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Industry 4.0 technologies and financial performance: Evidence from manufacturing companies in Cameroon

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Abstract: *Purpose*. This study aims to assess the impact of Industry 4.0 technologies - specifically Big Data, Internet of Things (IoT), collaborative robots, and Cyber-Physical Systems (CPS) - on the financial performance of manufacturing companies in Cameroon, addressing the research gap in the Sub-Saharan context. *Methodology*. Adopting a quantitative approach, primary data were collected via questionnaires from 104 manufacturing firms. The study employed Chi-square tests and binary logistic regression to analyse the relationship between technological adoption and key performance indicators, including Return on Assets (ROA), Return on Equity (ROE), turnover, and productivity. *Results*. The empirical findings indicate that integrating Big Data and IoT has a statistically significant positive effect on all measured financial indicators. Collaborative robots positively impact turnover, whereas Cyber-Physical Systems showed no significant correlation with financial performance in the studied context. *The theoretical contribution*. This research extends economic production theory to developing economies. It provides empirical evidence that digital transformation serves as a critical production input, significantly enhancing firm output and challenging the "IT productivity paradox" in African manufacturing sectors. *Practical implications*. The study suggests that manufacturing leaders in developing regions should prioritise investments in Big Data and IoT for immediate efficiency gains. Furthermore, it advocates for government-led subsidy policies to lower entry barriers for automation and foster international competitiveness.

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1. Introduction

In an increasingly competitive environment where technology continues to advance, it is important to examine the performance of manufacturing companies in Sub-Saharan Africa, particularly in Cameroon. The advent of the fourth industrial revolution, particularly Industry 4.0, has led to changes in production systems. The presentation of this new technology at the Hannover Fair in 2011 is an industrial policy developed by the German government to gain and maintain a global competitive advantage for manufacturing companies (Blanchet, 2016). Motivated by an increasingly competitive environment, the USA, the United Kingdom, and Japan were quick to adapt to the new situation. Having been absent during the previous revolution, the fourth industrial revolution is an opportunity for Africa to catch up by integrating into the digital industry.

Innovation in the industrial sector is generally a source of growth and development for a country. This is also assessed through companies' financial performance. According to Morin et al (1994), performance measures the sustainability of the organisation, namely: financial profitability, productivity, product quality, the ability to save resources, and sectoral and international competitiveness. Indeed, implementing the digital industry requires significant investments in infrastructure, human resources, and financial matters, to name a few. As a result, the costs associated with these investments remain a significant concern for companies. However, it should be noted that some companies in Sub-Saharan Africa have not hesitated to integrate the digital industry into their production system. The objective of this study is to assess the impact of Industry 4.0 technologies on the financial performance of manufacturing companies in Cameroon. Thus, the question raised is: What is the contribution of Industry 4.0 technologies to the financial performance of manufacturing companies in Cameroon? In other words, does the digital shift improve performance indicators such as return on assets, return on equity, turnover and productivity?

2. From Industry 4.0 to corporate financial performance: A literature review

2.1. Definition and role of Industry 4.0

According to Kargermann et al. (2013), the fundamental significance of Industry 4.0 lies in connecting products, machines, and people to the environment by combining production, information technology, and the Internet. According to the Industry 4.0 platform, "cyber-physical systems include embedded systems that use sensors to retrieve data and act on physical processes using actuators. They are connected via digital networks and utilise all globally available data and services, benefiting from multimodal human-machine interfaces." Indeed, the goal of Industry 4.0 is to provide individualised, intelligent, and environmentally friendly goods and services (Shadravan and Parsaei 2023). In addition, it involves integrating advanced technologies into the production process to improve productivity, efficiency, and intelligent decision-making. The goal is to individualise customer requirements, leverage the flexibility and adaptability of manufacturing, and use the control system to enable production in terms of quality, quantity, and service (Kora and Beluli, 2022).

Furthermore, the fourth industrial revolution enables the production of both mass-produced and personalised products tailored to consumers' real needs, stimulating innovation and promoting industrial competitiveness (Parker et al., 2016). It is more predictive, produced on demand and no longer builds up inventory (Blanchet, 2016). According to Manhart (2017), manufacturing industries should adopt these smart production strategies to maintain current competitiveness and have a long-term competitive advantage in the global market. The United Nations Industrial Development Organisation (2020) also states that countries where Industry 4.0 is widespread experience faster growth in manufacturing value added than other countries, creating new jobs.

