

Bibliometric and positivist analysis of the balanced scorecard perspective for redesigning business incubation services in the Fourth Industrial Revolution

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Keywords

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Abstract

Small business failure has been an enduring problem in developing economies such as South Africa. In view of this challenge and the crucial role of the small enterprises in the economy, small business incubation has widely been adopted to increase the success and viability of emerging enterprises. With the present turbulence and business model disruption that is prevailing in the business environment because of the technological revolution, the need to strengthen operations of small business incubators has become paramount. The purpose of this study was to explore the relevance of the balanced scorecard (BSC) perspective in redesigning the operations of small business incubators in South Africa. It considered the internal, learning, financial and customer perspectives on redesigning operations of small business incubators in the technological context. The methodology of this review follows the Preferred Reporting Items for Systematic Reviews and Bibliometric analysis (PRISMA) guidelines. It employs an extensive search strategy across the Scopus database, rigorously applying inclusion and exclusion criteria, yielding a detailed analysis of 33 selected studies that concentrated on business incubation. This study therefore performs a comprehensive bibliometric analysis of existing literature to provide insight into publication trends, critical articles, research sponsorship contribution and the philosophy of positivism, based on an analysis of objective patterns of the reality of redesigning the operations of small business operators through the lens of the BSC. The study further adopted a quantitative approach based on a questionnaire that was issued to 250 incubators from several sectors across South Africa. The study established that the use of Fourth Industrial Revolution (4IR) technologies was low, and that many small business incubators were not sure how the BSC perspective could be adopted with the aid of 4IR technologies. The study noted a need for further research on technological adoption and how the implementation of the BSC can be strategically implemented to enhance operational efficiency among small business incubators.

Introduction

This study explores the relevance of the balanced scorecard perspective for redesigning the operations of small business incubators in the context of the Fourth Industrial Revolution (4IR). Business model disruptions, redesigning and remodeling have become a central discourse in the context of the 4IR (Kibor, 2024). More than ever, the significance of the macro environment in shaping business operations has become evident with technology taking a prime role. These transitions and business model instabilities have wide implications on small entities given their established vulnerabilities associated with their weak financial positions, poor skills and management inadequacies as well as market in capabilities (Kibor, 2024; Jasin, Anisah, Fatimah, Azra, Suzanawaty & Junaedi, 2024). Small business high failure rate and weak skills position have been pivotal in the rise and popularity of small business incubators (Okoye, Nwankwo, Usman, Mhlono, Odeyeni & Ike, 2024). Business incubators provide services to strengthen small business entities to improve their survival and sustainability. Consequently, it can be argued that strengthening the operations of small business incubators translates to improving the operations of small enterprises. In the end, this positively impacts economies, given the significance of

small entities in South Africa and in other economies across the globe. The present study was formulated to assess the redesigning of small business incubation entities in South Africa within the context of the 4IR against indications that small entities continue to fail and have weak systems to adapt to the present situation. To do this, the study relied on the lens of the business scorecard as advanced by Kaplan and Norton (1992).

Literature review

While the concept of the BSC is said to have initially appeared in the publication of Johnson and Kaplan in 1987, its present day use is based on Kaplan and Norton's (1992) (Shehada, El Talla, Al Shobaki, & Abu-Naser, 2020). The BSC is considered a strong tool for guiding business model transformation and redesign and its value has been recognised many earlier studies (Martín-Gómez, Pineda-Ganforina, Ávila-Gutiérrez, Agote-Garrido, Lama-Ruiz, 2024). It is defined as a financial and non-financial tool for measuring enterprise performance (Kaplan & Norton, 1992). It offered a balanced perspective for the measurement of performance in a way that deviated from traditional emphasis on financial techniques only (Isoraite, 2008). The BSC is based on four perspectives for performance measurement which also become key focus area for organisational redesign. These four perspectives are: (1) the financial perspective, which emphasizes the need for favorable financial ratios that satisfy shareholders and business owners; (2) the internal perspective which points to the need for excelling in business processes and internal management; (3) the learning perspective, which captures the need for continuous improvement and change management; and last (4) the customer perspective, which captures the need for better customer management to ensure their satisfaction.

Redesigning small business incubators' operational efficiency through 4IR technologies has become a relevant dimension of inquiry given the need to foster the survival of small entities in the technological age. Lose and Tengeh (2016) explain that the concept of business incubation resembles the support and nurturing required by a newborn to ensure proper growth in the foundational stages of life. It encompasses the provision of essential support for start-up enterprises until they can be independent businesses. In South Africa, the concept is relatively new. The present design of incubation is significantly powered by government initiatives to drive small enterprises. Business incubators in South Africa often provide such services as guidance and support, training, start-up finance as well as product development and marketing assistance. The BSC is considered a powerful tool in strategic management that can be adopted to improve enterprise operations (Okoye et al., 2024). Its relevance in business remodelling and redesign is powerful, given its holistic interpretation of an enterprise (Shehada et al., 2020). It is widely deemed relevant, given its broad and multidimensional view of business operations. It is relevant in both strategic planning and implementation of enterprises. When applied to small enterprises, the BSC can offer a versatile tool for strengthening viability and providing possible directions for addressing small business failure.

