

Digitalization Requirements and their Impact on Enhancing Public Health Services: A Case Study of Public Hospital Institutions

MAGBI Mimouna

¹Blida2 University (Algeria), Laboratory for the management of local communities and their role in achieving development, m.magbi.etu@univ-blida2.dz

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Abstract:

This study examined the impact of digitalization requirements on enhancing public health services, focusing on the “Mohamed Boudiaf” public hospital in Medea. The study highlighted the growing importance of digitalization in improving healthcare efficiency and accessibility. The study aimed to identify essential digitalization requirements and evaluate their role in improving service delivery.

A questionnaire was conducted targeting administrative employees to gather data on the availability and implementation of digital tools and systems. The data were analyzed using statistical techniques such as Pearson correlation and Simple linear regression in R software. Results showed a strong positive correlation ($r = 0.899$) between the availability of digitalization requirements and the improvement of health services. Moreover, the findings underscore the critical role of providing essential digitalization infrastructure to enhance public health service quality and operational efficiency.

This study contributed to understanding how digitalization drives improved healthcare outcomes and highlights the necessity of investing in digitalization to ensure sustainable health sector development.

Keywords: Digitalization; Digitalization requirements; Public health; Health services; survey.

1. INTRODUCTION

During the age of digital advancement, there has been a significant worldwide shift towards utilizing technology to enhance public services. A crucial part of this transformative process is the widespread adoption of digitalization, which plays a pivotal role in providing easy access to information and services through dedicated digital infrastructures. Algeria, among other countries, has recognized the immense potential of digitizing its health sector to strengthen the delivery of public health services. By providing digitalization requirements, healthcare institutions can offer more efficient and accurate care, addressing longstanding challenges such as lengthy waiting lists and suboptimal service quality. This strategic focus on digitalization aligns with the current global trend of using digital technologies to revolutionize public services.

❖ Study Problem

From the preceding, our related question here is:

What is the effect of digitalization requirements on improving public health services?

Several Sub-questions include the following:

- Is there a correlation between the availability of digitalization requirements and improving public health services?
- Is there a statistically significant effect of digitalization requirements and improving public health services?

❖ Study Hypotheses:

In response to the raised questions, the study's hypotheses can be formulated as follows:

- H1: There is a significant correlation between the requirements of digitalization and the improvement of public health services.
- H2: There is a statistically significant effect of digitalization requirements and improving public health services.

❖ Study Objective

The study aims to achieve the following objectives:

- Presenting a theoretical framework for digitalization and public health services.

- Examining whether digitalization requirements are available at Mohammed Boudiaf Hospital as a public hospital institution in Medea.
- Assessing the quality of health services provided by Mohamed Boudiaf Hospital in Medea.
- Investigate how digitalization can enhance the health services provided at Mohamed Boudiaf Hospital.

❖ **Methodology of research:**

To achieve the stated objectives and deal with the study's problem, we have relied on an analytical and descriptive approach, using books and articles that interest us and data analysis with statistical analysis using R.

Sample:

Due to the expected difficulty in collecting data, a small sample was selected. Therefore, the study focused on the 93 administrative staff members at Medea's public hospital, Mohamed Boudiaf. Steven K. Thompson's equation was used to calculate the study sample, which consisted of 50 administrative employees distributed among various departments and main and sub-units in the public hospital. After 50 surveys were distributed, 40 were retrieved, meaning there was an 80% response rate. The study's results were based on 35 surveys after five were removed because they were invalid for analysis.

Method and tools:

We designed a survey (a questionnaire) to examine the correlation between digitalization requirements and improving public health services. The questionnaire was distributed to the administrative employees and was structured around two main axes. The first axe focused on the participants' opinions regarding the availability of digitalization requirements. The second axe focused on how these requirements affect the improvement of public health services. We measured these aspects using a 5-point Likert scale, with responses ranging from 1 (strongly disagree) to 5 (strongly agree).

2. Conceptual framework of digitalization:

Digitalization is the most significant technological trend transforming society and business.