2.2. Conceptual framework of performance

The concept of performance is polysemous because most researchers fail to reach a consensus on a standard definition (Ali et al., 2015). The complexity here stems from the fact that it encompasses several dimensions: human, financial, economic, strategic, technical, organisational, and many others (Tchankam, 2000). According to Machesnay 1991, performance is defined as "the degree to which the desired goal is achieved and predetermined by a company." Bourguignon (1995, 1996) presents the notion of performance in three aspects: a level of achievement of objectives (results), a process (action), and the achievement of the set objective through an evaluation judgment (success). Yves Chatenay goes further by defining performance as "the achievement of objectives with criteria of quantity, quality, cost and deadlines whose levels have been determined in advance" (Amaazoul, 2008). This definition aligns with the objectives of the fourth industrial revolution because it aims to produce high-quality goods in quantity and at low cost, using sophisticated technology to satisfy customers. Indeed, the financial performance evaluated in this study comprises profitability, productivity, and efficiency following the integration of intelligent tools into the production systems of manufacturing companies.

2.3. Industry 4.0 and financial performance

Financial performance refers to a company's ability to achieve greater profitability and satisfactory growth while creating greater shareholder value (Guérard, 2006). It is an indicator used to measure the company's financial resource utilisation process and its profitability relative to investments (Issor, 2017). The fourth industrial revolution enables the implementation of a flexible supply chain, emphasising reduced delivery times and manufacturing high-quality, customised products at low cost (Frank et al., 2019; Fawna, 2023). The use of robots, for example, can increase productivity by reducing certain costs such as heating, air conditioning, and lunch breaks. Reducing operating costs directly impacts operating results. Indeed, the absence of human fatigue allows for constant precision and increases the reliability of the process and the quality of the finished product (Porter & Heppelman, 2014; Elia et al, 2016). Product quality is one of the main characteristics that attracts consumers. Thus, companies that have integrated an intelligent production system are likely to see their turnover increase, as their products will become increasingly attractive not only to customers but also to investors and importers.

The precision provided by these intelligent machines also improves the efficiency and productivity of the production system. Indeed, the Internet of Things enables predictive maintenance, allowing companies to predict breakdowns and avoid unplanned, costly downtime. Industry 4.0 also supports management's decision-making process by providing information on usage costs (Sledgianowski et al., 2017). Furthermore, the automatic provision of data to the information system improves the quality and reliability of the information contained in the financial statements.

The integration of Industry 4.0 contributes to improving global competitiveness. Increased productivity and efficiency lead to cost savings and allow companies to offer competitive prices while maintaining profitability (Fawna, 2023). Indeed, this new technology contributes to more efficient energy use and to more sustainable consumption and production models (Stock and Seliger, 2016; Stock et al., 2018). According to Jürgens et al. (2017), improved quality control and customisation capabilities enhance customer satisfaction and brand loyalty, thereby driving market expansion. Furthermore, Industry 4.0 also advocates sustainable development and environmental protection because, through artificial intelligence, companies are using less and less paper through Big Data analysis, thereby reducing costs.

3. Theoretical foundations and hypothesis

Studying the impact of Industry 4.0 technologies on financial performance allows us to highlight the economic theory of production. According to Raymond (2002), this theory stipulates that all investments in information and communication technology are considered an "input" to the firm's production function. It highlights the impact of technological investments on firm productivity. Indeed, some studies, such as Brynjolfsson and Hitt (1996), have shown that spending on digital technologies significantly influences firm output. This contradicts Robert Solow's (1991) hypothesis, which states that IT capital does not influence firm productivity. The theory of production discussed in this study helps us assess the impact of digital technologies on the financial performance of manufacturing firms.

Several studies have focused on the implementation of industry and its impact on the organisation of the company, the supply chain, but few researchers have studied the links between these new technologies and the financial performance of companies. Research by Peng and Tao (2022) and Chouaibi et al. (2022) on the impact of digital technologies on company performance showed that digital transformation significantly influences company performance. Buchi et al. (2020), after conducting a regression analysis on 231 manufacturing units, concluded that Industry 4.0 significantly influences company performance. Li's (2022) study empirically confirmed that Industry 4.0 implementation significantly influences a company's economic and environmental performance.

Furthermore, Lin and Song (2019), after evaluating the effect of Industry 4.0 on the financial performance of 460 companies using a probit analysis, concluded that its implementation increases return on equity. In the same vein, some authors, such as Mosca et al. (2020), note that the greater the degree of digital transformation, the higher the production efficiency. More recently, studies by Guennoum and Bennouna (2023) have shown that implementing Industry 4.0 has a positive impact on a company's financial performance. Research by Teng and Yang (2022) has focused more on Industry 4.0 technologies such as big data, cyber-physical systems and the Internet of Things. They conclude that these digital technologies have a positive impact on improving business performance. However, Curran's (2018) research has shown that the application of digital technologies does not have a significant impact on business performance. From this empirical review, the following hypothesis emerges: The integration of Industry 4.0 technologies (Big Data, collaborative robots, the Internet of Things, and cyber-physical systems) has a positive and significant influence on companies' financial performance.