Purpose of the study

This study aimed to explore the relevance of the BSC perspective for redesigning business incubation services in the Fourth Industrial Revolution. Specifically, the study explored how the internal, financial, customer and learning perspective of the BSC can be the basis for redesigning the operations of business incubators so that they increase in efficiency as they address small business failure in South Africa.

Methodology

The study was aligned with bibliometric analysis using PRISMA guideline and positivist methodologies, based on an analysis of objective patterns of reality in redesigning the operations of small business operators through the lens of the BSC. The positivist paradigm relate to the acceptance that reality is objective and can be objectively analysed (Melnikovas, 2018; Higgins, 2020). Following the positivist paradigm, the quantitative approach based on the collection of data using a Likert scale questionnaire was adopted. Likert type questionnaires are a popular data collection method in the analysis of social phenomena (Creswell & Creswell, 2018; MacKenzie, Christensen, & Turner, 2015). The questionnaire was developed with reference to elements of the BSC as well as previous related studies. Data was collected with guidance and assistance from the Small Enterprise Development agency (SEDA),

which possesses a database of small business incubators in South Africa. The actual number of incubators in their database was not revealed. SEDTA randomly sampled out 250 small business incubators who were willing to participate in the study. The SEDTA also assisted in issuing the questionnaire to the 250 small business incubators who were categorised as indicated in Table 1.

Table 1: Categories of incubators which participated in the study

Sector of business incubator	Number of incubators	Percentage
Wholesale and trade	38	15.1%
Construction and engineering	31	12.2%
Tourism and hospitality	18	7.1%
Public sector	9	4.3%
Services	36	14%
Mining	13	5.1%
Agriculture	30	12.1%
Textiles, clothing, leather and footwear	14	6.1%
Wood and wood products, paper, publishing and printing	10	4%
Manufacturing	23	9%
Generic	28	11.1%
Total	250	100%

As shown in Table 1, the incubators that participated in the study were from a broad range of sectors enabled gather broad perspectives that were valuable to conclude the study. Data collected in this study was analysed using descriptive statistics with the support of the Statistical Package for the Social Sciences (SPSS) software.

Bibliometric analysis

Literature reviews and bibliometric analyses report exhaustively on research patterns, new insights and potential research gaps based on a thorough assessment of knowledge from existing literature of scientific quality (Aria, Misuraca & Spano, 2020). They involve retrieving literature, assessing the quality of studies and establishing protocols for evidence-gathering through a robust selection process that is transparent, replicable and can produce evidence-based conclusions (Briner and Denyer, 2012). Accordingly, this study follows the widely-used PRISMA framework to identify and analyse empirical studies focused on incubation of small business in Africa, America and Europe. Specifically, the data collection and selection procedure is based on the following steps: (1) identification of potentially relevant records; (2) screening of relevant articles; (3) eligibility assessment; and (4) data coding and extraction of relevant information. The first step involves the identification of scholarly materials via a database search. To systematically select potential peer-reviewed articles for screening, this review adopted the Scopus database, one of the largest abstract and citation repositories providing enriched bibliographic data from thousands of reputable journals (Baas, Schotten, Plume, Côté, Karimi, 2020). The choice of the Scopus database is informed by its offer of high-quality scientific papers from renowned publishers. The search strategy was developed around two keyword blocks, namely 'incubation' and 'small business'. Using Boolean operators and wildcards (i.e., 'OR', 'AND' '*' ', etc.), an all-inclusive search technique was applied to create the final queries to capture articles that investigated the concept under review. The search queries involved a combination of structured keywords under the five keyword blocks and was conducted across the title, abstract and keyword fields. With no restrictions on the publication period and the number of articles to include (Valentine, Pigott & Rothstein, 2010), the final article retrieval process was performed on 15 June 2024. The final query was a drawdown of 39 publication records which was further cut down to 37 peer-reviewed English-language articles, found to be potentially connected to the searched topics. In the second stage, the remaining dataset was imported into Zotero citation management software, where 0 duplicates were removed, followed by a manual evaluation of titles and abstracts, which resulted in a sample of 33 records related to the incubation and small business certification domain. It was realised at this stage that while some scholars used compliance and adoption interchangeably, others characterised compliance with different phrases. As a result, the authors needed to update the selection criteria to include articles measuring compliance through (a) patterns of reality of redesigning

the operations (b) of small business operators from the lens of the BSC (d) in the Fourth Industrial Revolution. The full inclusion and exclusion criteria used are presented in Table 1. Applying these criteria produced 37 eligible studies related to business incubation. In the third stage, a full text assessment was conducted for eligibility and to eliminate publications that did not refer to business incubation, all operational efficiencies or Fourth Industrial Revolution. After this screening, two more records were disqualified, leaving a final sample of 33 studies which are included in the current literature review and bibliometric analyses.

