

The impact of digital transformation on the performance of start-ups Expensya Model

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Abstract:

This study aims to test the impact of digital transformation indicators on the performance of startups, Expensya Foundation, as a model during the period 2014-2024, using the ARDL model, relying on the performance of startups as a dependent variable and digital transformation indicators as explanatory variables.

The results of the standard study found that there is a positive and significant impact of the cloud computing use index, the software integration index (INT), the artificial intelligence index (AI), and the mobile application use index (MOB) on the annual revenue growth of startups (RG) in the long and short term. The study recommended the need to develop an environment that encourages investment in digital technologies and attempts to integrate artificial intelligence technologies in all transactions carried out by institutions.

Keywords: digital transformation, start-ups, cloud computing, software integration, co-integration

Jel Classification Codes : E32,A65,D65.

1. Introduction :

As a result of the developments in digital technology in recent times, digital transformation has become an important strategy used by institutions during their activities, especially emerging ones, as they are new and seek to prove their presence in the market and gain market value that makes them rely on innovative technological tools in providing their services and dealing with their customers. The importance of digital transformation is reflected in improving the performance of emerging institutions and enabling them to make effective decisions at the lowest cost and effort, regardless of strengthening their relationship with their customers and expanding their scope in front of competing institutions, especially with the emergence of artificial intelligence, cloud computing and other emerging technologies. Many studies that dealt with the use of digitalization by emerging institutions have shown that they have achieved positive rates of sales growth, especially during the Covid period, which showed the importance of relying on digital transformation for business continuity .During our study, we will try to analyze the impact of digital transformation on the performance of emerging institutions by projecting the experience on Expensya as an emerging institution in the field of financial technology that provides solutions for managing corporate expenses, through tracking expenditures, preparing reports and managing the budget. Based on the above, the following forms can be presented: What is the impact of digital transformation indicators on the performance of Expensya?

1.1.Sub-Questions

Through the main problem, the following questions can be asked :

Is there a statistically significant relationship between the cloud computing index on Expensya's performance?

-Is there a statistically significant relationship between the Programmatic Integration Index on Expensya's performance ?

-Is there a statistically significant relationship between the AI index on Expensya's performance .?

Is there a statistically significant relationship between the indicator of the use of mobile applications on the performance of Expensya?

1.2. Hypotheses

To answer the problem of the study, the following hypotheses were formulated :

-There is a statistically significant relationship between the Cloud Computing Index and Expensya 's performance

-There is a statistically significant relationship between the Programmatic Integration Index and Expensya 's performance

-There is a statistically significant correlation between the AI index and Expensya 's performance

There is a statistically significant relationship between the indicator of mobile application use and the performance of Expensya

1.3. Objectives of the study

The study aims to

- Addressing the theoretical concepts related to the variables of the study.
- Modelling the relationship between digital transformation indicators and the performance of startups

2. Definition of the study variables

I.1. Startups

A term used to refer to newly established institutions, which started from a creative and entrepreneurial idea that is established by an entrepreneur, with the aim of developing a service or product and launching it in the market. (mehdiya, 2022) As for French law, it defined them as young institutions in the field of innovation and the modern technology sector. According to Fridenson patrick, startups are associated with four conditions : (zohra, 2020)

- The probability of growth is high.
- It relies on high technology.
- Requires significant funding with potential for multiple contributions.
- Ensure the seriousness of the market and assess the risks .

Through the concepts presented about emerging institutions, their advantages can be summarized in: (bayazid, 2022)

- Newly established institutions that seek to achieve success and prosperity.
- The speed of its growth by making large profits similar to the costs it bears.
- It relies on technology and provides the market with products in smart modern ways based on support from business incubators.
- It is characterized by a high degree of risk.

I.2. Digital Transformation

It means the extent to which institutions rely on technology in their activities, especially in the process of creating products and offering new services, in addition to providing new channels of returns and opportunities that increase the value of their products. (mohamed, 2023) It is also known as a process in which digital technology is integrated into all the work activities of organizations and institutions and the elements of change, challenge and innovation are constantly being obtained to keep pace with the development in this technical field. Digital transformation can be a strategic goal to adapt to technological progress, as it interferes with the functions of the institution in general, from recruitment to motivation. (akrem, 2024)

1.2.1. Importance of Digital Transformation

The importance of applying digital transformation within organizations lies in the following : (djloul, 2023)

-Improve Customer Experience

The application of digital transformation improves customer relations, which ensures the improvement of the quality of products and services in ways preferred by this category.

-Facilitate Processes

Digital transformation enables a supportive environment for the exchange of knowledge and

experience, enabling workers to obtain information easily and conveniently. This leads to enhanced competencies and reduces the size of risks.

