The impact of information and communication technology on poverty in MENA countries, an empirical study

Nedjar Malika */ University Mustapha stanbouli mascara. Algeria*
nedjar.malika@univ-mascara.dz

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Abstract:

This study aimed to demonstrate the role of information and communication technology in reducing poverty in the countries of the Middle East and North Africa, by measuring the impact of technological indicators on the poverty rate in these countries using panel data during the period between 2000-2019, and we concluded that there is a correlation relationship Medium among the variables of the study, and that the most appropriate model is the fixed effects model, as the study proved that all technological indicators have a significant and negative effect t on the poverty rate, and this is due to the technological delay in these countries with the high rate of poverty, in addition to the tense political conditions and the frequent civil wars In some areas since the year 2000, spending and investment in the technological field must be increased with the calming of the political situation.

Keywords: *information and communication technology, poverty,panel data, MENA countries.*

Jel Classification Codes : *c; c3; c33.*

Résumé :

Cette étude visait à démontrer le rôle des technologies de l'information et de la communication dans la réduction de la pauvreté dans les pays du Moyen-Orient et d'Afrique du Nord, en mesurant l'impact des indicateurs technologiques sur le taux de pauvreté dans ces pays à partir de données de panel durant la période 2000-2019 , et nous avons conclu qu'il existe une relation de corrélation moyenne entre les variables de l'étude, et que le modèle le plus approprié est le modèle à effets fixes, car l'étude a prouvé que tous les indicateurs technologiques ont un effet significatif et négatif t sur le taux de pauvreté, et cela est dû au retard technologique dans ces pays au taux de pauvreté élevé, en plus des conditions politiques tendues et des guerres civiles fréquentes Dans certaines régions depuis l'an 2000, les dépenses et les investissements dans le domaine technologique doivent être augmentés avec le apaisement de la situation politique.

Mots clés : *technologies de l'information et de la communication, pauvreté, données, pays MENA.*

Jel Classification Codes : *c ; c3 ; c33.*

1. **Corresponding author:** Nedjar malika, **nedjar.malika@univ-mascara.dz**

I-Introduction

Information and communication technology is considered an integral part in economic and social life, so that it cannot be dispensed with. It has led to a qualitative leap in all sectors. In the health sector, diseases are diagnosed and treated by various means of information and communication technology, and electronic surgeries are now performed by a group of Doctors, via satellite communications. In the educational field, distance education is carried out, which includes a group of individuals from different countries of the world, as well as in the agricultural sector, various modern technologies are now used for agriculture, irrigation and harvesting. In the field of commercial exchanges, buying and selling via the Internet is done through in order to reduce cost and save time, information technology plays an important role in eradicating poverty through electronic link programs for remote and poor areas, facilitating access to information, goods and products to them, while providing awareness and educational programs and health care for marginalized and poor groups.

These technological developments also included the countries of North Africa and the Middle East in all fields, so that the number of Internet, telephone, computer and television users increased from year to year in these countries, with online shopping, in addition to an increase in reducing the number of the poor through various social programs and job creation. Small institutions and financial support for them by governments.

I-1Problematic Study

What is the impact of information and communication technology on poverty in the countries of North Africa and the Middle East?

I-2Hypotheses of Study:

-There is a positive impact of ICT indicators on the poverty rate in the countries of the Middle East and North Africa.

- There is a strong correlation of technological indicators with the poverty rate.

I-3Study Methodology

- The study relied on a number of applied research that examined the relationship between technological indicators and poverty, so that the results of these studies differed between the positive and negative impact of these indicators on the poverty rate.
- The study sample is 22 countries in the Middle East and North Africa, during the period 2000-2019.
- The econometric model was used to show the effect of technological indicators on the poverty rate, by using various modern statistical tests in the eviews 10 program using Panel Data**.**

I-4Study Axes: In our study we have relied on three main axes:

First: A presentation of the various previous applied studies that examined the relationship between technological indicators and poverty**.**

Second: Theoretical framework, in which the various theoretical concepts of information and communication technology and poverty were discussed.

Third: The application framework, in which the impact of technological indicators on the poverty rate was demonstrated through data panel obtained using the eviews 10 program.