2.1. Definitions of digitalization:

The literature on digitalization lacks a clear definition of the term. This may be due to the interchangeable use of terms like digitalization, digitization, and digitation. These terms are often used without clear distinctions, leading to confusion. There are approximately 571,000 hits for "digitization" and 221,000 hits for "digitalization" on Google Scholar, highlighting the need for precise definitions. Digitization refers to the process of converting analogue data (such as images, video, and text) into digital format. On the other hand, digitalization refers to the adoption and increased use of digital technology by organizations, industries, and countries (Gorensek & Kohont, 2019, pp. 94-95). Digitalization is also defined as the way many domains of social life are restructured around digital communication and media infrastructures. In simple terms, digitalization may be defined as using digital technologies (Srai & Lorentz, 2018, p. 79). Based on the previous definitions, digitalization can be defined as transforming all traditional administrative tasks and services into electronic operations and services executed rapidly and with high accuracy, utilizing the available capabilities.

2.2. Requirements of digitalization:

Digitalization involves several critical requirements that organizations must address to transition into the digital age successfully. According to Rabhi and Lakhal (2016, p. 243), these requirements include digital skills and talent, hardware, networks, and software. A skilled workforce is essential for effectively implementing digitalization strategies. Organizations should focus on hiring or upskilling employees with data analytics, artificial intelligence, cloud computing, and digital marketing expertise. Furthermore, acquiring advanced hardware, including physical components such as computers, systems, and peripherals, is crucial. Institutions should invest in state-of-the-art hardware to support cost-effective and continuous development while ensuring compatibility with

evolving software technologies. Networks also play a vital role in digitalization, serving as the backbone through infrastructures like the Internet, Extranet, and Intranet. Finally, software drives digital systems, consisting of programming languages, application systems, data programs, and auditing tools. These software components enable organizations to fully leverage the potential of their computer systems and optimize their digital capabilities.

3. The concept of public health services:

Globally, healthcare systems establish a vital foundation for promoting well-being and ensuring access to medical services across all communities.

3.1. Definitions of health services:

Health services or medical care refers "to the services provided by healthcare organizations, such as services related to diagnosis, treatment, social and psychological rehabilitation, provided by specialized therapeutic and supporting medical departments. This includes medical services, emergency care, outpatient clinics, radiology, ambulance services, nursing, and pharmaceutical and nutritional services". (Kortel & Boulasbaa, 2013, pp. 246-247). Health services also defined as medical services; refer "to a set of functions that work towards directly satisfying human needs related to survival and well-being. These services are interconnected with other functions of society, such as economic, educational, and social functions, albeit indirectly. They provide individuals with the ability to adapt to their environment by supporting their environmental and psychological capabilities, enabling them to achieve the desired performance"(Al-Dabbagh,, 2007, p. 108). We define health services as services encompassing a variety of activities aimed at promoting, maintaining, and restoring health, as well as preventing and treating illness.

3.2. Characteristics of health services:

Health services are defined by several key features that influence how they are provided and experienced. Makid and Ben Ayad (2016, p. 11) state that these features include personalization, accessibility and availability, time sensitivity, integration, continuity, and governance by laws and regulations. Personalization refers to healthcare services' ability to meet

each patient's unique needs through direct interactions with healthcare providers, emphasizing individualized care and treatment. Accessibility and availability highlight the importance of universal access to healthcare, ensuring that people can obtain services regardless of their socioeconomic status or geographic location. This includes efforts to distribute resources and services equitably. The time-sensitive nature of healthcare emphasizes the necessity for prompt intervention, as delays in addressing urgent medical conditions can lead to severe complications. Integration points to the interconnectedness of various healthcare components, such as screening, diagnosis, treatment, and prevention, collectively contributing to comprehensive care. Continuity of care is vital for fostering long-term relationships between patients and providers and managing chronic conditions through follow-up visits and ongoing support. Lastly, healthcare services operate within legal frameworks established by government laws and regulations, ensuring compliance and oversight across public and private institutions.

These characteristics highlight the significance of delivering patient-centered, universally accessible, timely, coordinated, consistent, and law-governed healthcare.

4. Analysis of the results:

The data will be summarized, analyzed, and interpreted, followed by a validation test of the hypotheses.