-Development of Business Models

The digital field opens new channels in entrepreneurship by introducing innovative business models and moving from traditional business to new technologies such as artificial intelligence.

3. Methodology

3.1 Data and Variables

For the purpose of studying the impact of digital economy indicators on the performance of emerging institutions in the long term, the case of Expensya Foundation, the period 2014-2024 was determined, and based on what was presented by economic theory and what was addressed in previous studies and in order to answer the main problem, where the following variables were relied on according to the following table:

Table (1) Study Variables

Variable	Type of variable	Significance	Code	Source
Performance of start-ups	Dependent variable	Annual Revenues	RG	World Bank Expensya,com Statista.
Digital Transformation	Independent Variables	Adopting the use of cloud computing	Cloud	
		Integrations	INT	
		Use of AI	AI	
		Mobile apps	MOB	

The Source: Prepared by Researchers

The general wording of the study model is written, which includes a dependent variable RG and independent variables X, which can be expressed with a set of explanatory variables X1, X2.....Xt through the following :

$$RG_t = c + \sum_{i=1}^p \beta_i \Delta y_{t-1} + \sum_{i=0}^{q_2} \beta_3 \Delta x_{2_{t-1}} + \dots + \Delta \sum_{i=0}^{q_k} \beta_k \Delta x_{k_{t-1}} + \alpha_1 y_{t-1} + \alpha_2 y_{t-1} + \alpha_3 x_{2_{t-1}} + \dots + \alpha_k x_{k_{t-1}} + \varepsilon_t$$

Representing :

c: fixed limit

Δ High class

Independent variables:

p: slower period of the dependent variable y

q₁, q₂, ..., q_k: periods of independent variables x₁, x₂, ..., x_k respectively

β₁, β₂, ..., β_k: coefficients of short-term relationship

α₁, α₂, ..., α_k: coefficients of long-term relationship

ε: Random Error Limit

The steps of the ARDL model can be summarized as follows :

- Testing the stability of the variables under study.
- Define slowdowns for the ARDL model.
- Joint integration test.
- ARDL model estimation.
- Errors Amendments

3.2 Stability test

In order to estimate the general model of the study, we seek through this test to ascertain the stability of time series, and to know the degree of their integration in order to ensure that they are not stable from the second degree or more, depending on the Fuller Augmented Dickey test, where this test is based on two hypotheses: (Herranz, 2017)

H₀ : Presence of unit root in time series, i.e. unstable series.

H₁ : Lack of unit root in time series, all series are stable.

The results were as follows :

Table (2) : Unit Root Test Results for Study Variables

Variables	Augmented Dickey-Fuller Test		
	LeVel		
	Intercept	Trend And Intercept	None
RG	-0.8234354 0.0000	8.332176- 0.0013	7.165378- 0.0001
Cloud	5.376527- 0.0000	-3.424356 0.0043	-0.325436 0.0001
INT	-3.324712 0.0002	-2.521453 0.0000	-0.357356 0.0001
MOB	-0.113654 0.0024	-7.652843 0.0005	-5.243156 0.0000
AI	-3.4316732 0.0000	-1.365421 0.0000	-0.4265840 0.0000

The Source: Prepared by the author using Eviews12.

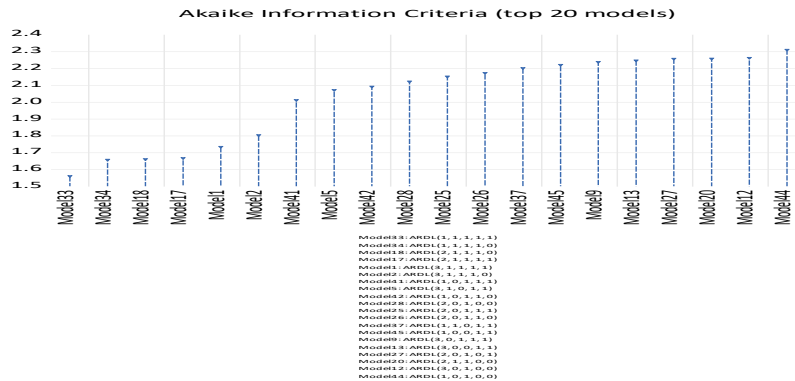
The results obtained in the above table revealed that all time series not contain the root of the unit, which was shown by the absolute values of the statistics. They were less than the critical values, and therefore we reject the zero hypothesis H₀, from which we can say that the appropriate model for this study is the ARDL model in order to test long-term relationships and estimate parameters.

