METHODOLOGICAL APPROACHES TO DIGITALIZATION ASSESSMENT AND POSSIBILITIES OF THEIR APPLICATION IN RA[1]

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Introduction. Nowadays digital technologies are one of the most important components of the development of the national economy. In recent years, many countries around world have started taking measures for the digital transformation of the economy. Digital transformation is a process of integration of information and communication technologies (ICT) in the economic system of the country, which implies the implementation of qualitative changes based on the use of innovation technologies.

The transition to a digital economy is a policy priority for all countries, but it is crucial for developing countries. For the latter, it creates both new challenges and opportunities. Digital transformation can create new markets, such as digital applications tailored to specific spheres, in areas such as agriculture, education, and healthcare. Digitalization has provided an opportunity to implement new business models for entrepreneurs and SMEs in developing countries. The relevance of this article lies in the fact that RA is among such countries, where the digital economy is one of the country's policy priorities.

The purpose of the article is to study the different approaches of digitalization assessment methodology, indicators, and indices and evaluate their localization possibilities in RA.

Following tasks were set in the scope of the article:

1. To study the existing indicators of the digitalization of the RA economy,

2. To analyze the methodological approaches of digitalization assessment,

3. To assess the possibilities of localization of methodological approaches of digitalization assessment in RA.

Methodology. The studies of foreign and domestic authors, legal acts and sectorial strategies were the information bases of the article. Logical, comparative, statistical and analytical methods were used in the scope of the research.

Literature review. Nowadays the countries that provide high rates development in the global economy are those that use digital technologies and provide the economy

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with digital resources[1]. All the countries around the world are facing the concept of the "Digital Economy" today. Currently, Norway, Switzerland, Denmark, South Korea, and several other countries are the leaders in this field[2].

There are many and various definitions and interpretations of the digital economy. Perhaps one of the simplest definitions of it was given by Vladimir Ivanov, Doctor of Economic Sciences, and Corresponding Member of the Russian Academy of Sciences, who defines the digital economy as follows: "The digital economy is a virtual environment that complements our reality[3].

Digital transformation, artificial intelligence, and other related technologies are enabling businesses to increase profitability and the quality of customer service. This process is characterized as a new direction of intervention in the DNA of businesses[4].

The important tools in the age of digital technologies are ICT, biotechnology, nanotechnology, and cognitive science, the interaction of which is collectively called the NBIC (N-nano; B-bio; I-info; C-cogno) convergence. The term was coined in 2002 by Michael Rocco and William Bainbridge[5].

Analyses. The modern achievements of science and the continuous upgrading of technology create additional opportunities and challenges for all areas of livelihood. As a result, the principles and rules of the market as well as the whole economy are radically changed. The basis and driving force of these changes is digitalization. The core of the digitalization of the economy is the investment and intensive penetration of ICT in all sectors of the economy.

The concept of "Digitalization" implies a new phase in the management of the production of goods and services and the improvement of these processes, based on the application of modern ICT: from the Internet of Things to electronic management technologies[6].

According to various estimates, digital transformation brings huge changes in various fields. This is due to the fact that information technologies and platforms

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[1] Mamleeva E.R., Sazykina M.Yu., Trofimova N.V., Development of the digital economy in the Republic of Bashkortostan, Creative Economics Publishing House, 2018, Number 10, Volume 12, p. 1629

[2] Panova O.G. Ryazanova G.N. Ivanova M.A. Digital economy: new opportunities and threats, Step into the future: artificial intelligence and the digital economy. Revolution in management: a new digital economy or a new world of machines [Text]: materials of the II International Scientific Forum. Vol. 4 / State University of Management. – M.: State University Publishing House, 2018. – 478 p., p. 360

[3] Same place.

