THE EFFECT OF SERVICE DELIVERY AUTOMATION (SDA) ON THE SOUTH AFRICAN BANKING INDUSTRY

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ABSTRACT

Adoption of automation has become the norm in the South African banking industry, owing to competition. Conventional banking institutions are uncertain of the possible adverse effects of integrating automation into banking processes to serve more customers with fewer resources. This study sought to investigate and model the extent to which the integration of automation could be the exogenous factor of the nine endogenous factors identified in this study. The five most prominent banking institutions in South Africa, were used as a case study. The study used a quantitative approach, and 223 bank employees were selected to contribute to the questionnaire survey, and the primary data were analysed using the structural equation modelling (SEM) technique to test the proposed hypotheses. The secondary information was extracted from the banks' annual integrated reports and fact sheets to generate additional insights into the primary data findings. The findings revealed that service delivery automation is a significant and direct predictor of productivity, efficiency, flexibility, operations costs, and the generation of new job opportunities (positive effects). Similarly, the adoption of bank automation was found to be significantly related to the generation of job losses, the changing nature of work, unbalanced demand for required skills, and inequality in wages of employees, which are described as adverse effects.

OPSOMMING

As gevolg van mededinging, het die aanneming van outomatisering die norm in die Suid-Afrikaanse bankbedryf geword. Konvensionele bankinstellings is onseker oor die moontlike nadelige gevolge van die integrasie van outomatisering in bankprosesse om meer kliënte met minder hulpbronne te bedien. Hierdie studie poog om die mate waarin die integrasie van outomatisering die eksogene faktor van die nege endogene faktore wat in hierdie studie geïdentifiseer is, te ondersoek en te modelleer. Die vyf mees prominente bankinstellings in Suid-Afrika, is as gevallestudie gebruik. Die studie het 'n kwantitatiewe benadering gebruik, en 223 bankwerknemers is gekies om by te dra tot die vraelysopname, en die primêre data is ontleed deur gebruik te maak van die strukturele vergelyking modellering (SEM) tegniek om die voorgestelde hipoteses te toets. Die sekondêre inligting is uit die banke se jaarlikse geïntegreerde verslae en feiteblaaie onttrek om bykomende insigte in die primêre databevindinge te genereer. Die bevindinge het aan die lig gebring dat dienslewering outomatisering 'n beduidende en direkte voorspeller is van produktiwiteit, doeltreffendheid, buigsaamheid, bedryfskoste en die generering van nuwe werksgeleenthede (positiewe effekte). Net so is gevind dat die aanvaarding van bankoutomatisering beduidend verband hou met die generering van werkverliese, die veranderende aard van werk, ongebalanseerde vraag na vereiste vaardighede en ongelykheid in lone van werknemers, wat as nadelige gevolge beskryf word.

1. INTRODUCTION

The world is on the verge of the fourth industrial revolution, in which technological advances occur. Innovation in artificial intelligence (AI) enables sophisticated applications such as robotic assistance, analytical data science, biometrics, autonomous vehicles, virtual assistants, and computerised manufacturing [1]. The service sector is affected by these technological breakthroughs. The banking industry has integrated automation into some of its repetitive business processes to keep up with technological innovation. The competitive environment in which the banking industry operates is paramount [2].

Banks in South Africa, as in any part of the world, are subject to the strategic use of automation that is driven by artificial intelligence, digitalisation, digitisation, and advanced applications. The manner in which banks operate could drastically change over the next decades as technology and customers' preferences are constantly redefined [3,4]. This dictates the new way in which technology needs to be used and, therefore, the new way in which banks need to interact with customers. The use of service delivery automation has transformed the conventional banking institutions' way of interacting with customers – for instance, a new procedure of making deposits, getting financial statements, and effecting money transfers – in order to keep up with customer preferences [5] and with the increasing competition in the industry.

Nevertheless, from banking industry leaders' perspective, integrating service delivery automation into business operations is to increase productivity and flexibility in operations, generate job opportunities, be more efficient in operations, and reduce the operational costs of interacting with customers wherever possible [6]. However, there is an ongoing debate among labour economists about the place of the workforce in the new service delivery chain. The argument is that the loss of job opportunities, inequality in wages, changes in the nature of work, and skill-biased technical change could be caused by the adoption of automation in the service delivery chain of the banking industry [7]. [8] reported that the disruption caused by the integration of service delivery automation in the banking industry is significant. This disruption may have a positive or an adverse influence, which is seen as its 'side-effects'. Specifically, automation could improve banks' operations; but it could also have a negative impact from an employee's perspective. Various scholars have asserted that there is still confusion about what service delivery automation (SDA) is capable of bringing to the banking industry as a whole [43].