3.3 Determine the optimal slowdown periods for the estimated model

Before estimating the study model and estimating the parameters, we determine the optimal slowdown periods based on several criteria BIC, HQ, SC, AIC, where we will rely on the AIC standard, which gives the optimal model that expresses the lowest value with the use of automatic

identification of all variables according to what is shown in the following figure:

Figure(1): Optimal slowing periods for the ARDL model



The Source: Prepared by the author using Eviews12.

The above results indicated that the optimal slowness periods according to the Akaike criterion were ARDL (1,1,1,1), which means that the dependent variable has one degree of delay, and one degree for all the independent variables explained to it.

3.4 Co-integration Test

For the purpose of revealing the existence of a long-term equilibrium relationship between the variables under study by comparing the statistical F values with the tabular upper and lower values, under the two hypotheses: (hadjer, 2025)

H0 : There is no long-term co-integration relationship between the variables.

H1: There is a long-term co-integration relationship between the variables.

The following table shows the results of the boundary test for the variables under study :

Table(3): bound test results

Null Hypothesis : No levels Relationship			F-Bound Test	
I(1).	I 0	Signif	Value	Test Statistic
2.32	3.22	10%	9.436326	F-Statistic
5.15	5.32	5%	4	K
4.43	6.83	2.5%		
3.13	4.24	1%		

The Source : Prepared by the author using Eviews12

from the results of the joint integration test that the statistical value of Fisher F was estimated at 9.436326, which is greater than all the critical values of the upper limit at all levels of significance 10%, 5%, 2.5%, 1%. Therefore, we reject the null hypothesis and accept the alternative hypothesis, which states that there is a long-term equilibrium relationship between the performance of emerging institutions as a dependent variable and the indicators of digital transformation as explanatory variables.

3.5 ARDL Model Estimation

After performing the bound test and determining the optimal slowdown periods, we will estimate the ARDL model according to the following table :

Table(4): ARDL model estimation results

Variable	Coefficient	Std-Error	T-Statistic	Prob
RG(1-)	0.214567	0.246578	0.252351	0.0043
CLOUD	-0.324572	0.267812	-0.143165	0.0036
CLOUD(1-)	-0.365422	0.154125	-0.284652	0.0011
INT	0.154122	1.321545	0.813543	0.0008
INT (1-)	0.234732	1.274356	2.402541	0.0240
MOB	0.452134	0.412365	1.134123	0.0054
MOB(1-)	-0.675321	0.276145	-.3.254367	0.0081
AI	-0.392134	0.614532	-2.052134	0.0012
AI(1-)	-0.162132	0.203216	-1.041543	0.0004
C	21.214567	12.61365	1.502154	0.1500
R-Squared	0.813245	Mean dependent var		3.532543
Adjusted R-Squared	0.796414	S.D dependent var		2.134326
S.E of Regression	0.382134	Akaike info criterion		1.324123
Sum squared resid	0.742345	Schwarz criterion		1.452137
Log likelihood	-0.542356	Hannan-Quinn crite		1.246522
F-Statistic	34.58324	Durbin-Watson stat		3.193245
Prob(F-statistic)	0.000312			

The Source : Prepared by the author using Eviews12

from the results of the estimation of the study model that the coefficient of determination was estimated at: 81%, which expresses the interpretive percentage of the indicators of digital transformation on the performance of emerging institutions, and the value of F 34.58324, which is greater than the tabular value, which means that the study model is statistically significant.

3.6 Long-Term Transaction Estimation

After ensuring that there is a long-term equilibrium relationship between the performance of emerging institutions and the variables interpreted for it and expressed in the indicators of digital transformation, the following table shows this :

Table(6):Results of estimating long-term coefficients

Variable	Coefficient	Std-Error	T-Statistic	Prob
RG	0.414356	0.194356	-1.324155	0.0013
CLOUD	0.563245	0.075436	3.432541	0.0003
INT	0.263268	0.521765	-1.324126	0.0043
MOB	0.472987	0.414350	-3.315467	0.0170
AI	0.375461	0.205429	2.314563	0.0001
C	32.81934	17.32426	1.810937	0.1362
EC=RG-(0. 0.414356CLOUD+0.563245UNT+0.263268* MOB+0.375461AI+32.81934)				

The Source : Prepared by the author using Eviews12

The long-term relationship between the performance of emerging institutions and the indicators of digital transformation was represented in the following equation :

$$EC=RG-(0.0414356CLOUD+0.563245UNT+0.263268* mob +0.375461AI+32.81934)$$

Where we reached :

- There is a positive and significant impact of the cloud computing use index on the annual revenue growth of startups (RG)in the long term ,as the increase of one unit of the cloud computing use index leads to an increase in the rate of revenue growth by 0.41 units .
- There is a positive and significant impact of the programmatic integration index (INT) on the annual revenue growth of startups (RG)in the long term ,as the increase of one unit of the programmatic integration index leads to an increase in the revenue growth rate by 0.56 units .
- There is a positive and significant impact of the artificial intelligence index (AI) on the annual revenue growth of startups (RG)in the long term ,as the increase by one unit of the AI index leads to an increase in the revenue growth rate by 0.37 units .
- There is a positive and significant impact of the mobile application use index (mob) on the annual revenue growth of startups (RG)in the long term ,as the increase of one unit of the mobile application use index leads to an increase in the revenue growth rate by 0.47 units .