4.1. Results:

The study's analysis will begin by validating and assessing the survey's reliability. Followed by the examination of demographic variables and concluded by presenting inferential statistical results.

4.1.1. The validity and reliability of the survey:

❖ The survey's validity:

To check the consistency of the survey paragraphs with their respective sections, the internal consistency validity was evaluated by examining the correlation coefficients between each paragraph and the total score of its section. Then, the survey's construct validity was assessed by analyzing the correlation coefficient between each section and the total score of its paragraphs. The results are presented in the tables below.

Table No. (1) Internal validity of the first axis items

		Items	Correlation Coefficient	Probability Value
The availability of hardware	T1	Modern computer devices are available in the hospital	0.697	0.000
	T2	The hospital regularly maintains computer devices, equipment, and related components	0.664	0.000
	T3	The number of devices available in the hospital is sufficient to provide services	0.643	0.000
Networks	N2	The hospital possesses an internal network that facilitates the exchange of up-to-date information among the staff	0.568	0.000
	N2	The hospital where you work shares information with other hospitals through an external network	0.776	0.000
	N2	There is a high-speed internet flow available in the hospital	0.809	0.000
Software	S1	The facility of operation and use characterizes the software used in the hospital	0.772	0.000
	S2	The software used is constantly updated to keep up with technological advancements	0.835	0.000
	S3	Specialized software is available in the hospital for managing patient records and employee files	0.674	0.000
Digital Skills and Talent	D1	In your opinion, the hospital staff are capable and qualified to implement digitalization	0.652	0.000
	D2	The staff is trained regularly to enhance their proficiency in modern digital devices and equipment	0.722	0.000
	D3	The hospital has qualified IT	0.809	0.000

		technicians who can promptly address any technical issues that may arise		
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Source: outputs of statistical analysis using R

The table above shows that all items on the first axis are statistically significant, with a statistical value of less than 0.05. This confirms a strong correlation between the paragraphs of the first axis and the axis itself.

Table No. (2) Internal validity of the first axis with its dimension

Dimension	Correlation Coefficient	Probability Value
The availability of hardware	0.871	0.000
Networks	0.884	0.000
Software	0.916	0.000
Digital Skills and Talent	0.413	0.000

Source: outputs of statistical analysis using R

The table above clearly shows that all dimensions on the first axis are statistically significant, with a p-value of less than 0.05. This confirms a strong correlation between the dimension of the first axis and the axis itself.

Table No. (3) Validity of the second-axis items

	Items	Correlation Coefficient	Probability Value
Q1	Digital services implemented in hospital reduce the time required to complete the requested services.	0.721	0.000
Q2	Digital services implemented in hospital help save effort and resources.	0.809	0.000
Q3	Digital services in hospitals aim to simplify procedures and workflows.	0.502	0.000
Q4	The reliability of digital services in hospital is commendable	0.928	0.000
Q5	Digital hospital services enhance accuracy and minimize errors	0.896	0.000
Q6	Digital services reduce the need for patients to visit the hospital to access them physically	0.757	0.000

Q7	Digital services implemented in hospitals are known for their transparency	0.683	0.000
Q8	Digital services minimize the risks associated with transactions that rely on paper.	0.392	0.000
Q9	Digital services implemented in hospitals provide high-quality care.	0.496	0.000
Q10	Digital services reduce daily operational costs, such as paper-based transactions, mail transport, and staffing needs.	0.542	0.000

Source: outputs of statistical analysis using R

The results presented in the previous table indicate that all items on the second axis are statistically significant, with p-values of less than 0.05. This confirms a strong correlation between the paragraphs of the second axis and the axis itself.

Table No. (4) The constructive validity of the survey

Axes	Correlation Coefficient	Probability Value
First axis: digitalization requirements	0.899	0.000
Second axis: Improving public health services	0.899	0.000

Source: outputs of statistical analysis using R

The table above indicates that the correlation coefficients are significant at 0.000, suggesting a strong correlation between the two axes of the survey and the overall average of its paragraphs. This implies that the survey, in its final form, is valid and that its paragraphs can effectively measure what they were intended to measure.