1.1. Problem statement

The paper discusses the influence that service delivery automation (SDA) can have on the nature of the banking industry. It has been revealed that conventional banking institutions are transcending the traditional operating system and moving into a more automated landscape to improve the service delivery chain and serve more customers with fewer resources. Similarly, it has been shown that measures of smart-driven technology, which is part of the automation ecosystem, have been adopted by banking institutions in order to increase their productivity, efficiency, and flexibility in their operations, reduce operational costs, and generate new job opportunities. These components are known as the positive effects. Conversely, it has been revealed that – despite the use of automated processes to improve operations – there is still alarming confusion about the side effects or adverse effects of the adopted automation on the banking industry. SDA could be considered as a critical problem because, from the labour market's perspective, it has shown the potential to bring about job losses (the creation of unemployment), changing the nature of work, creating an unbalanced demand for the required skills, and leading to inequality in the wages of employees. Accordingly, there has been an ongoing debate between labour economists, policymakers, industry leaders, and bank decision-makers about the use of smart technology in the service sector and about whether it is advantageous for all, because the use of technology is relevant only when it has a positive and transformative impact on people.

1.2. Significance of the study

The significance of this paper is to create an awareness of the impact of the integration of service delivery automation on the nature of the banking industry's business model. The reason is that the banking industry is still striving to adapt its operations, especially repetitive ones, to the emerging innovative technology. Therefore, an awareness flag should be raised to provide empirical evidence to the industry leaders, policymakers and decision-makers on the potential relationships between the implementation of service delivery automation and the nine exogenous factors identified in the conceptual framework of the study.

1.3. Proposed conceptual framework

This framework gives a clear picture of the purpose of this study, as it shows the potential relationship paths between the adoption of bank automation (the independent factor) and the model's nine dependent factors: the creation of job opportunities, operations costs, efficiency, flexibility, productivity, generation of job losses, the changing nature of work, wages inequality, and skill-biased technical change (Figure 1 below).

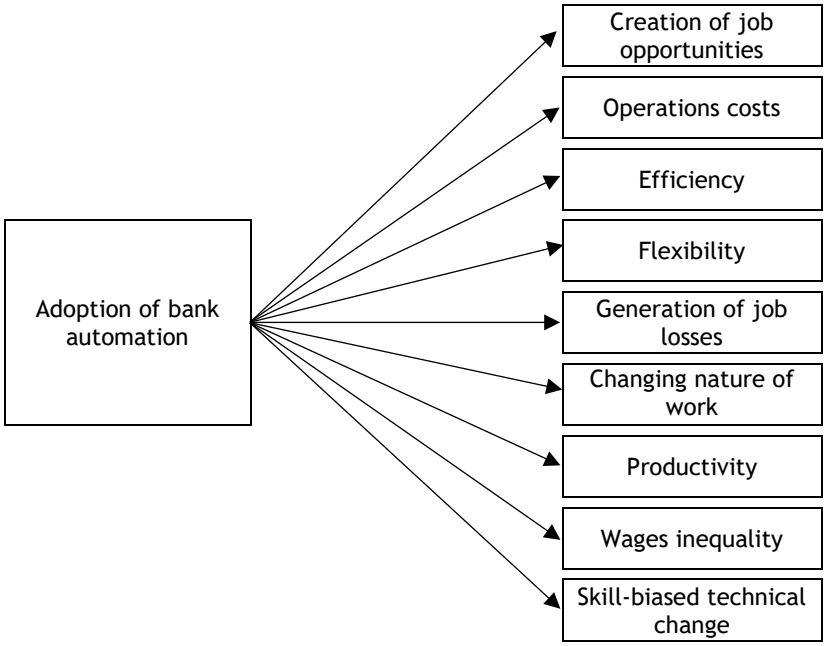

Figure 1: Proposed conceptual framework

A substantial review of the literature demonstrated and required the adoption of a double quantitative model to investigate the impact of service delivery automation systems on the five largest banks in South Africa. Thus the conceptual framework above sets out the hypothesised relationship paths between the independent variables that constitute the adoption of bank automation and the dependent variables that make up the nine factors shown in Figure 1. This is significant in establishing the constructs for hypothesis development.