I-5Literature review:

- **A study** (Rasim & Jülide , 2018) under the title ″ The Contribution of ICT to Poverty Reduction: A Panel Data Evidence″ The relationship between information and communication technologies (ICTs) and poverty is empirically examined in this study. Using four ICT indicators, six poverty indicators, and a panel data set made up of 182 nations, There are shown to be statistically significant relationships between poverty indicators and ICT indicators. Internet use is discovered to have the greatest impact on all measures of poverty among the ICTs. The highest effect of internet penetration among ICT variables suggests that, in addition to its other effects noted in the literature, encouraging internet.
- **A study** (Ebenezer , Kanayo K. , Andrew , & Phetole , 2022) titled "Poverty, ICT and Economic Growth in SADC Region: A Panel Cointegration Evaluation" This research from 2005 to 2019 looked at the relationship between economic growth, information and communication technology, and poverty in the SADC. The main goal of the study was to examine the relationship between economic growth and poverty in SADC nations utilizing the Mean-Group FMOLS, Mean-Group DOLS, and Robustness Mean-Group Estimators as its tools. In order to produce a single index value for ICT, the main component analysis was used. The data were then subjected to pertinent econometric tests to produce reliable results. The results showed that, with the exception of inflation, every variable had a negative impact on poverty in the SADC. The "leapfrogging"
- **A study** (Seemab, Dilawar , & Ihtisham , 2022) titled" Assessing the role of information and communication technology in reducing the gap between rich and poor: the case of South Asia" His study, which analyzed panel data from 2005 to 2019, presents an empirical picture of the relationship between information and communication technologies and the growth of the wealth divide. Levin and Lin (LL) and Im, Pesaran and Shin (IPS) tests were first used to find unit root problems. The short- and long-term effects of information and communication technology and other control factors on closing the wealth gap in South Asia were examined using the pooled mean group and mean group estimators. The outcomes demonstrated that, in

comparison to mean group estimators, the conclusions of the pooled mean group are more accurate and reliable. The study's findings demonstrated that the economy was negatively impacted by the increased use of information and communication technology..

- **A study** (Arema , 2021) under title "Impact of Information and Communication Technology (ICT) on Poverty Reduction in Rural Areas in Kogi State" This study looked at the effects of ICT on rural development in Kogi State from the standpoints of eradicating poverty. The neoclassical theory of poverty served as the study's foundation. A multi-stage sampling technique was used to choose 10 households from each of the 120 rural settlements that had previously been randomly chosen from the State's 21 Local Government Areas (LGAs). Thus, a total of 1,200 houses were included in the survey's sample. The Ordinary Least Square (OLS) technique was used in the study to estimate three regression models. The findings indicate that households' access to, ownership of, and use of ICT has had a beneficial and statistically significant influence on decreasing poverty in rural Kogi State.
- **A study** (Rizwan & Catherine , 2019)intiled "microfinance,financial inclusion and ict ;implications for poverty and enequality" Using a panel dataset of sixty-two nations between 2001 and 2012, this study evaluates how Information and Communication Technologies (ICT) contribute to the reduction of poverty and inequality through promoting financial inclusion, MFIs are recognized for their critical role in bringing credit and other financial services right to the doorsteps of people who are financially excluded. Therefore, research into the factors that influence financial inclusion, particularly in emerging nations, is necessary. In the preliminary examination of the data, we discover a positive correlation between ICT diffusion and financial inclusion and a negative correlation between poverty and inequality. The study's findings also point to the effects of financial inclusion on reducing poverty, regardless of how they are evaluated. Additionally, it was found that the ICT elements speed up economic growth and lower inequality and poverty when employed as tools for financial inclusion.
- **A study** (Tiroyamodimo M., Mohammad , & Malebogo , 2011) intiled under "role of ict in reducing of poverty in developing countries:bostwana as an evidence in sadc region"Even some of the most underdeveloped nations have been impacted by information and communication technologies (ICTs). These include the sudden rise in mobile phone use, the development of the internet and the spread of social networking sites around the world, and information and communications technology. ICT services and an

overabundance of digital content International observers and academics have been debating the functions of ICT. Prior studies concentrated on the effects of ICTs on economic, social, and cultural facets of life. There is little research on ICT content and services that are geared toward the underprivileged, particularly those that promote entrepreneurship as a means of reducing poverty in developing nations. This article examines how ICTs are affecting the South African Development Community (SADC) member nation of Botswana utilizing secondary data and document analysis.