4. Methodology

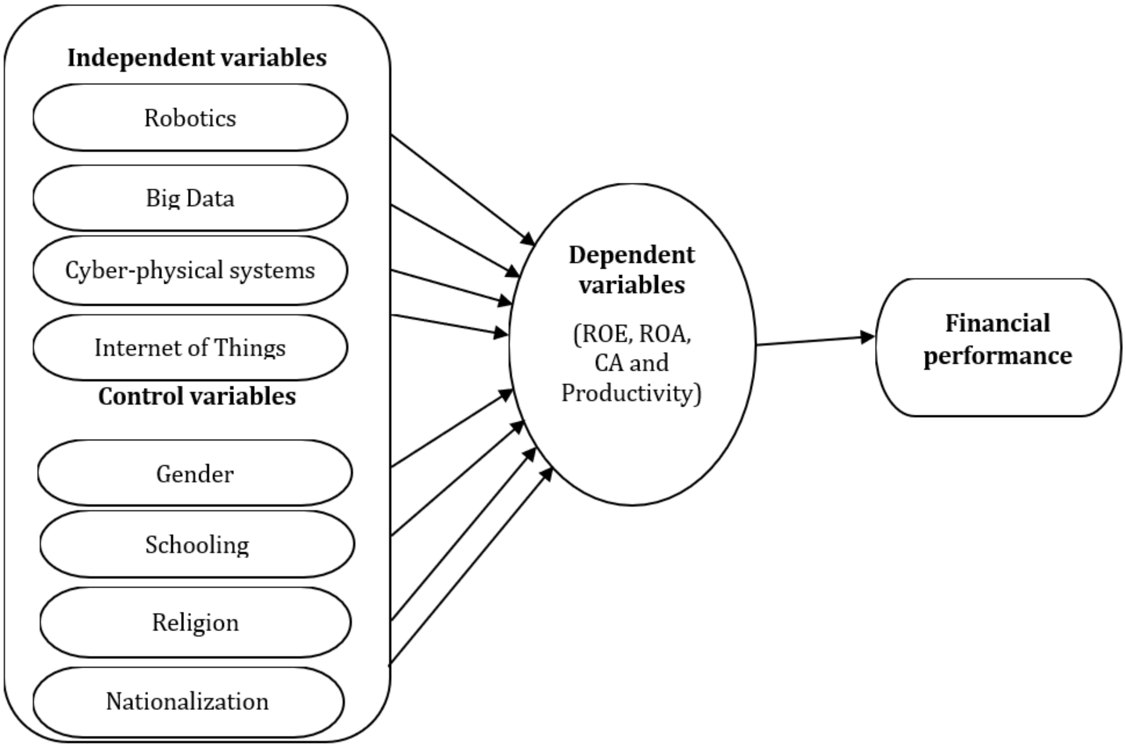
This study follows a hypothetico-deductive approach, drawing on concepts, theories, and empirical reviews to formulate a hypothesis that will be tested against the facts using statistical tools. To integrate the concept of Industry 4.0, the study population comprises manufacturing companies in Cameroon. In line with the objective set out above, we opted for a purposive sample. Furthermore, given the unavailability of secondary data, we opted to collect primary data using a questionnaire based on well-defined, specific themes. To this end, we will conduct data collection among employees holding management positions in manufacturing companies. We surveyed directors (13.46%), senior managers (41.35%), and department heads (45.19%). We collected a total of 104 questionnaires, with a particular focus on companies that had integrated at least one of the following Industry 4.0 tools: Big Data, collaborative robots, Internet of Things, and cyber-physical systems. Once collected, the data were analysed using Stata 15.

After data collection, we conducted the descriptive analysis of the items by percentage of respondents. We performed the Chi2 test to visualise the relationships between the dependent variables (Financial performance measured by: ROE, ROA, Turnover, and Productivity) and the independent variables (Collaborative Robots, Big Data, Cyber-Physical System, Internet of Things), as well as the level of significance. We also performed a binary logistic regression using model evaluation indicators such as log-likelihood, pseudo-R^2 (Nagelkerke and Cox and Snell), as well as AIC and BIC, to adjust the model, measure the proportion of variance explained by the independent variables, and compare the models. The rest of this study highlights the model construction and variable operationalisation, as well as the different results.

4.1. Model construction and operationalisation of variables

The objective of this study is to assess the impact of Industry 4.0 technologies on companies' financial performance. Based on the dependent and independent variables highlighted above, we have developed the conceptual model below. It is important to note that we have combined the independent variables with four control variables: gender, education, religion, and nationalisation, for a reliable analysis.