❖ **The reliability of the survey**

A measurement tool must be reliable and have internal and construct validity. The Cronbach's alpha coefficient was used to test reliability, and the results are displayed in the table below.

Table No. (5) Reliability Index using R

Survey's dimensions and axes	Number of items	Cronbach's alpha coefficient
1st axes digitalization	12 items	0.8705

requirements		
The availability of hardware	3 items	0.8921
Networks	3 items	0.8992
Software	3 items	0.8825
Digital skills and talent	3 items	0.9466
2 nd axes Improving public health services	10 items	0.8848
Total items of the survey	22items	0.9141

Source: outputs of statistical analysis using R

The previous table's results indicate that Cronbach's alpha coefficient value for all axes and dimensions varies from 0.882 to 0.946, and overall reliability is 0.914, confirming the study tool's strong reliability.

4.1.2. Analysis of personal and demographic characteristics

The demographic information of the sample follows a statistical distribution based on demographics such as gender, age, education, and experience, as presented in Table below. This information is crucial for understanding the characteristics of the study sample.

Table No. (6) Summary of demographic analysis

Gend er	%	Age	%	Educational level	%	Profession al Experienc e	%
Male	65.71	Less than 30	11.43	Medium	8.6	Less than 5 years	11.4
Femal e	34.29	Between 31 and 40	28.57	Secondary	37.1	Between 5 and 10	14.3
		Between 41 and 50	37.14	University	45.7	Between 11 and 20	34.3
		More than 50	22.86	Another level	8.6	More than 20	40.0

Source:outputs of statistical analysis using R

The table shows that most participants were male (65.71%), outnumbering female participants (34.29%). Most respondents were between 31 and 40 years old (37.14%). Most participants held a university degree and had significant professional experience of over 20 years. These

participant characteristics indicate that their answers are reliable and helpful for the analysis, confirming the survey's validity and reliability.

4.2. Testing the study hypotheses:

Through this element, we will attempt to test the various hypotheses related to the study and analyze the multiple results obtained from the applied tests.

4.2.1. Testing the first hypothesis:

The first hypothesis examines the correlation between digitalization requirements and the improvement of public health services, aiming to determine statistical significance:

- H0: There is no statistically significant correlation between digitalization requirements and improving public health services in Medea's public hospital 'Mohamed Boudiaf' at the significance level of 0.05.
- H1: There is a statistically significant correlation between digitalization requirements and improving public health services in Medea's public hospital 'Mohamed Boudiaf' at a significance level of 0.05.

To examine this hypothesis, the Pearson correlation coefficient was applied, and the findings are displayed in the table below:

Table No. (7) The test of the pearson correlation coefficient

digitalization requirements		
0.899	Pearson correlation coefficient	public health services improvement
0.000	p-value	

Source: outputs of statistical analysis using R

The data from the table shows a significant and positive correlation of 0.899 between the digitalization requirements (independent variable) and the improvement of public health services at Mohamed Boudiaf Public Hospital in Medea (dependent variable). This correlation is statistically significant at a level of less than 0.05.

As a result, we reject the null hypothesis and accept the alternative hypothesis, confirming the presence of a statistically significant correlation

between the availability of digitalization requirements and the enhancement of public health services.

4.2.2. Testing the second hypothesis:

The second hypothesis is the causal hypothesis because it addresses the extent of the impact of digitalization requirements on improving public health services in Medea's public hospital, 'Mohamed Boudiaf'. This hypothesis and its null hypothesis were formulated as follows:

- H0: There is no statistically significant effect of digitalization requirements on improving public health services in Medea's public hospital 'Mohamed Boudiaf' at the significance level of 0.05.
- H1: There is a statistically significant effect of digitalization requirements on improving public health services in Medea's public hospital 'Mohamed Boudiaf' at the significance level of 0.05.