2. LITERATURE REVIEW

2.1. Overview of service delivery automation (SDA)

Competition in the banking industry has dramatically changed the entire sector over the years. Part of this change has resulted in the development and use of alternative delivery channels that use advanced technologies. In recent years, the integration of technology to deliver services has seen an exponential increase in the banking industry, and it is currently making a significant impact on customers' perceptions and preferences and, ultimately, on financial services' productivity [18]. According to [19], service delivery automation is an umbrella concept: a series of human activities are automated by means of technologies in the delivery chain. Service delivery automation is simply the capacity to complement innovative technologies that can simplify business processes and reduce disruption. Similarly, not all technologies are seen as automated practices that could subsequently replace human activity. A mathematical equation on a spreadsheet, for example, should not be called 'automation'. Automation can be done gradually, although certain stages will still require human participation [20]. A mixture of several technological features can be used to automate service delivery. Traditional business process management (BPM) systems, for example, can be improved by merging them with modern robotic process tools. Instead, a cognitive artificial intelligence tool could assist in structuring and cleaning data before it is processed by a process tool that identifies exceptions that must be addressed manually. Also, the entire process does not have to be totally automated; nonetheless, partial automation is extremely beneficial or recommended, and it is the most popular strategy in the service sector nowadays [44].

Given the increased competition and the cognitive complexity of service automation, especially in the banking industry, banking institutions are now using the 'partial automation approach' to match up with technological innovation in order to provide outstanding banking solutions to their customers [21]. [22] states that the technology revolution and the implications of artificial intelligence in financial services are reshaping the new world of banking, in which customers have the full power to interact and process directly their different banking transactions anywhere, anytime. Technology has changed how banks operate by providing a new range of services and products to improve the integration of automated delivery channels. The automated delivery channels are mobile and internet banking applications and the most advanced automated teller machines (ATMs) [20].

[19] acknowledges that the digital revolution and the proliferation of the latest technologies allow us to say with confidence that the age of automation is upon us. The banking industry, previously known as a conservative industry, has undergone radical transformations over the last few years. Given the prevalence of several labour-intensive activities in the banking industry, it is clearly unsurprising that the sector has been leading in integrating service delivery automation solutions. Service delivery automation is the key to the future of the service sector. It has proven to be a real game-changer for the manufacturing sector and the service sector – specifically the banking industry – with personalised platforms that drive the better and timely execution of all processes related to banking.

In the same sense, [22] argues that the main purpose of service automation is to improve productivity and quality, and especially to enhance convenience in service delivery. Thus various banks are stepping up to the integration of the recent service automation technologies to deliver the next stream of productivity, cost savings, quality services, and, ultimately, to enhance customer experiences. With the end results being the drivers so far, banking institutions believe that making every effort count earlier will eventually yield the advanced and intelligent transformation of banks that can master the new techniques and skills required by integrating the automation system into processes.

There are banks that have success stories about the integration of automation systems into their repetitive processes; but there are other banks that still face sobering difficulties [22]. Many banks have proceeded with installing hundreds of robots and software programs capable of automating repeated processes or activities. Those banks still have very little to show in respect of effectiveness and efficiency. [23] acknowledges that some banks have deployed a range of tactical pilots without a long-range plan, leading to problems and confusion in scaling up. Other banking institutions have given advanced training to their pioneers, but have been unable to drive the results to the next level. Thus many banks have started to deploy service delivery automation, only to realise that they do not have the required abilities to drive the operations forward, much less create a transformative banking environment.

[24] insists that the future is bright despite early setbacks in integrating service delivery automation through the use of technologically-based assistance in banks' functions. As technology gradually evolves, the domain of expertise is settling between the banks and the service vendors, so that many are refraining from the 'one-solution-fits-all' or the 'hammer and nail' philosophy and adopting a more customised approach to solutions. Banks are definitely in a position to learn critical lessons about workflows in this new era [25] – for instance, how to manage efficiently the handoff between machines and men in designing systems that may negatively affect human actions.