Figure 1: Conceptual model



The econometric model is presented as follows:

$$\text{logit(Y)}= \beta_0 \sum \beta_i x_i$$

With Y as the dependent variable, $\boldsymbol{x_i}$ as the explanatory variables, β_0 as the constant, and β_i as the regression coefficients. The different variables expressed are:

Dependent variables: ivq1_bin, ivq2_bin, ivq3_bin, ivq8_bin

Independent variables: iiiq1, iiiq2, iiiq3, iiiq4

Control variables: iq5, iq6, iq7, iq8

The complete empirical form of the model is as follows:

$$\text{logit(Y)} = \beta 0 + \beta 1\text{iiiq}1 + \beta 2\text{iiiq}2 + \beta 3\text{iiiq}3 + \beta 4\text{iiiq}4 + \beta 5\text{iq}5 + \beta 6\text{iq}6 + \beta 7\text{iq}7 + \beta 8\text{iq}8$$

After presenting the different models in our study, we will now operationalise the variables.

As mentioned above, the integration of Industry 4.0 technologies was measured using a Likert scale ranging from strongly disagree to agree strongly. The dependent variable was measured through changes in financial indicators according to the following criteria: decrease, stable, and increase. The operationalisation of the variables is summarised in the table below:

Table 1: Operationalisation of variables

	Dimensions	Abbreviation	Definition	Terms
Dependent variables (Financial performance)	Variation of financial indicators	ivq1_bin ivq2_bin ivq3_bin ivq4_bin	Return on equity Return on assets Turnover Productivity	1. Drop 2. Stable 3. Increase
Independent variables (Industries 4.0 technologies)	Integration of Industry 4.0 technologies	iiiq1 iiiq2 iiiq3 iiiq4	Collaborative robots Big data Cyber-physical system Internet of Things	1. Strongly disagree 2. disagree 3. Neutral 4. Agree 5. Strongly agree
Control variables	Characteristics of the respondent and the company	iq5	Gender	1-Male 2-Female
		iq6	Schooling	1-secondary 2-higher
		iq7	Religion	1-Christian 2-muslim 3-other
		iq8	Nationalisation	1- local 2-International

5. Results

The results of this study are presented in two sections: the results of the descriptive analysis and the results of the explanatory analysis.

5.1. Results of the descriptive analysis

We will highlight the characteristics of the sample, the level of use of Industry 4.0 tools, and the variation in financial reporting elements.

The table below highlights the descriptive analysis of the sample variables.