Table 2: Criteria for article inclusion

Inclusion criteria

- Articles published between 2010-2023 on business incubation
- Relevance of the title and abstract to incubation and small business
- Publications in peer-reviewed journals and peer conference papers because of limited literature
- Articles published in English

Exclusion criteria

- Articles published before 2010
- Articles that do not focus specifically on incubation and small incubation or Fourth Industrial Revolution
- student dissertations, government reports and company publications
- Non-English articles
- Surveys, notes and book chapters

Data extraction

The data extraction process is a critical component of a systematic literature review, and it should be carefully tailored to align with the research question (Stravinskienė and Serafinas, 2021). In this regard, Kitchenham and Charters (2007) have provided valuable insights by suggesting additional pertinent data points that can be captured to enrich the analysis. Aside from basic information like authors, publication year, and source, our data extraction approach included a wide range of elements to guarantee a full comprehension of the research. The comprehensive data extraction process described below is directly linked to the quality assessment phase in our bibliometric literature review, which is a crucial step to evaluate the reliability and validity of the selected studies.

The PRISMA framework

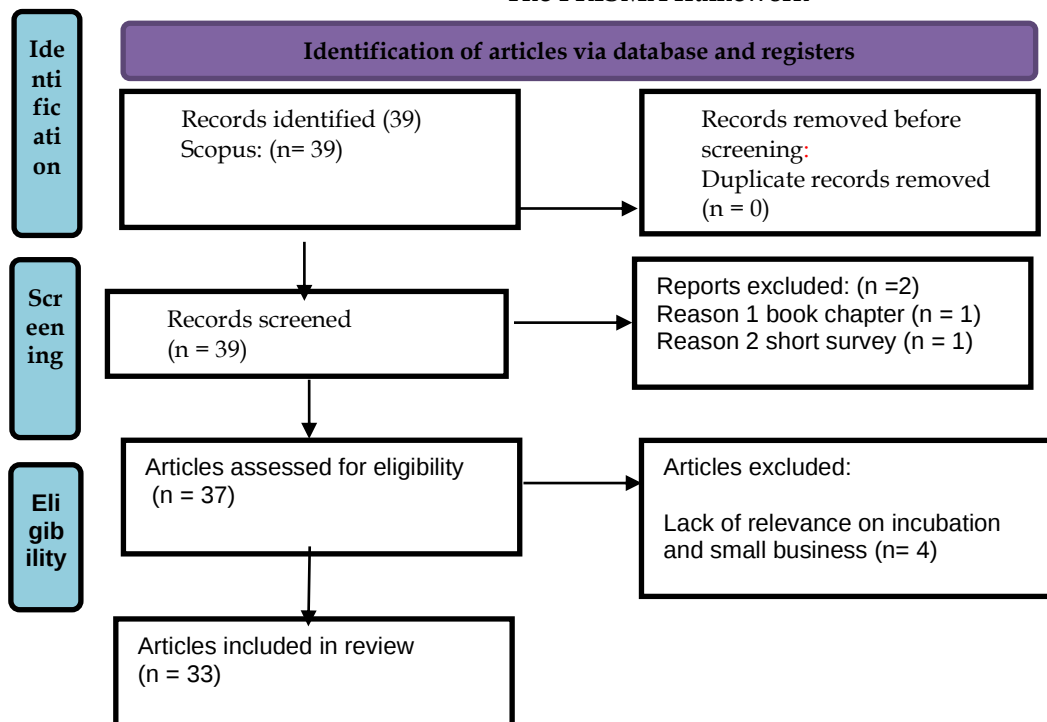
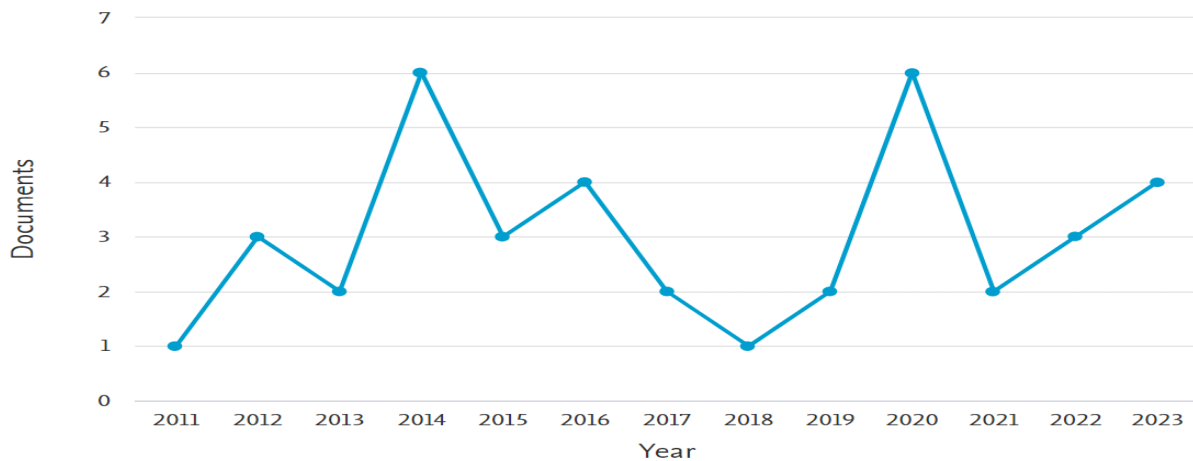


Figure 1: The PRISMA framework for article inclusion**Results****Descriptive results:**

We needed to process and analyse data from the Scopus database in relation to the published publications year after year, documents by country, documents by affiliation, top institutions contributed to business incubation and funding sponsor. The results of these activities are presented below.