- **A study** (julian, timothy m, & elise, 2014) intiled "the ict and poverty nexus in africa" The digital gap should not be seen as the cause of inequality and poverty, but rather as a symptom of it, according to this chapter's review of the literature on ICT and development. This is one method to break the link between ICT, development, and inequality. The inference is that having access to ICTs cannot, in and of itself, end poverty; at best, it can be used as a tool in efforts to reduce poverty.
- **A study** "The Role of ICT in Poverty Reduction in Onitsha L.G.A of Anambra State" The study looks at how ICT might help reduce poverty in the Anambra state region of Onitsha L.G.A. For the study, a survey research design was used. The total population of Onitsha North L.G.A. in the state of Anambra makes up the population. The fifty respondents in the area were sampled using a stratified sampling procedure. An expert in computer education from Nwafor Orizu College of Education in Nsugbe and an expert in measurement and evaluation from Nnamdi Azikiwe University in Awka, both in Anambra State, validated the questionnaire, which served as the primary instrument for data collection. The gathered data was examined using the mean statistics. The study's conclusions demonstrated how ICT can help reduce poverty by facilitating e-learning, capacity building, and employment opportunities.

  Through our analysis of previous studies, we found that some of them concluded that technological indicators have a positive impact on poverty, especially the Internet use indicator, and other studies have found that technological indicators have a negative impact on poverty, and from here we conclude that technological indicators cannot eradicate poverty, but rather are an aid tool for reducing poverty. From poverty, through e-learning and providing job positions, and reducing costs by avoiding movement for purchase, medication, learning and practice of trade through online buying and selling and electronic payment, in addition to linking remote areas to Internet networks in order to facilitate access to services and goods.

II- Theoretical framework

II-1The concept of information technology and its indicators

II-1-1Ict definition : There are several definitions of information and communication technology, including the following

- AJAYIICT can be defined as" a TECHNOLOGICAL means of COLLECTING (inputting/gathering), COLLATING (processing/analyzing), and CONVEYING (outputting/transferring) INFORMATION via TECHNOLOGY. (AJAYI, , 2009).
- Mid-Pacific ICT Center, 2014 is defined ict as “skills around computing and communications devices, software that operates them, applications that run on them, and systems that are built with them” (Alexander N. , Gabriel , & Katherine, 2015)
- UNESCO defines information and communication technology as” ICT is a scientific, technological and engineering discipline and management technique used in handling information, its application and association with social, economic and cultural matters (Ratheeswari, 2018), Teacher is the main part of the educational field in our society. He more works for the improvement level of our society in the every field. Skilled teachers can make the creative students in form of the good social worker, politician, poet, philosopher etc. for the society. Teachers can play a friendly role with the learner. The rapid development in technology has made creatively changes in the way we live, as well as the demands of the society.
- Blurton ICT is defined as “diverse set of technological tools and resources used to communicate, create, disseminate, store, and manage nformation”. Technologies included in ICTs are: Redio and Television (broadcasting technology), Telephony, Computers, and the Internet” (Shah Md. & Shafiul , May 2010).

II-1-2Ict indicators: there is 60 indicators of ict (International Telecommunication Union (ITU), 2022) which were endorsed following discussions including countries, international organizations, and specialists in the measuring of the information society. The following topics are covered by them: ICT infrastructure and access; ICT use and access by families and individuals; ICT use and access by businesses; the ICT sector and trade in ICT goods; ICT in education; and ICT in government. The list was created to aid nations in measuring the information society and has been approved by the UN Statistical Commission on multiple occasions, most recently in 2016.