To test this hypothesis, we conducted a simple linear regression, and the results are shown in the table below:

Table No. (8) The Simple linear regression of the effect of digitalization requirements on the level of public health services

Model	R	R-deux	R-deux Ajusté	F	p-value
1	0.947	0.803	0.809	140.318	0.000

Source:outputs of statistical analysis using R

Based on the table above, a robust positive correlation (0.947) exists between the independent variable “digitalization requirements” and the dependent variable “improving public health services”. The correlation coefficient squared is 0.803, indicating that digitalization requirements account for 80.3% of the impact on improving public health services at Medea's public hospital 'Mohamed Boudiaf'. The remaining 19.7% is attributed to other unaccounted factors in the study. As for measuring the overall significance of the model, the analysis of variance showed that the F value estimated at 140.318 is considered statistically significant, as the probability value was estimated at 0.000, which is less than 0.05. Therefore,

we say that the regression model is substantial, meaning that at least one of the regression coefficients is different from zero.

Hence, we reject the null hypothesis and accept the alternative hypothesis, confirming the statistically significant effect of digitalization requirements on improving public health services.

Table No. (9) Stepwise multiple linear regression result for the dimensions of digitalization requirements of entered into the equation to predict the impact of digitalization requirements on improving health services

Model	Contents of the model	B	Standard error	t value	P value
Model 1	The constant (Intercept)	0.963	0.446	2.156	0.039
	The availability of hardware	0.228	0.097	2.348	0.025
	Networks	0.102	0.073	1.383	0.176
	Software	0.336	0.091	3.673	0.000
	Digital Skills and Telnet	0.125	0.100	1.254	0.219

Source: outputs of statistical analysis using R

From the previous table, we note that the regression coefficient for the first model was 0.336 for software availability. This means that a one-unit increase in software availability leads to a 0.687 improvement in public health services, assuming the other variable, the availability of hardware, remains constant. In contrast, we find that each one-unit increase in the availability of hardware, considering the other variable, software availability, remains steady, resulting in a 0.228 improvement in public health services. The multiple stepwise linear regression equation can be written as follows:

$$(Y = 0.963 + 0.336X_1 + 0.228X_2)$$

Level of public health services = 0.963 + 0,695 Use of the Software and 0.228 of the availability of hardware.

5. Conclusion:

This study examined the correlation and impact of digitalization requirements on the improvement of public health services at Mohammed Boudiaf Public Hospital in Medea. It combined a theoretical framework that

reviewed relevant literature and key digitalization concepts with the principles of public health services in public institutions. Additionally, a practical analysis was conducted through a survey of 35 administrative employees in 2024. The survey data were analyzed using R, confirming the validity and reliability of the study tools through various statistical tests.

The internal validity of the constructs and the overall construct validity were found to be statistically significant, with a Cronbach's alpha coefficient of 0.947, confirming the reliability of the survey.

Key findings reveal a strong and statistically significant correlation between digitalization requirements and the enhancement of public health services.

Additionally, implementing these digitalization requirements was shown to positively affect service quality.

While the findings underscore the critical role of digitalization in improving public health services, their significance extends beyond the immediate context of Mohammed Boudiaf Hospital. The results highlight a broader potential for digital transformation to revolutionize Algeria's healthcare system by increasing efficiency, accessibility, and service quality. Implementing these findings could address systemic challenges such as resource allocation and workforce development, aligning public health institutions with modern technological standards. This research validates the importance of digitalization and provides a roadmap for policymakers and healthcare administrators to enhance healthcare delivery in Algeria.

Recommendations:

To achieve meaningful progress, the following steps are essential:

- Accelerate the digitalization of the public health sector nationwide to ensure uniform improvements in service delivery.
- Invest in robust employee training programs and allocate sufficient financial resources to support healthcare institutions' digital transformation.
- Ensure the completion and optimization of digitalization programs by prioritizing procuring and implementing necessary digital infrastructure and tools.