[4] Working Papers "Realizing Digital Potential in North and Central Asia", North and Central Asia Sub-Regional Office, 2020, p. 4

[5] Margaryan A., Innovative drivers of digital transformation of the economy, Step into the future: artificial intelligence and digital economy. Revolution in management: a new digital economy or a new world of machines: materials of the II International Scientific Forum. Vol. 4 / State University of Management. – M.: State University Publishing House, 2018. – 478 p., Page 179

[6] Savina T.N. Digital economy as a new development paradigm: challenges, opportunities and prospects // Finance and Credit. - 2018. - T. 24, No. 3. - P. 582.

fundamentally change business models, increasing their efficiency. According to World Bank experts, a 10% increase in the number of high-speed Internet users can increase the annual GDP growth rate from 0.4% to 1.4%. The importance of the role of the digital economy is evidenced by the annual growth of its share in the GDP. In developed countries, this figure is 7% on average. In 2010, the Boston Consulting Group estimated the amount of digitalization for the group of 20 countries at $2.3 trillion, or about 4.1% of their GDP. According to various forecasts, with the current continuous growth rates the share of digitalization in the global GDP will reach 30-40% in 10-15 years.

The share of ICT workers in developing countries is about 1% of the total workforce. The percentage of workers in this field is small compared to other fields, but it should be noted that due to the development of high technologies, jobs in other fields are also increasing with 4.9:1 ratio[1].

The speed of implementation of digitalization processes and the intensity of digital transformations in each country depends on a number of infrastructural prerequisites, which are evaluated by internationally calculated indexes. Among such indices are Digital Adoption Index (DAI) and Digital Quality of Life Index (DQL). The DAI is a worldwide index that measures countries' digital adoption across three dimensions of the economy:

- people,
- government,
- business.

The index covers 180 countries on a 0–1 scale, and emphasizes the "supply-side" of digital adoption to maximize coverage and simplify theoretical linkages. The overall DAI is the simple average of three sub-indexes. Each sub-index comprises technologies necessary for the respective agent to promote development in the digital era: increasing productivity and accelerating broad-based growth for business, expanding opportunities and improving welfare for people, and increasing the efficiency and accountability of service delivery for government[2].

The DAI index was last calculated by the World Bank in 2016. According to these data, Armenia is 60th among 183 countries, the value of the index was 0.62[3].

The DQL represents the study on the digital wellbeing across 121 countries (92% of the global population). The study indexes each country according to five pillars that impact a population's digital quality of life:

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[1] Same place, page 584.

[2] Sargsyan, H., Gevorgyan, R., and others, The problems of forming the institutional system of digital transformations of the RA economy, -Yerevan, YSU Publishing House, 2020. – page 35., Source: http://publishing.ysu.am/files/Tvaynatsum.pdf

[3] Source: https://www.worldbank.org/en/publication/wdr2016/Digital-Adoption-Index, last accessed 22.09.2023:

1. Internet affordability,
2. Internet quality,
3. Electronic infrastructure,
4. Electronic security
5. Electronic government[1]:

Table 1 shows the values of the DQL and its 5 pillars for a group of CIS and other countries.

Subscales of the Digital Quality of Life Index[2]

Country	Internet access	Internet quality	El. Infrastructure	El. Government	El. security
Poland	0,08	0,14	0,15	0,18	0,17
Estonia	0,01	0,15	0,18	0,19	0,17
Lithuania	0,01	0,15	0,17	0,19	0,15
Slovenia	0,05	0,15	0,16	0,17	0,15
Bulgaria	0,05	0,15	0,13	0,17	0,14
Latvia	0,02	0,15	0,17	0,17	0,14
Slovakia	0,01	0,14	0,16	0,17	0,14
Czech Republic	0,01	0,15	0,15	0,16	0,14
Croatia	0,01	0,14	0,13	0,18	0,13
Rumania	0,01	0,14	0,14	0,16	0,13
Azerbaijan	0,09	0,12	0,14	0,09	0,13
Russia	0,01	0,12	0,16	0,10	0,17
Kazakhstan	0,01	0,12	0,15	0,10	0,14
Serbia	0,01	0,14	0,13	0,10	0,13
Montenegro	0,01	0,14	0,14	0,10	0,12
Georgia	0,01	0,12	0,13	0,13	0,12
Ukraine	0,01	0,12	0,11	0,11	0,11
Armenia	0,01	0,13	0,14	0,09	0,11

The indicators of the table show that Armenia's position in the fields of Internet access, e-governance, and e-security is the most vulnerable. The situation is relatively favorable in terms of Internet quality and e-infrastructure.