II-1-2-1ICT infrastructure and access: In many nations, ensuring universal service and access to ICT is a primary government priority that is frequently

embodied in legislation that regulates the industry. 10 The suggested ICT infrastructure and access metrics quantify accessibility in terms of individuals and relate to individual use. The majority of the indicators use per capita data, which is the conventional way to show how many people have access to ICTs. Almost all ICT service providers maintain administrative records for operational and invoicing purposes, which is one explanation for this. Then, to calculate a per capita indicator, it is a straightforward mathematical exercise to divide the installed base of a specific ICT device or service by the population.**Table (01):: ICT infrastructure and access**

indicator	**Definition**
Fixed-telephone subscriptions per 100 inhabitants	Fixed-telephone subscriptions refers to the sum of active number of analogue fixed telephone lines, voice-over-IP (VoIP) subscriptions, fixed wireless local loop (WLL) subscriptions, ISDN voice-channel equivalents and fixed public payphones. This indicator was previously called Main telephone lines in operation. This indicator is divided by the population and multiplied by 100.
Mobile cellular telephone subscriptions per 100 inhabitants	Mobile-cellular telephone subscriptions refers to the number of subscriptions to a public mobile-telephone service that provide access to the PSTN using cellular technology
Fixed broadband Internet subscriptions per 100 inhabitants, broken down by speed	Fixed-broadband subscriptions refers to fixed subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s. This includes cable modem, DSL, fibre-to-the-home/building, other fixed broadband subscriptions, satellite broadband and terrestrial fixed wireless broadband
Active mobile-broadband subscriptions per 100 inhabitants	Active mobile-broadband subscriptions refers to the sum of active handset-based and computer-based (USB/dongles) mobile-broadband subscriptions to the public Internet
International bandwidth usage per inhabitant (bits/second/inhabitant)	Average usage of all international links, including optical fibre cables, radio links and traffic processed by satellite ground stations and teleports to orbital satellites (expressed in Mbit/s).
Percentage of the population	Percentage of the population covered by at

covered by a at least a 3G mobile network	least a 3G mobile network refers to the percentage of inhabitants that are within range of at least a 3G mobile-cellular signal, irrespective of whether or not they are subscribers.
Fixed broadband basket	The fixed-broadband sub-basket refers to the price of a monthly subscription to an entry level fixed-broadband plan
Mobile cellular low-usage basket	The mobile cellular basket refers to the price of a standard basket of 70 minutes and 20 SMS messages per month in predetermined on-net/off-net/fixed ratios
Mobile broadband Internet prices per month	Data-and-voice price baskets. The low-consumption data-and-voice price basket is based on a monthly data usage of a minimum of 500 MB of data, 70 voice minutes, and 20 SMSs. The high-consumption data-and voice price basket is based on a monthly data usage of a minimum of 2 GB, 140 minutes, and 70 SMSs
Multichannel TV subscriptions per 100 inhabitants	Multichannel TV subscriptions refers to services that provide additional TV programming beyond free-to-air terrestrial channels. Multichannel TV services are cable TV, direct-to-home satellite services, Internet-protocol TV, and digital terrestrial TV. Multichannel TV subscriptions should only be included if additional channels are available through payment of a fee. It is divided by the population and multiplied by 100.

Source : international Telecommunication Union (ITU)

II-1-2-2 ICT access and use by households and individuals: The definitions and sample questions in this section correspond to the basic ICT use indicators for households and individuals, HH1 through HH23. It also includes certain methodological considerations, the most crucial of which are those on statistical units, scope, and classificatory variables for reasons of comparability. (Core List of ICT Indicators, 2005).

- HH1 Proportion of households with a radio.
- HH2 Proportion of households with a TV.
- HH3 Proportion of households with telephone.
- HH4 Proportion of households with a computer.
- HH5 Proportion of individuals using a computer .

- HH6 Proportion of households with Internet.
- HH7 Proportion of individuals using the Internet.
- HH8 Proportion of individuals using the Internet, by location .
- HH9 Proportion of individuals using the Internet, by type of activity .
- HH10 Proportion of individuals using a mobile cellular telephone .
- HH11 Proportion of households with Internet, by type of service.
- HH12 Proportion of individuals using the Internet, by frequency .
- HH13 Proportion of households with multichannel television, by type.
- HH14 Barriers to household Internet access.
- HH15 Individuals with ICT skills, by type of skills .
- HH16 Household expenditure on ICT .
- HH17 Proportion of individuals using the Internet, by type of portable device and network used to access the Internet .
- HH18 Proportion of individuals who own a mobile phone .
- HH19 Proportion of individuals not using the Internet, by type of reason.
- HH20 Proportion of individuals who purchased goods or services online, by type of good and service purchased .
- HH21 Proportion of individuals who purchased goods or services online, by type of payment channel .
- HH22 Proportion of individuals who purchased goods or services online, by method of delivery .
- HH23 Proportion of individuals who did not purchase goods or services online, by type of reason **.**

II-1-2-3ICT access and use by enterprises: Definitions and sample questions are provided here for the business core ICT use indicators B1 through B12. Additionally, it offers some methodological notes, with those on statistical unit, scope, and classificatory variables being the most significant. This section does not offer broad guidance on how to conduct or analyze business surveys, it should be emphasized. Its objective is to communicate the methodological ideas and conceptual problems that are most pertinent to the information gathering process for business ICT use. (Core List of ICT Indicators, 2005).