Documents by year**Figure 2: Documents by year**

The quantity of published publications year after year reflects trends in a specific academic subject. Analysing past trends can help predict future ones. Scholars have recently focused on small business incubation across Africa, Europe, and Asia only since around 2011. Though the volume of available publications has risen from only one in the beginning to 2020 till the end of 2021 (see Figure 2), academic interest in the subject matter remained relatively low for seven years as the release of publications stagnated between one and two articles per year, with a marked publication drought in 2013. Between 2019 and 2021, there was generally a slight increase in the average rate of article release, despite some fluctuations in quantities in 2019 and 2020. During this period, a maximum of six articles were published yearly. The trend suggests that in the future, many more scholars may join and contribute to the advancement of this research domain, which is slowly receiving attention from the scientific community. However, it must be noted that the eleven-year aggregate of 20 publications and the recent fluctuations in the number of articles published yearly appear to signal maturation problems within the regulatory compliance related to the protection of personal information in research. Notably, in 2021 there is a decline in publication and an increase in 2024 and 2023 due to adoption of 4IR technologies by business incubators. However, there is a need to deepen the research on the implementation and effect of the 4IR technologies.

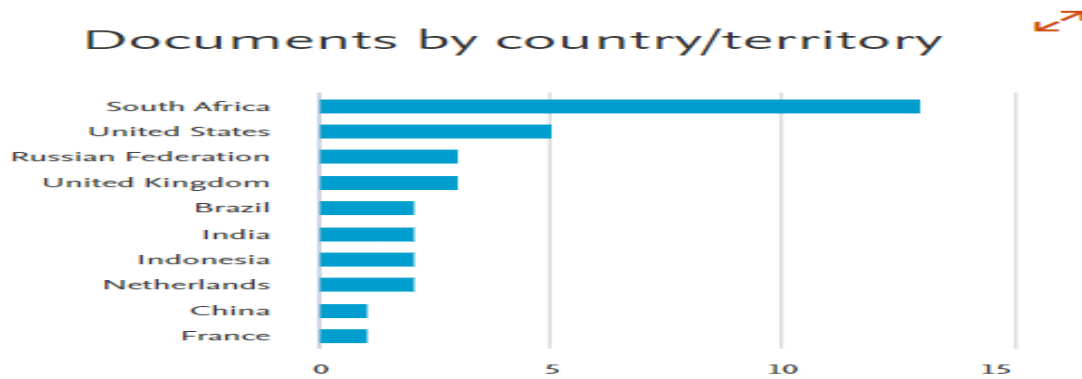


Figure 3: Documents by country

The contribution and the international collaborations between these major countries of various countries to the topic are represented in Figure 3. The 33 articles on incubation and small business originated from 9 countries from four geographical regions (i.e., Asia, Africa, North America and Europe). South Africa and United State published the highest number of articles (13 South Africa and five United States), followed by Russia and the United Kingdom with three publications each, while Brazil, India, and Indonesia had two publications each. Finally, two countries, China and France contributed one publication each to the ongoing discussions on incubation and small business through 4IR.

Documents by author

Compare the document counts for up to 15 authors.

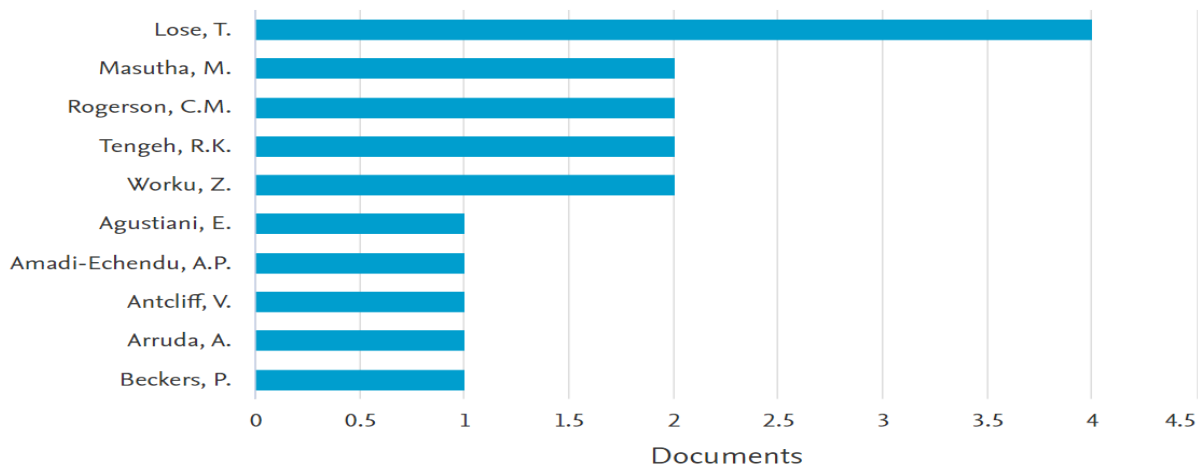


Figure 4: Document by authors

Figure 4 above shows that out of 39 articles, single author (Lose T.) contributed 4.5 (8.7%), while 6 (0.2%) articles were contributed by joint authors (Masutha M., Rogerson C.M., Tengeh R.K. and Worku Z.

