value of the (White) test was (1.1378) with a significant level greater than (5%). Therefore, we accept the null hypothesis, which indicates that there is no problem of stability of variance in the estimated model in Jordan.

Table 5: Results of testing the problem of instability of variance for Jordan variables for the period (1990-2020)

Heteroskedasticity Test: White			
F-statistic	1.1378	Prob . F(14,16)	0.3985
Obs* R-squared	15.4658	Prob. Chi-Square	0.3471

V.   CONCLUSIONS

1. The digital economy based on information technology arose as a new phenomenon in the world, as it appeared as a realistic concept since 1921, as a scientific term in 1994 and as a practical application in 1995. The economic nature of information technology is considered the first breakthrough in the studies of economic researchers in the field of economic digitization.

2. The digital economy is a new method for doing business and economic activities through the use of digital technology represented by the global network of communications and information (the Internet), computer technologies and smart phones, for the purpose of increasing and improving growth through the

development of all economic sectors (agricultural, industrial, commercial, financial and service), as well as the production of goods Intangible digital, such as software, using digital and computer means and methods.

3. The digital economy is considered a new stage in the development of economic methods, based on and based on human knowledge, that is, it is an advanced stage of the stages of the knowledge economy, based on the extent of technology penetration and overlapping in economic activities and sectors, and the extent to which countries benefit from the technological and information revolution, and what it led to New industries and discoveries and advanced technologies.

Standard side:

1- Economic globalization: It directly and significantly affects international trade in the short term, and this means that an increase in economic globalization leads to an increase in international trade. As for the long term, economic globalization has an adverse and significant effect on international trade, and this means that an increase in economic globalization leads to a decrease in international trade.

2- Foreign direct investment: directly and significantly affects international trade in the short term, and this means that an increase in foreign direct investment leads to an increase in international trade. Stability in neighboring countries, which led to the severing of distinguished commercial corridors, as well as to the Jordanian tax system, which is considered a cost to the investor, and the lack of legal oversight and reforms in government institutions.

3- Patents: adversely and significantly affect international trade in the short term, and this means that an increase in patents leads to a decrease in international trade, and the reason is due to the decrease in government spending in the field of patents, as well as to the weakness and shortcomings in innovative activities, and the lack of incentives for an environment Innovation, but in the long run directly and significantly affect international trade.

4- Human development: It directly and insignificantly affects international trade in the short and long terms. This means that an increase in human development leads to an increase in international trade.

RECOMMENDATIONS

1- The infrastructure of the digital economy should be strengthened by providing new and advanced technology, which paves the way for raising the efficiency of service delivery

2- Enhancing competitiveness in the field of the digital economy in a way that provides the ability to overcome the negative aspects of economic globalization.

3- Increasing agreement on higher education and scientific research, in addition to the need to pay attention to adopting modern marketing methods and

developing banking operations, which enhances the advancement of the digital economy.

REFERENCES

[1] Alami, Hassan, 2013, The Role of Investment in Information and Communication Technology in Achieving Sustainable Development, Master Thesis, Faculty of Economics and Management Sciences, University of Farhat Abbas Setif 1, Algeria, 18.

[2] Ali, Nagham Aziz Muhammad. (2018) Analysis of the effects of the digital divide on development in developing economic environments. Master's thesis, University of Wasit, College of Administration and Economics, 16.

[3] Ferial, Qaboosh, 2018, The Impact of Economic Diversification on Economic Growth in Algeria during the Period (1990-2015), Master Thesis, Faculty of Economic Sciences, Management Sciences and Commercial Sciences, University of Oum El-Bouaghi - Larbi Ben M'hidi - Algeria.

[4] Tsay, Rueys, 2012, The Analysis of Financial Time Series, 3rd.ed, John Wiley and Sons, New Jersey, USA.

[5] Al-Razo, Hassan Muzaffar, 2006, Elements of the digital economy and an introduction to the economics of the Internet, Institute of Public Administration, Riyadh, Saudi Arabia, 13

[6] Sheikha, Qusay Ahmed, 2015, The role of Islamic investment funds in achieving economic growth, a comparative study. Traditional investment funds, master's thesis (unpublished), Faculty of Economics, Damascus University, Syria, 77

[7] Abbas, Mohsen Khudair, Ali, Mustafa Rashid, 2020, Analysis of the Impact of the Digital Economy on Development in the Environment of Arab Countries: Selected Countries, Al-Muthanna Journal of Administrative and Economic Sciences, Volume 10, Issue 3, 165.

[8] Al-Wedyan, Safaa, Khawalda, Hamza, Barham, Naseem, 2021, Assessment of Innovative Capacity in Jordan Using the Patents Index, An-Najah University Journal for Research (Human Sciences), Volume 35, Issue 1.23-24

[9] Abdulaziz, Ahmed, Zakaria, Jassim, Al-Tahan, Firas Abdel-Jalil, 2011, economic globalization and its impact on the Arab countries, Journal of Administration and Economics, Al-Mustansiriya University, Issue 86. 77

[10] Ismail, Mohamed, Hassan Gamal Kassem, 2023, Foreign Direct Investment Trends in Arab Countries in the Wake of the Covid-19 Pandemic, Arab Monetary Fund.20.

[11] Jarque C.M. & Bera A.K. 1980 . "Efficient Test for Normality, Homosced-asticity and Serial Independence of Regression Residuals". Economics Letters 257, 6

[12] Breusch T.S. 1978. "Testing for Autocorrelation in Dynamic Linear Models". Australian Economic papers.

[13] Faryal, Qaboosh, 2018, The Impact of Economic Diversification on Economic Growth in Algeria during the Period (1990-2015), Master Thesis, Faculty of Economic Sciences, Management Sciences and Commercial Sciences, University of Oum El-Bouaghi - Larbi Ben M'hidi - Algeria,.71

[14] Jasim, Jaafar Hassan, 2010, Introduction to the Digital Economy, First Edition, Dar Al Bidaya, Amman, 112-117

[15] Ebeid, Khadija, 2014, The Role of the Digital Economy in Restructuring International Trade in Light of the Challenges of Sustainable Development, Case Study of South Asian Countries, Master Thesis, Faculty of Economics, Commercial Sciences and Management Sciences, Farhat Abbas Setif University, 22

[16] Ahmedov,I. 2020, The Impact of the Digital Economy on International Trade, European Journal of Business and Management Research Vol. 5, Issue 4. .6

[17] Abdel Salam, Al-Sayed Osama, 2019, Digital Economy, Dar Ghaida for Publishing and Distribution, Amman, Jordan, 12

[18] Al-Mousawi, Safaa Abdul-Jabbar, Al-Araji, Kazem Saad, Nema, Zainab Hadi, 2016, Digital Economy, Dar Al-Ayyam for Publishing and Distribution, Amman, Jordan, 11.