[22] asserts that, in years to come, the second wave of automation powered by AI will emerge, with smart technologies performing more than 20 per cent of labour activities across the banks' functional areas, expanding capacity and enabling employees to focus on activities and projects that require human intellect. Banking institutions must adopt a proactive rather than a reactive strategy to seize these potentialities. In other circumstances, they will need to create new optimised processes in line with automated work and consider in-house and external people with skills to drive automation efficiently.

2.2. Substantial and integrated deployment of technology will become a norm

Almost all conventional banks have embraced the automation revolution. Adopting advanced technology in the banks' operations has become an ideal and strategic direction to follow in the years ahead [26]. Table 1 below shows the core strategic slogan propositions that have been initiated to reflect the importance of advanced technology integration now and in the future.

Table 1: The strategic key technological value slogans of South African banks

Bank	Key strategic value slogans
A	We are building a scalable, digitally-led business
B	We are encouraging virtual money management by providing value-adding internet and customised banking functionalities
C	We provide digital platforms to deliver cost-effective and innovative transactional solutions to our clients
D	We are building a digital, agile, and competitive banking system for the future
E	We position ourselves to appraise the disruption scale sweeping through financial services

Source: Adapted from [27]

Table 1 shows that the South African banking environment cannot be penetrated without significantly deploying service delivery automation metrics, which are hugely important to operational strategies. Competitiveness, economies of scale, efficiency, innovation, simplicity, and cost reduction are the key strategic drivers that automation and artificial intelligence's values are capable of offering to support the slogan propositions. For instance, the FirstRand Group prides itself on being innovative and strategically disruptive through implementing service delivery automation. It was reported [28] that, by the year 2017, roughly eight per cent of FirstRand's total sales were digitally processed, which was considered a key driver for growth. In addition,[29] argues that the digitisation of its banking operations means that technological deployment becomes an essential and necessary stage in banking. On the other hand, bank A explicitly focuses on integrating technology innovation in a new strategic path post-Barclays, based on the bank's separation strategy [30].

[31] has reported on the speech of the Director of Wealth and Investment for Bank E, Shaun Kotwal, who argued that the investment and wealth management markets are ripe for upheaval. Inefficiencies in large paper trails, as well as excess fat in the system, have created gaps that one could call upon technology to address. Thus the bank is working towards a fully digital experience, from origination through onboarding to processing, facilitated by advanced technology developments. Going from advice to execution is still usually a lengthy procedure; however, speed and efficiency could improve, making it a less painful experience. Better digital goods and services powered by emerging technologies such as blockchain, AI, the Internet of Things, and seamless back-end procedures and operations will surely be transformative players for the future wealth management business [33].

The South African banking landscape is increasingly changing, and the economic rebalancing of the industry is driving significant changes. The expectations of different stakeholders, especially regulators, customers, investors, and the community at large, are also important drivers that are reshaping the South African banking industry, which is dominated by five banks: A, B, C, D, and E. These banks have, therefore, turned to technological innovation to meet or exceed their clients' expectations [32].

3. MATERIALS AND METHODS

To address the impact of service delivery automation on the nature of the banking industry, this research considered the five prominent banking institutions in South Africa banks (A, B, C, D, and E) as a case study. These banking institutions were once regarded as conventional or traditional, characterised by the use of the physical footprint (branches/outlets) to provide financial solutions to their customers. They are now moving into a more automated landscape to improve their banking operations and to serve more customers with fewer resources. This means that non-traditional banking institutions (those without a physical presence) were not part of the scope of this study.

A double-quantitative approach was followed to understand the phenomenon. The first quantitative approach used data acquired from a questionnaire survey (the primary data), in which 223 employees were selected to share their perceptions of the phenomenon. The data were analysed using the structural equation modelling (SEM) technique to test the relationships between the *adoption of automation* and the

nine measurement factors: *productivity, efficiency and flexibility in operations, operations costs, generation of job opportunities, job losses, changing nature of work, unbalanced demand for required skills,* and *inequality in the wages of employees*. Thus the adoption of bank automation was made up of five independent variables or items. In turn, the productivity, efficiency in operations, operations costs, generation of job opportunities, and job losses were each made up of five dependent variables or items. The changing nature of work, the unbalanced demand for required skills, and inequality in the wages of employees were measured with four dependent variables each. However, the flexibility construct was made up of three dependent variables after changes (see Table 2 in section 4.1.1 below).