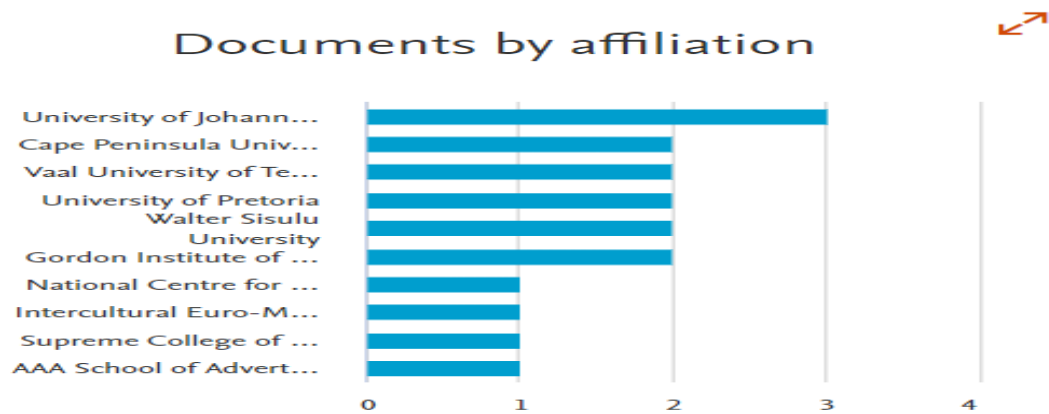


Figure 5: Documents by affiliation

Five institutions contributed to research on incubation and small business in Africa. Together, the top five active institutions were responsible for most publications on the topic (Figure 5). The list of top five institutions was jointly dominated by University of Johannesburg with 3 articles while Cape Peninsula University, Vaal University of Technology, University of Pretoria and Walter Sisulu University followed with 2 each.

Findings

The BSC, as explained earlier is based on strengthening four perspectives which were considered in this study. These are the financial perspective, the internal perspective, the learning perspective, and the customer perspective. The study explored the relevance of the BSC perspective for redesigning the operations of the operations of small business incubators in the present technological era. The results of the study as reported in this section are based on perceptions obtained on the four perspectives of the BSC. Descriptive statistics on the perspectives of the 250 incubators which participated in this study are reported on. In the section that follows, the results in relation to the internal perspective of the BSC as relevant to redesigning the operations of small enterprise incubators in the 4IR context are discussed.

Relevance of the internal perspective of the BSC in redesigning the functions of small business incubators

The statement ‘Fourth industrial revolution technologies facilitate internal efficiencies in redesigning the operations of small business incubators in South Africa’ was first considered for analysis. Table 3 shows key descriptive statistics associated with the responses analysed.

Table 3: Perceptions on the statement ‘Fourth industrial revolution technologies facilitate internal efficiencies in redesigning the operations of small business incubators’

		Value	C ount	Pe rcent
Standard attributes	Label	Fourth Industrial Revolution technologies facilitate Internal efficiencies.		
Central tendency and Dispersion	N	Valid 250		
		Mean 1.94		
		Standard Deviation .925		
	Percentile 25	1.00		
	Percentile 50	2.00		
Labeled Values	Percentile 75	3.00		
	1	Strongly Agree	97	38.6%

2	Agree	84	33.5%
3	Neutral	58	23.1%
4	Disagree	8	3.2%
5	Strongly Disagree	3	1.2%

As shown in Table 3, the majority (38.6% of the 250 respondents) strongly agreed that 4IR technologies facilitate internal efficiencies. There was also better agreement (33.5% of respondents) that 4IR technologies improve internal efficiencies. Neutrality that 4IR technologies facilitate internal efficiency was also notable (23.1%) while there was low agreement (3.2% of respondents) that 4IR technologies facilitate internal efficiency. A very minimal number of participants (1.2%) strongly disagreed that 4IR technologies facilitate internal efficiency. Additionally, a mean of 1.94, which is lower than 2.5, indicated better agreement with the statement considered in Table 3.

The study also considered perceptions of incubators on the adoption of current technologies to improve internal incubation processes and the results are shown in Table 4. This was meant to establish the relevance of 4IR technologies in improving the internal processes of small business incubators in the South African context.

Table 4: Perceptions on the statement 'Incubators should adopt current technologies to improve their internal processes'

		Value	Count	Percent
Central Tendency and Dispersion	Label	Incubators should adopt current technologies to improve their internal processes.		
	Type	Numeric		
	Valid	250		
	Mean	2.20		
	Standard Deviation	.896		
	Percentile 25	1.00		
	Percentile 50	2.00		
	Percentile 75	3.00		
Labeled Values	1	Strongly Agree	64	25.5%
	2	Agree	86	34.3%
	3	Neutral	88	35.1%
	4	Disagree	10	4.0%
	5	Strongly disagree	20	8.0%

As provided in Table 8, the majority (35.1%) were neutral while 34.3% agreed with the statement that incubators should adopt current technologies to improve their internal processes. 0.8% strongly disagreed compared to 25.5% who strongly agreed with the assertion, and only 4% disagreed with the statement. It

was clear that while the tendency was to be neutral, there was also higher agreement with the statement as compared to lack of agreement.