- B1 Proportion of businesses using computers.
- B2 Proportion of persons employed routinely using computers .
- B3 Proportion of businesses using the Internet .
- B4 Proportion of persons employed routinely using the Internet.
- B5 Proportion of businesses with a web presence .
- B6 Proportion of businesses with an intranet.
- B7 Proportion of businesses receiving orders over the Internet .

- B8 Proportion of businesses placing orders over the Internet.
- B9 Proportion of businesses using the Internet by type of access.
- B10 Proportion of businesses with a Local Area Network
- B11 Proportion of businesses with an extranet.
- B12 Proportion of businesses using the Internet by type of activity .

II-1-2-4ICT sector and trade in ICT goods: This section offers categories and definitions that are pertinent to the fundamental core indicators, ICT1 through ICT8,**.**

ICT sector: It consists of businesses in the manufacturing and service sectors whose products electronically capture, transfer, or display data and information.

ICT goods: are defined by the OECD as "…..intended to fulfil the function of information processing and communication by electronic means, including transmission and display, or use electronic processing to detect, measure and/or record physical phenomena, or to control a physical process".

- ICT1 Workforce of the ICT sector (as a percentage of total business sector workforce).
- ICT2 Value added of the ICT sector (as a percentage of total business sector value added).
- ICT3 ICT goods imports as a percentage of total imports.
- ICT4 ICT goods exports as a percentage of total export.
- ICT5 ICT services imports as a percentage of total imports of services.
- ICT6 ICT services exports as a percentage of total export of services.
- CT7 ICT-enabled services imports as a percentage of total imports of services.
- ICT8 ICT-enabled services exports as a percentage of total export of services.

II-1-2-5ICT in education: This section offers categories and definitions that are pertinent to the fundamental core indicators (ED1 to ED9).ED1 Proportion of schools with a radio used for educational purposes.

- ED2 Proportion of schools with a television used for educational purposes.
- ED3 Proportion of schools with a telephone communication facility.
- ED4 Learners-to-computer ratio in schools with computer-assisted instruction.
- ED5 Proportion of schools with Internet access by type of access.
- ED6 Proportion of learners who have access to the Internet at school.
- ED7 Proportion of learners enrolled at the post-secondary level in ICT-related fields.
- ED8 Proportion of ICT-qualified teachers in schools .
- ED9 Proportion of schools with electricity**.**

II-1-2-6ICT in government: This section offers categories and definitions that are pertinent to the fundamental core.

- EG1 Presence of National E-Government Strategy or Equivalent .
- EG2 Presence of DIGITAL ID or Similar Authentication Required to Access Online Services .
- EG3 Presence Public Procurement Portal
- EG4 E-participation Index
- EG5 Open Government Data Index .

II-2Defining poverty and its dimensions

II-2-1poverty definition: "Some see poverty as strictly an economic state. Others see it as a condition of political vulnerability. Still others see it predominantly as a measure of social class. All of these interpretations are simultaneously correct and insufficient. The challenge is that we all have a sense in our minds of what a financially challenged existence looks like, but struggle to put that vision into a set of measurable indicators. Several competing measures have thus emerged, each telling only part of the story" (Deonandan, , 2019).

II-2-2the difference between absolute poverty and relative poverty :

Absolute poverty refers to those whose salaries fall below a threshold set by a specific nation. People are unable to meet their basic needs for food, water, and shelter below this line. Additionally, they lack access to basic services including utilities, healthcare, and education.

Relative poverty refers to people whose combined incomes are less than a specific threshold, usually 50% of the median income for the nation. The boundary for relative poverty is subject to shift because changes in the median income brought on by economic growth. When income and consumption are excluded from the definition of poverty and instead include security and access to services that are essential to wellbeing, 50% (Charizze , 2021).