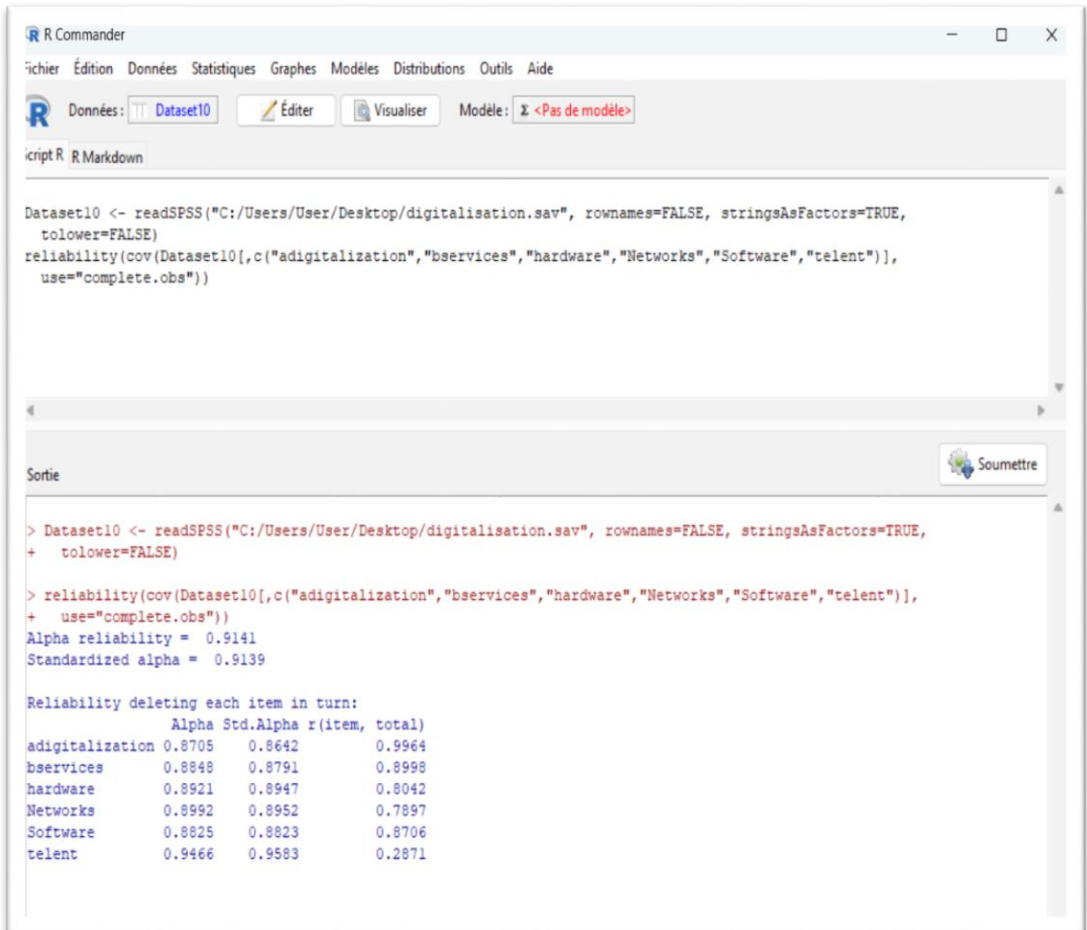
These measures are crucial for leveraging the benefits of digitalization, fostering a patient-centered healthcare system, and addressing the evolving needs of Algerian communities.

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7. Appendices:

Figure (1): The reliability of the survey



The screenshot shows the R Commander interface. The 'Données' (Data) pane shows 'Dataset10' loaded. The 'Script' pane contains the following R code:

```
Dataset10 <- readSPSS("C:/Users/User/Desktop/digitalisation.sav", rownames=FALSE, stringsAsFactors=TRUE,
  tolower=FALSE)
reliability(cov(Dataset10[,c("adigitalization", "bservices", "hardware", "Networks", "Software", "telent")],
  use="complete.obs"))
```

The 'Sortie' (Output) pane shows the results of the reliability analysis:

```
> Dataset10 <- readSPSS("C:/Users/User/Desktop/digitalisation.sav", rownames=FALSE, stringsAsFactors=TRUE,
+   tolower=FALSE)

> reliability(cov(Dataset10[,c("adigitalization", "bservices", "hardware", "Networks", "Software", "telent")],
+   use="complete.obs"))
Alpha reliability = 0.9141
Standardized alpha = 0.9139

Reliability deleting each item in turn:
```