Following literature assertions that 4IR technologies inspire the adoption of new strategies associated with remodeling business processes, this study sought perceptions of respondents on their degree of agreement that the 4IR revolution enriches the internal vision for the incubation function. The results are presented in Table 5 below.

Table 5: Perceptions on statement 'Fourth industrial revolution enriches the internal vision for the incubation function'

		Value	Count	Percent
Standard Attributes	Label	Fourth industrial revolution enriches the internal vision for the incubation function.		
N	Valid	250		
	Mean	3.93		
	Standard Deviation	4.555		
Central Tendency and Dispersion	Percentile 25	3.00		
	Percentile 50	3.00		
	Percentile 75	4.00		
Labeled Values	1	Strongly Agree	1	0.4%
	2	Agree	32	12.7%
	3	Neutral	117	46.6%
	4	Disagree	80	31.9%
	5	Strongly disagree	15	6.0%

As indicated in Table 5, respondents were generally neutral (46.6%) with regard to the statement that 4IR technologies enrich internal vision for the incubation function. 31.9% disagreed, 12.7% agreed, 0.4% strongly agreed, and only 6% strongly disagreed. As such, respondents were generally unsure how 4IR technologies can be taken to enrich the internal vision of incubators. The internal processes of business incubators require professionals in specialized processes such as mentoring and training.

The study explored perceptions on whether 4IR technologies can improve internal processes through the capacity to engage these various professionals. The results are shown in Table 6.

		Value	Count	Percent
Standard Attributes	Label	Technology is key to facilitate hiring of mentors, trainers and consultants who have the best talents and experience in incubation.		
N	Valid	250		
	Mean	3.24		
Central Tendency and Dispersion	Standard Deviation	2.662		
	Percentile 25	3.00		

Labeled Values	Percentile 50	3.00		
	Percentile 75	4.00		
	1	Strongly Agree	8	3.2%
	2	Agree	43	17.1%
	3	Neutral	30	51.8%
	4	Disagree	5	22.3%
	5	Strongly disagree	1	4.8%
			2	

The results in Table 6 show a high neutral (51.8%) to the statement that 'Technology is key to facilitate hiring of mentors, trainers and consultants who have the best talents and experience in incubation'. There was also a higher tendency (mean=3.24) to disagree with the statement. 22.3% disagreed with the statement as opposed to agreement (17.1% of respondents agreed) with the statement. 4.8% strongly disagreed while 3.2% strongly agreed with the statement. This suggests that generally respondents were not sure about the role of technology in facilitating the hiring of mentors, trainers and consultants in the process of redesigning their operations.

Relevance of the financial perspective of the BSC in redesigning the functions of small business incubators

The BSC also includes a financial perspective which was also considered in this study. The study explored perceptions on the argument that digital technologies aid financial management of incubators for increased survival and operational efficiency. Table 7 shows the descriptive statistics on the statement that 'Digital technologies aid financial management of incubators for increased survival and operational efficiency'.

Table 7: Perceptions on the statement 'Digital technologies aid financial management of incubators for increased survival and operational efficiency'

		Value	Count	Percent
Standard Attributes	Label	Digital technologies aid financial management of incubators for increased survival and operational efficiency.		
	N	250		
Central Tendency and Dispersion	Valid	1		
	Missing	3.25		
	Mean	.958		
	Standard Deviation	Percentile 25		
	Percentile 50	3.00		
	Percentile 75	3.00		
		4.00		
Labeled Values	1	Strongly Agree	16	6.4%
	2	Agree	28	11.2%
	3	Neutral	99	39.6%

4	Disagree	9	36
		2	.7%
5	Strongly disagree	1	6.
		5	0%

A mean response of 3.24 shows a greater propensity to disagreement that digital technologies aid financial management of incubators for increased survival and operational efficiency. The majority (39.4%) of the responses were neutral, while 36.7% disagreed and 6% strongly disagreed. Low agreement rates (11.2% agreed and 6.4% strongly agreed) were evidenced in this study. The learning perspective was considered as provided in the section that follows.

Relevance of the learning perspective of the BSC in redesigning the functions of small business incubators in the 4IR context

Table 8 shows the results associated with the assertion that technology facilitates incubator learning.

Table 8: Perceptions on the statement 'Technology facilitates incubator learning'

		Value	C	Pe
			ount	rcent
Standard Attributes	Label	Technology facilitates incubator learning.		
N	Valid	250		
	Missing	1		
	Mean	2.04		
	Standard	.935		
	Deviation			
Central Tendency and Dispersion	Percentile 25	1.00		
	Percentile 50	2.00		
	Percentile 75	3.00		
Labeled Values	1	Strongly Agree	8	32
			1	.3%
	2	Agree	9	38
			7	.6%
	3	Neutral	5	22
			7	.7%
	4	Disagree	1	4.
			1	4%
	5	Strongly disagree	4	1.
				6%

There was higher agreement (38.7%) that technology facilitates leaning among the small business incubators which participated in this study. 32.3% strongly agreed with the assertion while 22.7% were neutral. 4.4% disagreed with the statement and only 1.6% of the respondents strongly disagreed. A mean of 2.04 also suggested a higher tendency to agree that technology can facilitate learning among small business incubators.