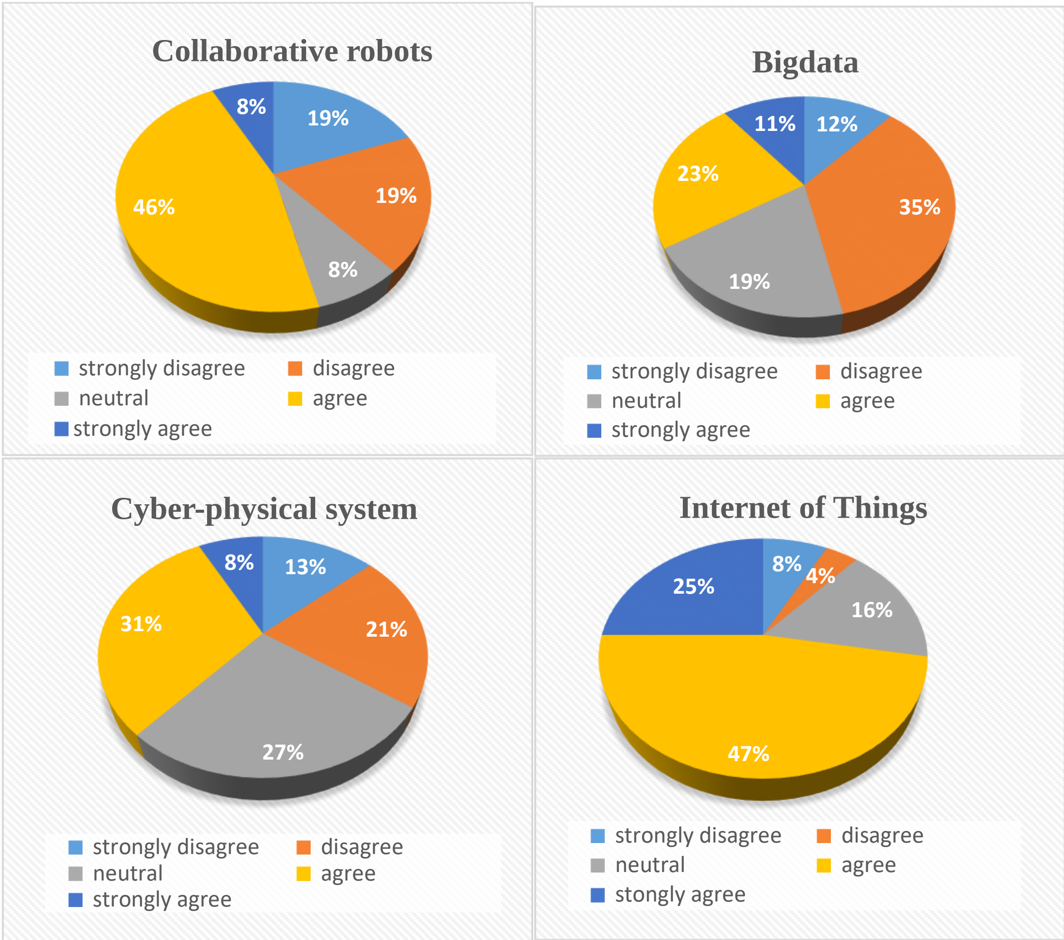
Table 2: Characteristics of the sample

Variable	Value	Noun	Percentage
iq1 (Number of employees)	Less than 50	23	22,12%
	Between 50 et 100	16	15,38%
	Between 100 et 150	17	16,35%
	Between 150 et 200	22	21,15%
	More than 200	26	25,00%
iq2 (legal status)	UL	3	2,88%
	LLC	40	38,46%
	PLC	52	50,00%
	LC	9	8,65%
iq3 (Age of the respondent)	15-24	7	6,73%
	24-39	21	20,19%
	40-54	60	57,69%
	+55	16	15,38%
iq4 (position in the company)	General manager	14	13,46%
	Responsible executive	43	41,35%
	Head of department	47	45,19%
iq5 (Gender)	Male	84	80,77%
	Female	20	19,23%
iq6 (level of education)	Secondary school	47	45,19%
	Higher education	57	54,81%
iq7 (Religion)	Christian	71	68,27%
	Muslim	27	25,96%
	Other	6	5,77%
iq8 (Nationalisation)	Local	50	48,08%
	International	54	51,92%
iq9 (implantation area)	Bafoussam	5	4,81%
	Buea	2	1,92%
	Douala	89	85,58%
	Yaoundé	8	7,69%
iq10 (Turnover)	1 to 99 million	25	24,04%
	100 million to 499 million	24	23,08%
	500 million to 1 billion	33	31,73%
	More than a billion	22	21,15%
iq11 (equity)	1 to 99 million	38	36,54%
	100 million to 499 million	17	16,35%
	500 million to 1 billion	35	33,65%
	More than a billion	14	13,46%

It appears that 25% of the sampled companies have a workforce of more than 200 employees, while 22% have fewer than 50. 50% of companies are PLC (Public limited company), followed by LLC (Limited liability company) at 38.46%, LC (Limited company) at 8.65%, and UL (Unlimited Liability) at 2.88%. We also observe that the female gender represents a minority, 19.23% of the sample, against 80.77%. The level of education is divided between secondary (45.19%) and higher education (54.81%). Local companies represent 48.08% of the sample, while multinationals account for 54.92%. Most of the sampled companies are located in Douala (85.58%), followed by Yaoundé (7.69%). The respondents' roles are shared between general manager (13.46%), manager (41.35%) and department head (45.19%).

To assess the use of Industry 4.0 tools, such as collaborative robots, big data, cyber-physical systems, and the Internet of Things, respondents were asked to share their opinions on their use in their company. The figure below highlights the results of the descriptive analysis.