In recent years, the number of Internet users has been growing steadily; currently exceeding half of the planet's population or about 4 billion people. However this indicator has significant differences depending on the level of development of the countries. The share of Internet users among population is 86.7% in developed countries, 44.4% in

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[1] Source: https://surfshark.com/dql2023, last accessed 22.09.2023:

[2] Sargsyan, H., Gevorgyan, R., and others, The problems of forming the institutional system of digital transformations of the RA economy, -Yerevan, YSU Publishing House, 2020. - page 62., Source: http://publishing.ysu.am/files/Tvaynatsum.pdf

developing countries, and 19.5% in underdeveloped countries. According to 2018 data in RA, 68.2% of the population uses the Internet, and this value is quite low[1].

In summary, we can say that the digitalization processes in the RA are still in the developing stage, the size of the digital economy is still limited, the policy measures and strategies announced for many years have not provided sufficient, tangible results, and RA ranks below average among comparable countries.

The state of digitalization and digital literacy of different strata of the population is described through various indicators, such as the number of Internet users, or the level of ownership of PCs in households. However, these simple indicators are not sufficient to evaluate the different perspectives on digital literacy and digital skills. In the convergence of many indicators characterizing the digital economy, it is mandatory to have such indicators that refer to the assessment of the digitalization of individuals. A methodology for calculating such an indicator was developed in Korea. For this purpose, researchers from Korea's National Information Society Agency, experts in the field, as well as professors from Korea University jointly developed the Personal Informatization Index (PII) using the Delphi research method[2]. This unique indicator is calculated on the basis of data collected as a result of surveys conducted among the population. 37 different indicators are used in the calculation of the index The PII is composed of 37 different indicators (Table 2): during the survey, individuals evaluate themselves and the state of their digitalization using those 37 indicators, evaluating each indicator with a 4-point Likert scale, where 4 corresponds to strongly agree, and 0- strongly disagree. Those 37 indicators are grouped into 3 components:

1. Personal access opportunity to digital devices,
2. Personal capacity to use computer hardware and software,
3. Personal usage of digital devices for livelihood activities.

Each indicator that makes up the PII is given a certain weight, that weight is multiplied by the score obtained during the survey, and at the end, all the products obtained by the simple sum formula are added and the given individuals receives the value of their PII. The high value of the PII indicates that "informatization level" of the given individual is high. The PII is a rather telling methodological tool for assessing the digital penetration level, digital literacy and other digital characteristics of population in RA. The calculation of the PII is quite simple; moreover, this index is multi-layered and summarizes different aspects of the individual's informatization. Indicators (Table 2)

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[1] Sargsyan, H., Gevorgyan, R., and others, The problems of forming the institutional system of digital transformations of the RA economy, -Yerevan, YSU Publishing House, 2020. – page 64, Source: http://publishing.ysu.am/files/Tvaynatsum.pdf .

[2] Heungsuk Choi, Korean Personal informatization indices (KPII) and its Policy Implications, 2010, Source: https://unstats.un.org/unsd/economic_stat/ICT-Korea/Documents/3.6_Choi_Korea.pdf, last accessed 19.09.2023:

that compose the PII can be easily localized in RA. The only difficulty in calculating the PII is related to the obtaining data from surveys and formation of information base.

<div align="right">Table 2</div>

<div align="center">The composition of Personal Informatization Index (PII)[1]</div>