II-2-3Multidimensional aspects of poverty: Following the 1970s' strong emphasis on Basic Human Needs, a lot of research has been done on the various aspects of poverty and how the poor themselves feel their circumstances.

- ✓ **Economic, political, social and environmental aspects**: By concentrating on these elements, poverty can be put into perspective. The strategy is structural and aims to draw attention to the measurable aspects of poverty. It offers a snapshot of the factors contributing to and defining poverty.
- ✓ **Spatial and temporal aspects**: Here, the changing aspect of poverty is more in the spotlight. The importance of how poverty varies over time and space is sometimes not properly acknowledged. Once a crop has been harvested, the circumstances of poor, rural households frequently get much better in terms of money, food, work, and health. But some

individuals live in chronic poverty and experience ongoing hunger, contaminated water, illiteracy, social prejudice, etc. Geographically, the accessibility of facilities like markets, hospitals, and schools has a big impact on how likely it is for people to get above poverty. Looking at these spatial and temporal dimensions has the benefit of recognizing the unpredictability of poverty, which makes the supply of development chances, in particular, much more interesting to the poor.

- ✓ **Vulnerability, isolation, powerlessness**: These ideas focus on how the poor view poverty. Vulnerability denotes a lack of means to counteract deteriorating circumstances. The physical and social inability to access opportunities and resources that are available to others is referred to as isolation. Lack of ability to assert rights and protest against exploitation is reflected in powerlessness. All three ideas contribute to understanding how the poor behave and why risk minimization is a popular strategy. This method makes a significant addition in that it illustrates how poverty and social exclusion lead to preferences for the poor that are qualitatively different from those of non-poor people. (Lars Engberg- & Helle Munk , 2010).

Ⅲ-measuring the impact of media and communication technology on poverty using panel data.

We will measure the relationship between technological indicators and poverty t hrough several steps: describing and coding these variables and data sources for their collection, then estimating the model using the least squares method, then Haussmann's test. .

Ⅲ-1 The model used

$$pv_{it} = b0 + b1int\ e_{it} + b2\ mc_{it} + b3\ fb_{it} + b4\ ft_{it} + \sigma t + \varepsilon it$$

table (2): Variables used in the study and their sources

variable symbol	variable name	The study period	Study data sources
pv	The dependent variable is poverty	2000-2019	United nations development program (undp)
int	Individuals using the Internet (% of population)	2000-2019	The International Telecommunication Union (ITU)
mc	Mobile-cellular subscriptions per 100 inhabitants	2000-2019	The International Telecommunication Union (ITU)

fb	Fixed broadband subscriptions per 100 inhabitants	2000-2019	The International Telecommunication Union (ITU)
ft	Fixed-telephone subscriptions 100 inhabitants	2000-2019	The International Telecommunication Union (ITU)

Source : Prepared by the researcher

Table (3): Statistical description of the study variables

	FB	FT	INT	MC	PV
Mean	4.722909	14.78856	32.49827	78.68355	0.697700
Median	1.480000	12.58225	24.09270	77.47000	0.720000
Maximum	66.00000	63.09548	99.70149	212.6400	0.890000
Minimum	0.000000	0.305771	0.025785	0.000000	0.400000
Std. Dev.	7.309503	11.28070	28.56896	51.65705	0.117032
Skewness	3.030285	1.554690	0.762191	0.277783	-0.663172
Kurtosis	17.19667	6.184913	2.446739	2.381861	2.546240
Jarque-Bera	4368.390	363.2186	48.21373	12.66372	36.02659
Probability	0.000000	0.000000	0.000000	0.001779	0.000000
Sum	2078.080	6506.968	14299.24	34620.76	306.9880
Sum Sq. Dev.	23455.26	55864.59	358305.5	1171450.	6.012726
Observations	440	440	440	440	440

Source: Prepared by the researcher based on the results of eviews 10

Ⅲ-2Study of the correlation between variables: We study the correlation to find out the possible correlation pairs between the variables of the study, whether this correlation is negative or positive.