Going back to the design of the primary quantitative data collection measuring instrument, it was the author's own design or self-development initiative to reflect the problem at hand. The measuring instrument or questionnaire used five-point Likert-scale scores to ease the completion of the questionnaire from a participant's perspective and significantly to align the potential results with the research objectives. The data collection was done using LinkedIn, which displays the profile of participants, meaning that they were purposefully selected on the basis of their experience and level of seniority (profile) in their banks. To reduce bias, the researcher used a Google Form questionnaire to avoid missing or incomplete information.

The second quantitative approach considered the secondary data obtained from the banks' annual integrated reports and fact sheets, which were used as an additional approach to the primary data analysis to a certain extent. Thus the focus was on the statistical number of bank branches/outlets and employees of the five banks from 2015 to 2021 to make statistically based inferential conclusions.

3.1. Measurement of construct

3.1.1. Content validation of the study

Regarding content validation, this study used a method that enabled the instrument to assess appropriate and important deductions or, alternatively, to make decisions on the basis of the scores of the instrument easier. This study's construct measures were highly reliable, and aligned most strongly with previous research in a related field. A panel of two academic researchers and professionals from the University of Johannesburg Statistical Consultation Services, known as Statkon Consultancy, primarily validated the questionnaire items reflecting the concepts at hand. This, therefore, provided the basis for locating the study's findings in the context of existing theories. In addition, the researcher combined two validities – discriminant and convergent – in order to ensure the construct's unbiased status. Those are described in the section below.

4. RESULTS AND DISCUSSION

4.1. Primary data

4.1.1. Structural model testing: Primary findings

In addition to content validation, construct validity is determined by two components: convergent and discriminant validity [38,39]. Both convergent and discriminant validity use coefficients to accept or reject an assertion of construct validity [39]. According to [38], convergent validity refers to "the degree to which two measures of constructs that theoretically should be related are, in fact, related. In brief, convergent validity tests [whether] the constructs that are expected to be related are, in fact, related". However, "discriminant validity is the extent to which a measure does not correlate with other constructs from which it is supposed to differ" [40]. Specifically, convergent validity is more concerned with the items of a construct positively correlating to measure that construct. In contrast, discriminant validity is more concerned with a weak or negative correlation between items of different constructs (cross-loading).

In assessing convergent and discriminant validity, the standardised loadings, composite reliability, and measurement of constructs were assessed by considering the confirmatory factor analysis (CFA) of the proposed model. Thus each construct showed satisfactory composite reliability, which led to an average composite reliability of 0.91, and the standardised loadings of each construct were all above the standardised loading value of 0.30, except for the loading scores of item 13 and item 26 respectively under the factors 'job opportunity' and 'flexibility'. This implied that the instrument did not demonstrate the best convergent validity, but was considered acceptable, as almost all construct items were positively

correlated to measure what they were intended to measure under each construct. Regarding the discriminant validity, the fact that item 13 and item 26 were poorly correlated under their respective factor/construct showed that those items measured factors other than their assigned/initial factors. By performing the exploratory factor analysis (EFA), the two items (13 and 26) seemed to correlate well with items of the factor/construct 'job opportunities'. In turn, this indicated that the measurement did not fully accommodate the discriminant validity despite other constructs supporting the discriminant validity principles stated above. With that in mind, further factor analysis using EFA would identify and label the new factors considering the average variance extracted. That average variance extracted (AVE) was greater than all corresponding construct correlations, which was evidence of the discriminant validity of the constructs [35, 36, 37]; and this evidence could be used in potential future studies to justify further the discriminant validity of the research instrument.

A stepwise process of eliminating the items contributing most to the lack of fit was executed in the CFA. It was clear that item 26 made less of a contribution to the construct 'flexibility', and the removal of that item seemed to improve the model fit of the construct. On the other hand, item 13 did not have a significant impact on measuring the construct 'job opportunities', but was retained, thus conserving the threshold number of items for the scale of a construct [34]. That resulted in the total number of 47 items being retained. In the confirmatory factor analysis that was conducted, despite certain fit indices showing negligible fluctuations or negligible inconsistent values, the overall fit statistics revealed an adequate level of fit indicators (shown in the table below), and this was largely sufficient to reach the objectives set for the analysis of the hypotheses of the model.