	The definition of indicator	Weight
1	Ease of access to computers or networks when needed	0,100
2	Capacity of the computer to store file storage	0,020
3	Internet access speed	0,060
4	Ownership of computer peripherals such as printer or scanner (%)	0,020
5	Installing, deleting, updating the necessary programs on computer	0,057
6	Connecting a variety of external devices to computer	0,057
7	Making reports using Word, Excel, and PowerPoint programs	0,057
8	Connecting computer to a wireless or wired Internet and using it	0,057
9	Transferring files from computer to others using the Internet	0,057
10	Scanning and repairing malware on computer	0,057
11	Setting preferences in a web browser	0,057
12	Degree of utilizing Internet service within the last 1 month	0,160
13	Internet search activities for news within last year	0,018
14	Internet search activities for e-mail within last year	0,018
15	Internet search activities for media content within last year	0,018
16	Internet search activities for education content within last year	0,018
17	Internet search activities for SNS within last year	0,018
18	Internet search activities for Messenger within last year	0,018
19	Internet search activities for personal blogs within last year	0,018
20	Internet search activities for internet café, club, etc. within last year	0,018
21	Internet search activities for cloud service within last year	0,018
22	Internet utilization for traffic information over the last year	0,005
23	Internet utilization for online shopping over the last year	0,005
24	Internet utilization for financial services over the last year	0,005
25	Internet utilization for administrative service over the last year	0,005
26	Internet utilization for welfare service over the last year	0,005
27	Online posting content such as news over the last year	0,005
28	Sharing the link of the contents posted online over the last year	0,005
29	Staying in touch with people known online over the last year	0,005
30	Communicating with new people online over the last year	0,005
31	Expressing opinion about social issues online over the last year	0,005

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[1] Geumhwan Ko, Jayant K. Routray & M. M Ahmad (2018): ICT infrastructure for rural community sustainability, Community Development, DOI: 10.1080/15575330.2018.1557720

32	Submitting policy proposals online over the last year	0,005
33	Donating or volunteering for community online over the last year	0,005
34	Online voting or polls over the last year	0,005
35	Internet search for getting job over the last year	0,005
36	Internet search for increasing income over the last year	0,005
37	Internet search for reducing costs over the last year	0,005

The calculation of the PII can be used to characterize various aspects of digitalization. For example, in the Korea, the PII was calculated to evaluate the effectiveness of the community development policy of rural areas. In particular, surveys were carried out in two types of rural areas: areas where state support programs were applied, and areas where they did not. The calculation of the PII was the basis for comparison of these two types of rural areas. In the same way, the calculation of the PII on the example of RA can serve as a basis for comparing the different regions of the RA and finding out the state of their digital divide, or comparing the state of digitalization of rural and urban areas and highlighting the determinants that condition the existing differences.

Scientific novelty. The scientific novelty of this article lies in the fact that by studying various indicators of digitalization in RA, as well as by researching the foreign experience of methodological approaches to digitalization assessment, a methodological approach was singled out, which has possibilities of localization in RA and can serve as a methodological basis for assessment of digitalization and characterization of its various manifestations in RA.

Conclusions. The analyses of the digital transformation of the economy, and the study of digitalization processes in RA, led to the following conclusions:
- The transition into a digital economy is an important policy priority for all countries, but it is even more crucial for developing countries, where digital transformation creates new challenges and opportunities.
- Digitalization processes in the Republic of Armenia are still at the developing stage, the size of the digital economy is still limited, the policy measures and strategies have not provided sufficient, tangible results and RA ranks below average among comparable countries.
- On the basis of the methodological analysis carried out for the assessment of digital literacy of different groups of the population, it became clear that we can calculate the Personal Informatization Index (PII) based on 37 indicators. The latter allows us to assess the digital literacy of a person. It is recommended to assess the

effectiveness of the rural development policies and measures by calculating the index and using the results for comparisons between target groups.

References

1. Geumhwan Ko, Jayant K. Routray & M. M Ahmad (2018): ICT infrastructure for rural community sustainability, Community Development, DOI: 10.1080/15575330.2018.1557720
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3. Mamleeva E.R., Sazykina M.Yu., Trofimova N.V., Development of the digital economy in the Republic of Bashkortostan, Creative Economics Publishing House, 2018, Number 10, Volume 12,
4. Margaryan A., Innovative drivers of digital transformation of the economy, Step into the future: artificial intelligence and digital economy. Revolution in management: a new digital economy or a new world of machines: materials of the II International Scientific Forum. Vol. 4 / State University of Management. – M.: State University Publishing House, 2018. – 478 p.,
5. Panova O.G. Ryazanova G.N. Ivanova M.A. Digital economy: new opportunities and threats, Step into the future: artificial intelligence and the digital economy. Revolution in management: a new digital economy or a new world of machines [Text]: materials of the II International Scientific Forum. Vol. 4 / State University of Management. – M.: State University Publishing House, 2018. – 478 p.,
6. Sargsyan, H., Gevorgyan, R., and others, The problems of forming the institutional system of digital transformations of the RA economy, -Yerevan, YSU Publishing House, 2020.
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8. Working Papers "Realizing Digital Potential in North and Central Asia", North and Central Asia Sub-Regional Office, 2020,
9. https://surfshark.com/dql2023
10. https://www.worldbank.org/en/publication/wdr2016/Digital-Adoption-Index