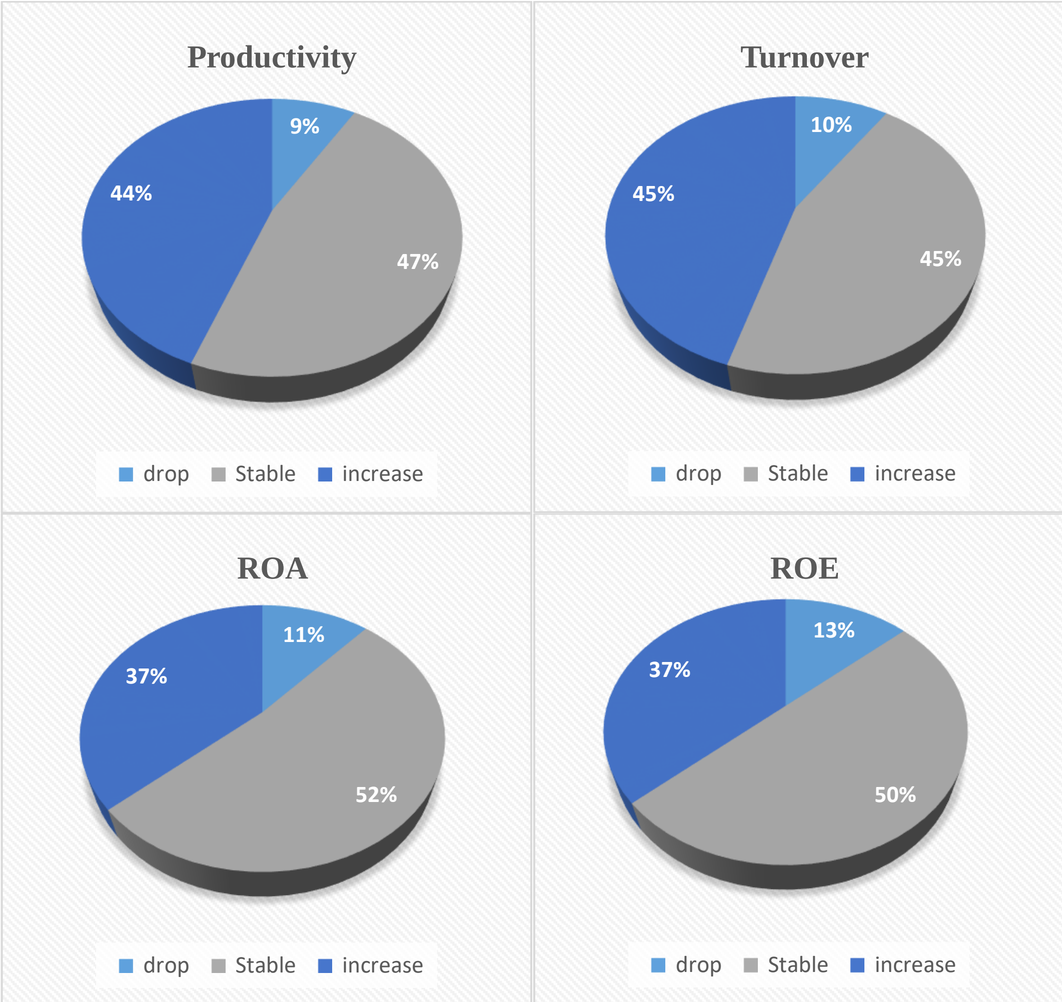
Figure 2: Assessment of the level of use of Industry 4.0 tools



It is found that 46% of the respondents in this sample are somewhat in agreement, 8% express a neutral opinion because they do not know, 19% do not agree and 8% strongly disagree. Regarding the use of Big Data, only 24% expressed a somewhat agree opinion, 8% were strongly agree, 20% neutral, 36% disagree and 12% strongly disagree. The use of cyber-physical systems presents a diversity of opinion because, 31% are somewhat agree against 27% who do not know and 21% who do not agree. However, 57% of the respondents expressed a somewhat agree opinion regarding the use of the Internet of Things in their companies, 9% are strongly agree, 20% do not know, 5% disagree and 9% strongly disagree. These results suggest that respondents have varied opinions and preferences, but with strong tendencies towards certain options. It should be noted, however, that these interpretations are based on descriptive statistics; further analysis will allow us to understand the relationships between variables.

Respondents were asked to give their opinion on financial reporting elements such as: productivity, turnover, ROE and ROA. The figure below highlights the results of the descriptive analysis.

Figure 3: Assessment of financial reporting elements



It was found that 44% of respondents have seen their productivity increase over the past three years, 47% report stability, and 13% report a decrease in productivity. Regarding revenue, opinions are diverse: 45% report an increase, 45% report stability, and 10% report a decrease. Responses regarding return on assets and capital are relatively consistent, with half of the sample reporting stability in ROA and ROE. 37% report an increase in ROA and ROE, compared to an average of 12% reporting a decrease in ROA and ROE.

5.2. Explanatory analysis results

We will present the results of the Chi-square test and the logistic regression.

5.2.1. Relationships between variables and significance levels: Chi-square test

The table below allows us to assess the relationships between the dependent and independent variables and their significance levels using the Chi-square test.

Table 3: Chi-square test

	ivq1 (ROE)	ivq2 (ROA)	ivq3 (Turnover)	ivq4 (Productivity)
iiiq1 (Collaborative robots)	17,92*	14,41	17,20*	18,95*
	(0,022)	(0,072)	(0,028)	(0,015)
iiiq2 (Big data)	27,41***	19,29*	19,22*	20,28**
	(0,001)	(0,013)	(0,014)	(0,009)
iiiq3 (Cyber-physical system)	13,90	13,63	10,90	9,50
	(0,085)	(0,092)	(0,207)	(0,302)
iiiq4 (Internet of Things)	27,96***	30,94***	24,65**	27,16***
	(0,000)	(0,000)	(0,002)	(0,001)

Source: authors

ROE (Return on Equity), ROA (Return on Assets), Turnover and Productivity.