3.7 Short-Run Estimation result:

Table(6):Results of estimating short-term coefficients

Variable	Coefficient	Std-Error	T-Statistic	Prob
D(CLOUD)	0.154367	0.322632	-2.315643	0.0012
D(INT)	0.235134	0.263543	2.431654	0.0001
D(MOB)	0.521654	0.193654	4.503215	0.0034
D(AI)	0.324122	0.124328	-3.435124	0.0048
CointEq*(1)	-0.712563	0.294356	-9.431532	0.0007

The Source : Prepared by the author using Eviews12

Through the results of the estimate, it was found that all parameters are statistically significant at a significant level of 5% ,and after estimating the error correction model CointEq It is negative and significant $P=0.0007$ (, and this explains the existence of a joint integration relationship between the variables under study, where the value obtained is explained by a degree of deviation during the short term by T-1 from the long-term equilibrium value, 86% of the imbalance in the T period is corrected in order to maintain the long-term equilibrium situation. Through the results, it was also found that:

- There is a positive and significant impact of the cloud computing use index on the annual revenue growth of startups (RG)in the short term,as the increase of one unit of the cloud computing use index leads to an increase in the rate of revenue growth by 0.15 units .
- There is a positive and significant impact of the programmatic integration index (INT) on the annual revenue growth of startups (RG)in the short term,as the increase of one unit of the programmatic integration index leads to an increase in the revenue growth rate by 0.23 units .
- There is a positive and significant impact of the artificial intelligence index (AI) on the annual revenue growth of startups (RG)in the short term,as the increase by one unit of the AI index leads

to an increase in the revenue growth rate by 0.32 units .

-There is a positive and significant impact of the mobile application use index (mob) on the annual revenue growth of startups (RG) in the short term, as the increase of one unit of the mobile application use index leads to an increase in the rate of revenue growth by 0.52 units .

3.8 Study of the validity of the form :

3.8.1 Brush God Fry Test

To make sure that there are no problems with the model under study, we will test the heterogeneity of the variation Pagan God Frey test Brush

Table(8) :Brush God Fry Test Results

Brush God Fry ARCH Test			
F-statistic	0.464356	(2.7)Prob F	0.5432
Obs*R-Squared	0.293245	(2)Prob ChiSquare	0.7214

The results of the arch test indicate that the variance of the error limit is constant through the ChiSquare probability value of 0.5432 (non-significant) with a probability of 0.7214, which enables us to accept the null hypothesis that the residues are homogeneous and there are no errors in their homogeneity

4. Conclusion:

In light of the changes taking place in the digital world today, digital transformation has become an imperative for emerging institutions, especially those looking for leadership and growth in their field. Expensya's experience has shown that the adoption of digital technology has contributed to the growth of the latter at the local and international levels. As its reliance on artificial intelligence, cloud computing and other technologies led to its expansion in multiple markets and strengthened its relationship with its customers, especially its ability to keep pace with technological changes, it provided many solutions to manage expenses, which contributed to reducing administrative burdens and improving the control process. During this study, we tried to test the impact of digital transformation indicators on the performance of startups, Expensya Foundation, as a model during the period 2014-2024, using the ARDL model. Based on the theoretical study and standard modeling, we reached the following :

-All time series associated with the study variables are stable at the first difference, and based on the joint integration test, we have reached a long-term equilibrium relationship between the study variables.

-The presence of a positive and moral impact of the cloud computing use index, expressed in cloud storage and infrastructure, which contributes to reducing costs and increasing resources, which is reflected in increasing revenues in the short and long term.

Model

- The presence of a positive and moral impact of the Software Integration Index (INT), which reflects the use of accounting and marketing systems, which contributes to raising the efficiency of its operations and supports decision-making, resulting in increased productivity and revenues of the institution in the short and long term.
- The presence of a positive and moral impact of the artificial intelligence index (AI), which is represented in the use of smart systems and data analysis, which reduces operational expenses and contributes to raising returns in the short and long term.
- The presence of a positive and moral impact of the indicator of the use of mobile applications (mob), which indicates an increase in the use of mobile applications, which supports the increase of sales of the institution in the long and short term.
- The diagnostic test of the model showed that it was free of standard problems, especially the absence of errors in the consistency of the variables of the study .

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