ԹՎԱՅՆԱՑՄԱՆ ԳՆԱՀԱՏՄԱՆ ՄԵԹՈԴԱԲԱՆԱԿԱՆ ՄՈՏԵՑՈՒՄՆԵՐԸ ԵՎ ԴՐԱՆՑ ՏԵՂԱՅՆԱՑՄԱՆ ՀՆԱՐԱՎՈՐՈՒԹՅՈՒՆՆԵՐԸ ՀՀ-ՈՒՄ

Մերի Համբարձումի Մուրադյան
Հովհաննես Սիմոնի Ասատրյան

Համառոտագիր։ Թվային տնտեսության անցումը հանդիսանում է բոլոր երկրների տնտեսական զարգացման քաղաքականության առաջնահերթություններից մեկը, ընդ որում այն առանձնակի նշանակություն ունի զարգացող երկրների համար։ Վերջիններիս համար այն ստեղծում է նոր մարտահրավերներ ու հնարավորություններ։ Այն կարող է ստեղծել նոր շուկաներ, ինչպիսիք են որոշակի տեղական պայմաններին համապատասխանեցված թվային կիրառություններ, այնպիսի ոլորտներում, ինչպիսիք են՝ գյուղատնտեսությունը, կրթությունը, առողջապահությունը։ Թվայնացումը հնարավորություն է ընձեռել կիրառելու նոր բիզնես-մոդելներ զարգացող երկրների ձեռներեցների և փոքր ու միջին ձեռնարկությունների համար։ Այսպիսի երկրների շարքին է դասվում նաև Հայաստանը, որտեղ թվային տնտեսությունը հանդիսանում է երկրի քաղաքական առաջնահերթություններից մեկը։ Ինչով էլ պայմանավորված է սույն հոդվածի **արդիականությունը։ Հոդվածի նպատակն** է ուսումնասիրել թվայնացման գնահատման մեթոդաբանությունների, ցուցանիշների, ինդեքսների տարբեր մոտեցումները և գնահատել դրանց տեղայնացման հնարավորությունները ՀՀ-ում։ Ուստի **խնդիր է** դրվել.
1. Ուսումնասիրել ՀՀ տնտեսության թվայնացման վիճակի առկա ցուցանիշներ,
2. Վերլուծել թվայնացման գնահատման մեթոդաբանական մոտեցումները,
3. Գնահատել թվայնացման վիճակը բնութագրող մեթոդաբանական մոտեցումների տեղայնացման հնարավորությունները ՀՀ-ում:

Գիտական նորույթ։ Հոդվածի գիտական նորույթը կայանում է նրանում, որ առանձնացվել է թվայնացման գնահատման մեթոդաբանություն, որն ունի ՀՀ-ում տեղայնացման հնարավորություններ և կարող է ծառայել որպես մեթոդաբանական հիմք ՀՀ-ում թվայնացման տարբեր դրսևորումների գնահատման ու բնութագրման համար։ Բնակչության տարբեր խմբերի թվային գրագիտության գնահատման մեթոդաբանական մոտեցումների վերլուծության հիման վրա պարզ դարձավ, որ կարելի է հաշվարկել Անձնական ինֆորմատիզացիայի ինդեքսը (PII), որը բաղկացած է 37 տարբեր ցուցանիշներից։ PII-ը թույլ է տալիս գնահատել անհատի թվային գրագիտությունը, այդ իսկ պատճառով առաջարկվում է օգտագործել այս ցուցանիշը գյուղական համայնքների զարգացմանն ուղղված քաղաքականությունների և միջոցառումների արդյունավետության գնահատման համար։

Բանալի բառեր. թվային տնտեսություն, թվայնացման գնահատում, Կյանքի որակի թվային համաթիվ, Թվային ներդրման համաթիվ, Անհատական ինֆորմա-

тիզացիայի ինդեքս (ԱԻԻ), Տեղեկատվական հեռահաղորդակցության տեխնոլո֊
գիաներ (ՏՀՏ), զարգացման քաղաքականություն, համացանց, ՀՀ.