	Alpha	Std.Alpha	r(item, total)
adigitalization	0.8705	0.8642	0.9964
bservices	0.8848	0.8791	0.8998
hardware	0.8921	0.8947	0.8042
Networks	0.8992	0.8952	0.7897
Software	0.8825	0.8823	0.8706
telent	0.9466	0.9583	0.2871

Figure (2): The validity of the survey

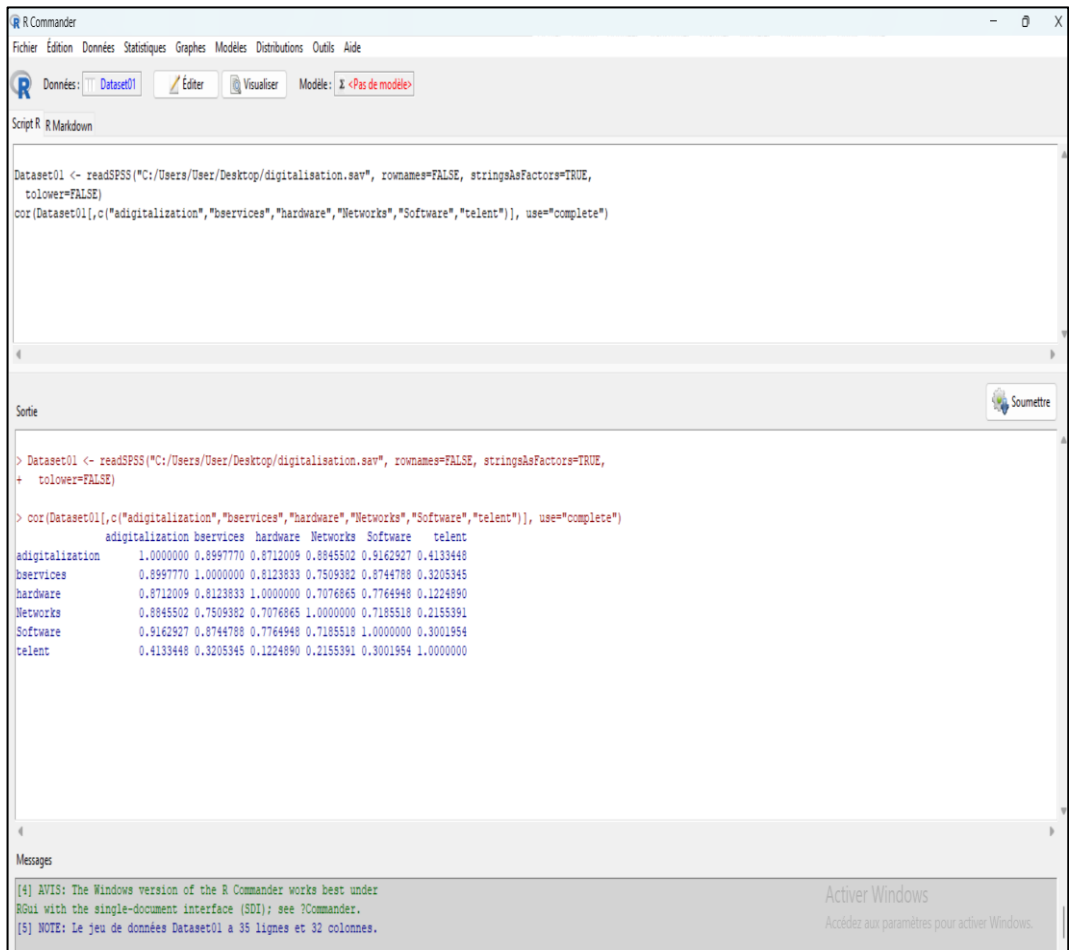
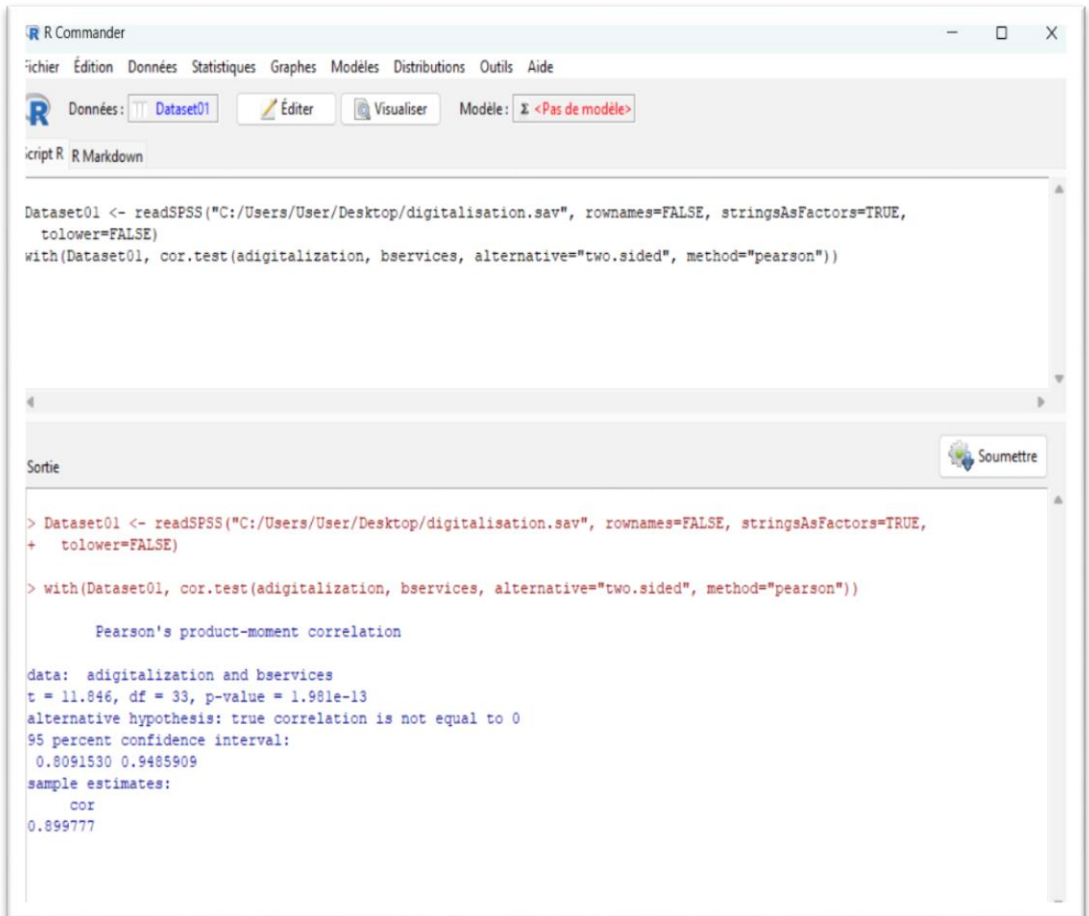