Looking at this table, we see significant, highly significant, extremely significant, and strong relationships. Boxes with low p-values (less than 0.05) indicate significant relationships between variables iiiq and ivq. Boxes with p-values less than 0.01 indicate highly significant relationships between variables iiiq and ivq. Boxes with p-values less than 0.001 indicate highly significant relationships between variables iiiq and ivq. Conversely, boxes with high p-values (greater than 0.05) indicate insignificant relationships between variables iiiq and ivq.

In general, this table suggests that some variables (iiiq2 and iiiq4) are significantly related to some variables (ivq1, ivq2 and ivq4) while others are not (iiiq1 and ivq2; iiiq and all dependent variables). Therefore, there is a significant relationship between the use of robots and financial indicators such as return on equity, turnover and productivity. A very significant relationship is observed between the use of Big Data and productivity, and the Internet of Things and turnover. We also noted an extremely significant relationship between the use of Big Data and return on equity, and between the use of the Internet of Things and other indicators such as return on equity, return on assets, and productivity.

5.2.2. Binary logistic regression

The table below presents the results of the binary logistic regression.

Table 4: Results of the binary logistic regression

Variables	Dependent variable: Financial performance											
	ROE			ROA			Turnover			Productivity		
	Coeff	OR	p-value	Coeff	OR	p-value	Coeff	OR	p-value	Coeff	OR	p-value
Collaborative robots (iiiq1)	0,29	1,34	0,15	0,22	1,25	0,28	0,33*	1,39	0,04	0,26	1,3	0,18
Bid data iiiq2)	0,45*	1,57	0,04	0,58**	1,79	0,01	0,41*	1,51	0,04	0,50**	1,65	0,01
Cyber-physical system (iiiq3)	-0,18	0,84	0,42	-0,11	0,9	0,62	-0,22	0,8	0,33	-0,16	0,85	0,46
Internet of things (iiiq4)	0,38*	1,46	0,04	0,51**	1,67	0,01	0,34*	1,4	0,05	0,43**	1,54	0,01
Gender (iq5)	0,02	1,02	0,89	0,05	1,05	0,74	0,01	1,01	0,94	0,03	1,03	0,84
Schooling (iq6)	0,1	1,11	0,52	0,15	1,16	0,38	0,08	1,08	0,61	0,12	1,13	0,47
Religion (iq7)	-0,05	0,95	0,76	-0,02	0,98	0,91	-0,07	0,93	0,67	-0,04	0,96	0,81
Nationalisation (iq8)	0,15	1,16	0,34	0,2	1,22	0,22	0,12	1,13	0,45	0,18	1,2	0,28
Constanta		0,02	-2,01		0,02	-2,34		0,01	-1,83		0,04	-2,13
Log-likelihood		-50,23			-44			-52			-46,1	
Pseudo R^2 (Nagelkerke)		0,32			0,39			0,34			0,37	
Pseudo R^2 (Cox & Snell)		0,25			0,32			0,27			0,3	
AIC		124,46			110			129			114	
BIC		142,59			128			146			130	
Number of observations		104			104			104			104	

Source: author from our estimates; Estimation method: maximum likelihood

The table above shows the model evaluation indicators, including log-likelihood, pseudo-R^2 (Nagelkerke and Cox & Snell), AIC, and BIC. These indicators suggest that the models have a relatively good fit. The log-likelihood values are -50.23, -44, -52 and -46.1 for the dependent variables ROE, ROA, Turnover and Productivity, respectively. The pseudo-R^2 values are 0.32, 0.39, 0.34 and 0.37 for the dependent variables ROE, ROA, Turnover and Productivity, respectively. The values of AIC and BIC are, respectively, 124.46 and 142.59 for the dependent variable ROE; 110 and 128 for the dependent variable ROA; 129 and 146 for the dependent variable CA; and 114 and 130 for the dependent variable Productivity.

5.2.3. Statistical interpretation of independent variables

The logistic regression results show the relationships between the independent variables and the dependent variables ROE (Return on Equity), ROA (Return on Assets), Turnover and Productivity.

5.2.3.1. Significant independent variables

Big Data Platform (iiiq2): This variable has a positive and significant coefficient for the dependent variables ROE (0.45*, OR=1.57, p-value=0.04), ROA (0.58**, OR=1.79, p-value=0.01), turnover (0.41*, OR=1.51, p-value=0.04), and productivity (0.50**, OR=1.65, p-value=0.01). This suggests that the use of big data platforms is associated with: a 45% increase in return on equity (ROE); a 58% increase in return on assets (ROA); a 41% increase in turnover, and a 50% increase in productivity.