МЕТОДОЛОГИЧЕСКИЕ ПОДХОДЫ К ОЦЕНКЕ ЦИФРОВИЗАЦИИ И ВОЗМОЖНОСТИ ИХ ЛОКАЛИЗАЦИИ В РА

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Аннотация. Переход к цифровой экономике является приоритетом политики для всех стран, но он имеет особое значение для развивающихся стран. Для последних это создает как новые проблемы, так и возможности. Цифровая трансформация может создать новые рынки, такие как цифровые приложения, адаптированные к конкретным сферам, в таких областях, как сельское хозяйство, образование и здравоохранение. Цифровизация предоставила возможность реализовать новые бизнес-модели для предпринимателей и МСП в развивающихся странах. **Актуальность** данной статьи заключается в том, что РА входит в число таких стран, где цифровая экономика является одним из приоритетов политики страны.

Цель статьи – изучить различные подходы к методологии, индикаторам и индексам оценки цифровизации и оценить возможности их локализации в РА. В рамках статьи были поставлены следующие **задачи**:

1. Изучить существующие показатели цифровизации экономики РА.
2. Проанализировать методические подходы оценки цифровизации.
3. Оценить возможности локализации методических подходов оценки цифровизации в РА.

Научная новизна статьи заключается в том, что выделен методический подход, который имеет возможности локализации в РА и может служить методологической основой для оценки цифровизации и характеристики различных ее проявлений в РА. На основе методического анализа, проведенного для оценки цифровой грамотности различных групп населения, стало ясно, что можно рассчитать Индекс Личностной Информатизации (PII), который состоит из 37 различных показателей. PII позволяет оценить цифровую грамотность человека, поэтому рекомендуется оценивать эффективность политики и мер развития сельских территорий путем расчета индекса.

Ключевые слова: цифровая экономика, оценка цифровизации, Индекс цифрового качества жизни (DQL), Индекс внедрения цифровых технологий (DAI), Индекс информатизации личности (PII), Информационно-коммуникационные технологии (ИКТ), политика развития, Интернет, РА.

METHODOLOGICAL APPROACHES TO DIGITALIZATION ASSESSMENT AND POSSIBILITIES OF THEIR APPLICATION IN RA

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Abstract. The transition to a digital economy is a policy priority for all countries, but it is crucial for developing countries. For the latter, it creates both new challenges and opportunities. Digital transformation can create new markets, such as digital applications tailored to specific spheres, in areas such as agriculture, education, and healthcare. Digitalization has provided an opportunity to implement new business models for entrepreneurs and SMEs in developing countries. The relevance of this article lies in the fact that RA is among such countries, where the digital economy is one of the country's policy priorities.

The purpose of the article is to study the different approaches of digitalization assessment methodology, indicators, and indices and evaluate their localization possibilities in RA. Following tasks were set in the scope of the article:
1. To study the existing indicators of the digitalization of the RA economy,
2. To analyze the methodological approaches of digitalization assessment,
3. To assess the possibilities of localization of methodological approaches of digitalization assessment in RA.

The scientific novelty of this article lies in the fact a methodological approach was singled out, which has possibilities of localization in RA and can serve as a methodological basis for assessment of digitalization and characterization of its various manifestations in RA. Based on the methodological analysis carried out for the assessment of digital literacy of different groups of the population, it became clear that the Personal Informatization Index (PII) can be calculated which is composed by 37 different indicators. The PII allows us to assess the digital literacy of a person that is why it is recommended to assess the effectiveness of the rural development policies and measures by calculating the index.

Keywords: digital economy, digitalization assessment, Digital Quality of Life Index (DQL), Digital Adoption Index (DAI), Personal Informatization Index (PII), Information Communication Technologies (ICT), development policy, internet, RA.