Table (4): The correlation between the variables

	FB	FT	INT	MC	PV
FB	1				
FT	0.3573	1			
INT	0.6452	0.2472	1		
MC	0.4975	0.2175	0.7939	1	
PV	0.5064	0.6193	0.6060	0.5796	1

Source: Prepared by the researcher based on the results of eviews 10

Through the results of the correlation matrix, we note the following:

- The dependent variable poverty is positively correlated with all independent variables.
- All independent variables are positively related to each other.
- There is an almost medium correlation between the dependent variable poverty and all the independent variables estimated between 50% and 60%.

Ⅲ-3Model Estimation: To show the relationship between ICT indicators and poverty, we estimate the model using three models: Pooled Regression Model, Fixed Effects Model, and Random Effects Model, and based on 10 Eviews The following results were obtained:

Table (5): Results of model parameters estimated using the three models

independent variables	Pooled Regression Model	Fixed Effects Model	Random Effects Model
Constant	0.541367 (0.0000) ***	0.644405 (0.0000) ***	0.632682 (0.0000) ***
FB	0.000625 (0.3296)	0.000715 (0.0293) ***	0.000857 (0.0084) ***
FT	0.005047 (0.0000) ***	0.000870 (0.0374) ***	0.001544 (0.0001) ***
INT	0.001105 (0.0000) ***	0.000711 (0.0000) ***	0.000748 (0.0000) ***
MC	0.000544 (0.0000) ***	0.000177 (0.0018) ***	0.000176 (0.0019) ***
R-squared	0.623840	0.936649	0.416562
Adjusted R-squared	0.620381	0.932824	0.411197
Prob(F-statistic)	0.000000	0.000000	0.000000

Source: Prepared by the researcher based on the results of eviews 10

Ⅲ-4Hausman Test: We conduct the Hausman test to find out which of the effects is more appropriate to estimate the model, whether the fixed effects model or the random effects model, and to determine which of the two models is chosen, we put the following hypotheses:

H0: is the null hypothesis when the random effects model is appropriate.

H1: is the alternative hypothesis when a fixed-effects model is appropriate.

Table(6): Hausman's test results

Source:

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	33.794337	4	0.0000

Prepared by the researcher based on the results of eviews 10

We note in the table through the results of the Hausman test that the probability value of the test is equal to 0.000, which is less than 5%, which is statistically significant, and from it we reject the null hypothesis H0 and accept the

alternative hypothesis, which confirms that the model more suitable for our study is the fixed effects model.

Ⅲ-5Interpreting the results of estimating the model using the fixed effects model: We estimate the model parameters using the fixed effects model, after the results of the Hausman test, which confirmed this, through the method of ordinary least squares, and the following table shows that:

Table(7): Model parameters estimated using fixed effects

independent variables	**the fixed effects model**
Constant	0.644405 (0.0000) ***
FB	0.000715 (0.0293) ***
FT	0.000870 (0.0374) ***
INT	0.000711 (0.0000) ***
MC	0.000177 (0.0018) ***
R-squared	0.936649
Adjusted R-squared	0.932824
Prob(F-statistic)	0.000000

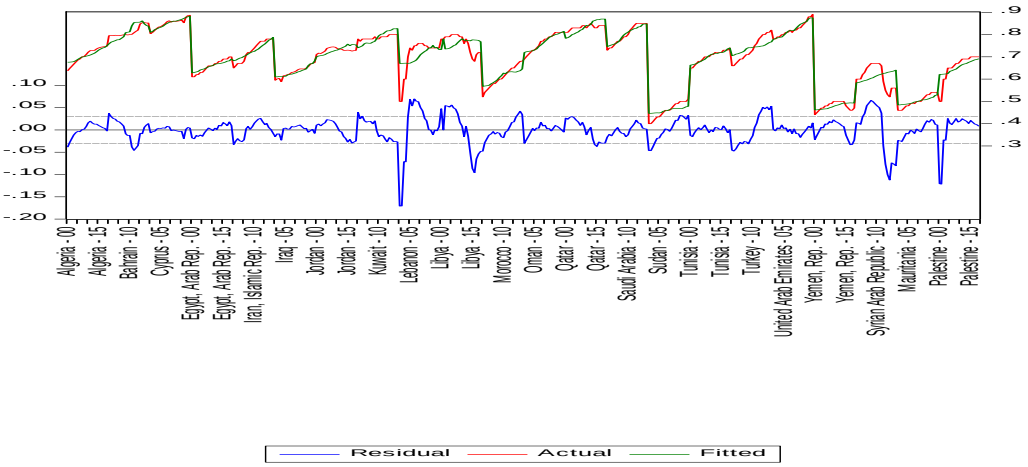
Source: Prepared by the researcher based on the results of eviews 10

After we concluded that the fixed effects model is the appropriate model, we can write it as follows:

PV = 0.6444+ 0.0007*FB + 0.0008*FT + 0.0007*INT + 0.0001*MC .