Use of the Internet of Things (iiiq4): this variable has a positive and significant coefficient for the dependent variables ROE (0.38*, OR=1.46, p-value=0.04), ROA (0.51**, OR=1.67, p-value=0.01), Turnover (0.34*, OR=1.4, p-value=0.05) and Productivity (0.43**, OR=1.54, p-value=0.01). This suggests that the use of Internet of Things is associated with: a 38% increase in return on equity (ROE); a 51% increase in return on assets (ROA); a 34% increase in turnover (TO), and a 43% increase in productivity.

Collaborative robots (iiiq1): This variable has a positive and significant coefficient for the dependent variable turnover (0.33*, OR=1.39, p-value=0.04). This suggests that the use of robots, including collaborative robots, is associated with a 33% increase in asset growth (Turnover).

5.2.3.2. Non-significant independent variables

Cyber-physical systems (iiiq3): This variable does not have a significant coefficient for any of the dependent variables. This suggests that the use of cyber-physical systems is not associated with higher return on equity, return on assets, turnover, or productivity.

Gender (iq5), Education (iq6), Religion (iq7), and Nationalisation (iq8): These variables do not have significant coefficients for any of the dependent variables. This suggests that these variables are not associated with higher return on equity, higher return on assets, higher turnover or higher productivity.

6. Discussion

The logistic regression results show a positive and significant relationship between the big data platform and dependent variables such as ROE, ROA, Turnover, and productivity. Furthermore, big data integration has a positive and significant influence on return on assets, return on equity, revenue, and productivity. This result corroborates those of Lin and Song (2019), who, after studying 460 companies, concluded that implementing Industry 4.0 increases return on equity. More recently, Guennoum and Bennouma (2023) found that Industry 4.0 implementation has a positive impact on companies' financial performance. The results of the explanatory analysis show that 35% of the companies surveyed use the Internet of Things in their production system. According to the logistic regression, the use of the Internet of Things has a positive and significant influence on return on equity (p-value = 0.04) and a very significant influence on return on assets and productivity (p-value = 0.01). These results align with those of Teng and Yang (2022), who, after studying Industry 4.0 technologies such as cyber-physical systems and the Internet of Things, concluded that these digital tools have a positive impact on company performance. Gul's (2025) work also highlights the positive impact of technological tools on company performance. According to the logistic analysis, the use of collaborative robots has a positive and significant effect on turnover. However, the use of cyber-physical systems does not affect financial performance. This suggests that they are not associated with return on equity, return on assets, turnover, or productivity.

The descriptive analysis results show that Industry 4.0 is well known in Cameroon. However, several companies have not yet integrated these tools into their production systems due to exorbitant costs for some and a lack of infrastructure for others. Djoutsa et al. (2017) also point out that the energy divide causes a lack of enthusiasm for innovation, problems with road infrastructure, and access to electricity or the Internet. Nevertheless, based on the results of the logistic regression, we find that the integration of Industry 4.0 technologies, such as big data, the Internet of Things, and collaborative robots, except for cyber-physical systems, has a positive and significant impact on financial performance. In light of the above, the results of the (binary) logistic regression suggest that the use of big data platforms and the Internet of Things is associated with higher return on equity, higher return on assets, revenue growth, and higher productivity. The use of collaborative robots is associated with higher asset growth. The hypothesis that the integration of Industry 4.0 technologies has a positive, significant influence on companies' financial performance is supported.

7. Practical implications

The objective of this study was to assess the impact of Industry 4.0 technologies on the financial performance of manufacturing companies in Cameroon. The results obtained may be helpful to companies seeking to improve performance through innovative technologies such as the Internet of Things, big data, and collaborative robots. Managers can also partner with technology tool providers to facilitate acquisitions. Furthermore, the government could implement a policy to subsidise industrial projects to promote the integration of digital technologies into the production system.

8. Conclusion

This study highlighted the contribution of Industry 4.0 technologies (Internet of Things, collaborative robots, big data, and cyber-physical systems) to the financial performance of manufacturing companies in Cameroon. Based on an empirical approach, it identified three tools that positively and significantly influence companies' financial performance: the big data platform, collaborative robots, and the Internet of Things. Indeed, the results show that using these tools significantly and positively improves return on assets, return on equity, productivity, and revenue. These tools also help improve companies' production systems and enable them better to position themselves in the increasingly competitive international market. However, the lack of infrastructure, qualified personnel, and high integration costs are obstacles for most companies. In view of these limitations, this study suggests that companies establish partnerships with those providing digital services. Furthermore, a look is taken at the government to request its support in improving access conditions to infrastructure.

Conflict of interest statement

The authors declare that they have no conflicts of interest.

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