The study also investigated the perceptions of the respondents of the statement that 'Technology can be used for development of incubation activities through wider exposure to information'. This was considered within the learning perspective since organisational learning and development are related concepts in business analysis. Table 9 shows descriptive statistics on the perceptions of respondents in relation to the argument that technology can be used for development of incubation activities through wider exposure to information.

Table 9: Perceptions on the statement 'Technology can be used for development of incubation activities through wider exposure to information'

		Value	C ount	Pe rcent
Standard Attributes	Label	Technology can be used for development of incubation activities through wider exposure to information.		
Central Tendency and Dispersion	N	Valid	250	
		Missing	1	
		Mean	2.24	
		Standard Deviation	.926	
	Percentile 25		2.00	
	Percentile 50		2.00	
	Percentile 75		3.00	
Labeled Values	1	Strongly Agree	58	23.1%
	2	Agree	96	38.2%
	3	Neutral	78	31.1%
	4	Disagree	14	5.6%
	5	Strongly disagree	44	16.9%

The majority (38.2%) agreed that technology can be used for development of incubation activities through wider exposure to information, 23.1% of the 250 respondents strongly agreed with statement. The neutral response was also notable (31.1%) compared to the rates of disagreement (5.6%) and strong disagreement 91.6%).

The perceptions of respondents of the view that present technologies should be adopted to improve an incubator's efficiency were also considered and the descriptive statistics were as shown in Table 10.

Table 10: Perceptions on the statement 'Present technologies should be adopted to improve an incubator's efficiency'

		Value	C ount	Pe rcent
Standard Attributes	Label	Present technologies should be adopted to improve an incubator's efficiency.		
Central Tendency and Dispersion	N	Valid	250	
		Missing	1	
		Mean	2.56	
		Standard Deviation	.765	
	Percentile 25		2.00	
	Percentile 50		3.00	
	Percentile 75		3.00	
Labeled Values	1	Strongly Agree	25	10.0%
	2	Agree	76	30.3%

3	Neutral	1	53
		34	.4%
4	Disagree	1	5.
		4	6%
5	Strongly disagree	1	0.
			4%

While the majority (53.3%) of the respondents were neutral to the statement that the present technologies should be adopted to improve an incubator's efficiency, 30,3% agreed and 10% strongly agreed with the statement. Disagreement with the statement was generally low, 5.6% disagreed and only 0.4% strongly disagreed with the statement.

Relevance of the customer perspective of the BSC in redesigning the functions of small business incubators.

The fourth element of the BSC as discussed in this section relates to the customer perspective of the BSC. The studied considered the views of the respondents on statements that 4IR technologies can be adopted for better engagement with prospective and former incubatees who are the customers of business incubators. The responses are provided in Table 11.

Table 11: Perceptions of the statement 'Fourth industrial revolution technologies can be adopted for better engagement with prospective and former incubatees'

		Value	C ount	Pe rcent
Standard Attributes	Label	Fourth industrial revolution technologies can be adopted for better engagement with prospective and former incubatees.		
N	Valid	250		
	Missing	1		
	Mean	2.36		
	Standard Deviation	4.112		
Central Tendency and Dispersion	Percentil e 25	1.00		
	Percentil e 50	2.00		
	Percentil e 75	2.00		
	1	Strongly Agree	101	40.2%
	2	Agree	95	37.8%
Labeled Values	3	Neutral	37	14.7%
	4	Disagree	9	3.6%
	5	Strongly disagree	4	1.6%

There was strong (40.2%) agreement that 4IR technologies can be adopted for better engagement with prospective and former incubatees. This was also supported by a large number of respondents (37.8%) who agreed that 4IR technologies can be adopted for better engagement with customers. 14.7% were neutral and 3.6% disagreed while 1.6% strongly disagreed.

Table 12 provides descriptive statistics in relation to perceptions on the view that 4IR technologies can improve satisfaction with incubation services.

Table 12: Perceptions of the statement 'Fourth Industrial revolution technologies can improve satisfaction with incubation services.'

		Value	Count	Percent
Standard Attributes	Label	Fourth Industrial revolution technologies can improve satisfaction with incubation services.		
N	Valid	250		
	Missing	1		
	Mean	2.56		
	Standard Deviation	.918		
	Percentile 25	2.00		
	Percentile 50	3.00		
	Percentile 75	3.00		
Central Tendency and Dispersion	1	Strongly Agree	42	16.7%
	2	Agree	56	22.3%
	3	Neutral	126	50.2%
	4	Disagree	23	9.2%
	5	Strongly disagree	3	1.2%
Labeled Values				

The majority (50.2%) of the respondents were neutral that 4IR technologies can improve satisfaction with incubation services, 22.3% agreed, 16.7% strongly agreed and 9.2% disagreed while only 1.2% of the respondents strongly disagreed.

Table 13 presents descriptive statistics on the view that: use of recent technologies improves the efficiency of incubators. This was important considering that efficiency is likely to lead to improved customer satisfaction with the incubation services.