Figure (3): Correlation Pearson

The screenshot shows the R Commander interface. The top menu bar includes 'Fichier', 'Édition', 'Données', 'Statistiques', 'Graphes', 'Modèles', 'Distributions', 'Outils', and 'Aide'. Below the menu is a toolbar with buttons for 'Données: Dataset01', 'Éditer', 'Visualiser', and 'Modèle: <Pas de modèle>'. The main window is divided into two panes. The top pane, labeled 'Script R', contains the following R code:

```
Dataset01 <- readSPSS("C:/Users/User/Desktop/digitalisation.sav", rownames=FALSE, stringsAsFactors=TRUE,
  tolower=FALSE)
with(Dataset01, cor.test(adigitalization, bservices, alternative="two.sided", method="pearson"))
```

The bottom pane, labeled 'Sortie', displays the output of the code. It includes the same R code as the script, followed by the results of the Pearson correlation test:

```
> Dataset01 <- readSPSS("C:/Users/User/Desktop/digitalisation.sav", rownames=FALSE, stringsAsFactors=TRUE,
+   tolower=FALSE)
> with(Dataset01, cor.test(adigitalization, bservices, alternative="two.sided", method="pearson"))

Pearson's product-moment correlation

data:  adigitalization and bservices
t = 11.846, df = 33, p-value = 1.981e-13
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.8091530 0.9485909
sample estimates:
      cor 
0.899777
```

Figure (4): Stepwise multiple linear regression