Through the results of the model parameters estimated by the fixed effects model, the model is significant because the F-statistic value is 0.00000.

Fig.(01): Graphic representation of current and estimated values



Source: eviews 10 results

Table (8): Persistent effects of countries

	COUNTRY	Effect
1	Algeria	0.025789
2	Bahrain	0.081422
3	Cyprus	0.094340
4	Egypt, Arab Rep.	-0.024644

5	Iran, Islamic Rep.	0.024555
6	Iraq	-0.037007
7	Jordan	0.041879
8	Kuwait	0.067306
9	Lebanon	0.004353
10	Libya	0.077512
11	Morocco	-0.082995
12	Oman	0.063045
13	Qatar	0.108314
14	Saudi Arabia	0.086444
15	Sudan	-0.199202
16	Tunisia	0.007348
17	Turkey	0.028387
18	United Arab Emirates	0.080652
19	Yemen, Rep.	-0.184594
20	Syrian Arab Republic	-0.069573
21	Mauritania	-0.161542
22	Palestine	-0.031793

Source: eviews 10 results.

Through the table shown above, we note the difference in the impact from one country to another. Most of the countries had a positive impact, while the countries that had a negative impact were (Egypt, Iraq, Morocco, Sudan, Yemen, Syria, Mauritania), and Qatar recorded the largest value in the impact with 0.108314, Then Cyprus was followed by 0.094340, and Sudan and Yemen recorded the lowest values in the effect with -0.199202, -0.184594, respectively.

Ⅲ-6Interpretation of model estimation results with a fixed effects model

The fixed effects model is statistically significant because the probability value is less than 5%, which is 0.0000.

The R-squared value is 93%, which indicates the ability of the independent variables to explain the dependent variable.

All independent variables are statistically significant because their probability value is less than 5%.

There is a positive and weak effect of all the independent variables on the poverty rate in the countries under study, that is, there is a direct relationship between the variables of information and communication technology and the poverty rate. The economic theory because the greater the use of information and communication technology led to a decrease in poverty rates, and this explains that these countries are still very far in the technological field due to the political conditions and civil wars in some Arab countries.

Ⅳ-Conclusion

In this study, we have tried to show the impact of technological indicators on the poverty rate during the period 2000-2019 in 22 MENA countries, where we first presented some previous studies that examined the relationship between information and communication technology and poverty. poverty.

As for our study, we conducted a standard study using panel data, through the impact of technological indicators on the poverty rate in the countries under study. On the poverty rate in these countries, that is, there is a direct relationship. The greater the use and ownership of information and communication technology, the higher the poverty rate, but very slightly, not exceeding 1%.

We can explain this negative impact of technological indicators on the poverty rate in these countries under study, to the delay of these countries in the technological field, except for the Gulf countries, which have become leaders in this field, with the large population growth in some countries such as Egypt and the high number of poor in some countries such as Yemen and Sudan, which It was an obstacle to the use of information and communication technology, in addition to the tense political situation and the increase in civil wars since the millennium, such as Iraq, Syria, Lebanon, Sudan and Yemen, which led to the delay of these countries in the technological field and the increase in the number of the poor and migration to European countries, and in light of these results we can reject the first hypothesis "Technological indicators have a positive impact on the poverty rate," and the second hypothesis was accepted "technological indicators have a strong correlation with the poverty rate in the countries under study." All technological indicators had a strong correlation with the poverty rate, and in light of that we can make the following suggestions:

-Investing in research and development and increasing its expenditures.

-Creating a competitive market in the technological field in order to reduce costs and attract foreign direct investment.

- Attempting to connect the technology in order for the technological means to reach the remote and poor areas.

-Providing support in the technological, health, educational and agricultural fields for vulnerable and poor groups.

-Combating illiteracy through various educational programs in order to be able to use the latest available technological means.

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