Table 13: Perceptions on the statement 'Use of recent technologies improves the efficiency of incubators'

		Value	Count	Percent
Standard Attributes	Label	Use of recent technologies improves the efficiency of incubators		
N	Valid	250		
	Missing	1		
	Mean	3.05		
Central Tendency and Dispersion	Standard Deviation	.897		
	Percentile 25	3.00		

Labeled Values	Percentile 50	3.00		
	Percentile 75	4.00		
	1	Strongly Agree	1	4.
	2	Agree	4	19
	3	Neutral	1	48
	4	Disagree	5	22
	5	Strongly disagree	1	5.
			3	2%

The majority (48.2%) were neutral that use of recent technologies improves the efficiency of incubators. 22.7% disagreed while 19.1% agreed and 4.4% strongly agreed compared to 5.2% who strongly disagreed with the assertion. These responses suggest that the incubators were generally neutral on the potential of recent technologies in improving incubation services.

Discussion of the results of the study

The responses provided in this study were interpreted using frequency of responses within Likert scales as well as considering the mean response as a measure of central tendency. A mean of 2.5 suggested the neutral response; the lower the mean below 2.5, the higher the agreement with the statement being analysed; while the higher the mean above 2.5, the higher the level of disagreement to a statement. A summary of the mean response as well as the minimum and maximum values as well as the standard deviation within the Likert scales is provided as Table 14 below.

Table 14: Summary of descriptive statistics for the study

		Mini mum	Maxi mum	Mean	Std. Deviation
Fourth industrial revolution technologies facilitate Internal efficiencies.	250	1	5	1.94	.925
Incubators should adopt current technologies to improve their internal processes.	250	1	5	2.20	.896
Present technologies should be adopted to improve an incubator's efficiency.	250	1	5	2.56	.765
Digital technologies aid financial management of incubators for increased survival and operational efficiency.	250	1	5	3.25	.958
Technology facilitates incubator learning.	250	1	5	2.04	.935
Technology is key to facilitate hiring of mentors, trainers and consultants who have the best talents and experience in incubation.	250	1	5	3.08	.844
Technology can be used for development of incubation activities through wider exposure to information.	250	1	5	2.24	.926
Fourth Industrial Revolution technologies can improve satisfaction with incubation services.	250	1	5	2.56	.918
Use of recent technologies improves the efficiency of incubators.	250	1	5	3.05	.897
Fourth industrial revolution enriches the external vision for the incubation function.	250	1	5	3.13	.869
Fourth industrial revolution enriches the internal vision for the incubation function.	250	1	5	3.29	.805
Valid N (listwise)	250				

Agreement was very high (mean <2) with the statement that 4IR technologies facilitate internal efficiencies. This finding relate to results of such studies as that of Lose and Khuzwayo (2021) as well that of Raji, Olodo, Oke, Addy, Ofodile and Oyewole (2024). Strong disagreement (mean>3) was observed in

relation to such statements as: 'Fourth industrial revolution enriches the internal vision for the incubation function'; 'Fourth industrial revolution enriches the external vision for the incubation function'; 'Use of recent technologies improves the efficiency of incubators'; 'Technology is key to facilitate hiring of mentors, trainers and consultants who have the best talents and experience in incubation'; and 'Digital technologies aid financial management of incubators for increased survival and operational efficiency'. At the same time neutrality was suggested regarding the statements: 'Incubators should adopt current technologies to improve their internal processes'; 'Present technologies should be adopted to improve an incubator's efficiency'; 'Technology facilitates incubator learning'; and 'Technology can be used for development of incubation activities through wider exposure to information'. These results seem to indicate low appreciation of the capacity to improve incubation services through the BSC perspective that is facilitated by recent technologies. The findings have failed to support earlier studies such as Lose and Khuzwayo (2021) as well as Shehada et al. (2020), which found the BSC to be a vital tool for the operations of small enterprises. The high neutral response may be taken to indicate low adoption and use of 4IR technologies, resulting in weak appreciation of the various implications of using 4IR technologies for the various incubation services.

Limitations and future research

The study followed a quantitative approach which failed to establish the reasons for responses provided by respondents. Future research could take a closer look at the relevance of the BSC in redesigning small business incubators' operations through a mixed approach or simply qualitative research approach to allow the respondents to give descriptive reasons for their responses. Future studies may also consider the use of the BSC in the technological age across various economic sectors. This may be vital to expose sector-specific variables that affect the adoption of 4IR technologies in the offering of small business incubation services.

Conclusion

Bibliometric techniques are being used for a variety of purposes like determination of various scientific indicators, evaluation of scientific output, selection of journals for libraries and even forecasting the potential of a particular field. The popularity in the adaptation of bibliometric techniques in various disciplines stimulated stupendous growth of literature on bibliometrics and its related areas. This study was necessitated by observations that enterprises across sectors are operating in a changed business environment, and some traditional business models have become irrelevant. This is attributed partly to wide technological changes that have meant new ways of operating and satisfying new needs. Special focus is on small business incubators which are expected to remain vibrant and ensure that they are effective in strengthening the operations of small entities. In essence the small business incubators face a need to redesign to meet new needs of incubatees. The present study explored a BSC perspective for the redesign of small business entities in the technological context associated with the 4IR. It considered the internal, learning, financial and customer perspectives for the redesign of small business incubators. The study found weak appreciation of 4IR technologies, resulting in lack of knowledge on how 4IR technologies can be pivotal in their redesign. The study recommends further studies to foster better appreciation of the BSC as a necessary tool for business model redesign in the technological context.

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