Table 2: The overall fit of the model based on each construct

Fit measures / Measurement models	Overall model fit					Composite reliability
	Model fit model comparison		Model fit model comparison			
	CMIN/DF (x^2/df)	SRMR	CFI	IFI	TLI	
Job opportunities	11.4315	0.093	0.093	0.836	0.839	0.81
Operations costs	7.4488	0.056	0.922	0.923	0.845	0.92
Efficiency	8.2373	0.073	0.915	0.916	0.906	0.90
Flexibility	1.252	0.03	0.989	0.989	0.990	0.78
Generation of job losses	3.1281	0.037	0.986	0.986	0.971	0.92
Changing nature of work	5.737	0.023	0.995	0.995	0.984	0.91
Productivity	0.435	0.007	1.00	1.00	1.00	0.90
Wage inequality	1.2585	0.009	0.999	0.999	0.998	0.91
Skill-biased technical change	1.247	0.012	0.999	0.999	0.997	0.87

CFI: comparative fit index, TLI: Tucker-Lewis index, IFI: incremental fit index, SRMR: standardised root mean square residual, DF: degrees of freedom.

4.1.2. Hypothesis testing and discussion

A set of hypotheses was formulated and tested to come up with insights to understand the impact and influence of automation in the banking industry. The test was based on the output of the SEM. In addition, the comparison of the significant and non-significant paths is reported and discussed in this section; it took the form of the hypothesised paths' significance or non-significance, as shown in Table 3 below.

4.1.3. Adoption of bank automation and the creation of job opportunities: ABA → JOBO

The standardised estimated path coefficient beta for the relationship was greater than zero (β= 0.578) at a p-value less than 0.05 (p=0.000); similarly, the t-value was found to be 8.83 (t>1.96) for hypothesis H_1. These results were in line with the study conducted by AERA [9]. The findings implied that *hypothesis 1* (H_1) was supported because the relationship between the adoption of bank automation and the creation of job opportunities was strongly significant. Alternatively, the more a bank adopts new automation technologies, the more job opportunities are created. Employees of the five banks were aware that the implementation of service delivery automation had the potential to create a significant number of job opportunities. This led to the question of whether the types of job opportunity being created by the adoption of automation in the five banks of interest were within the reach of all employees.

Table 3. Hypotheses testing

Proposed hypotheses	Paths	SEM output: Proposed model			Results*
		Standardised (**β**)	t-value (t)	p-value	
H_1 The adoption of the automation system in the bank generates more new job opportunities than job losses.	ABA → JOBO	0.578	8.83	0.000	Supported
H_2 Adoption of automation tends to lower the bank's daily operations costs.	ABA → OPC	0.601	9.92	0.000	Supported
H_3 The more service delivery channels are automated, the greater the number of tasks that can be efficiently accomplished.	ABA → EFF	0.685	12.94	0.000	Supported
H_4 Adoption of automation tends to increase the flexibility of banking operations.	ABA → FLEX	0.622	12.99	0.000	Supported
H_5 The more banks automate processes, the more low-skilled jobs are lost/displaced.	ABA → JLOSS	0.279	4.08	0.000	Supported
H_6 The adoption of the automation system in the bank changes the nature of staff work.	ABA → CHAN	0.513	7.71	0.000	Supported
H_7 The more banking processes are automated, the more productivity increases.	ABA → PROD	0.573	9.10	0.000	Supported
H_8 The adoption of service delivery automation leads to wages inequality.	ABA → WIN	0.349	5.12	0.000	Supported
H_9 The adoption of the automation system in the bank creates unbalanced demand for staff skills.	ABA → SKILL	0.449	6.50	0.000	Supported

Note: *ABA = Adoption of bank automation, JOBO = Creation of job opportunities, OP C= Operations costs, EFF = Efficiency, FLEX = Flexibility, JLOSS = Generation of job losses, CHAN = Changing nature of work, PROD = Productivity, WIN = Wages inequality, SKILL = Skill-biased technical change.*

4.1.4. Adoption of bank automation and operations costs: ABA → OPC

The findings of the SEM through the path model provided strong positive support for the hypothesised relationship between the adoption of bank automation and operations costs (*hypothesis 2*), justified by the value of beta 0.60 at p=0.000 and the t-value of 9.92. These results suggested that a high degree of bank automation tends to reduce the overall operations costs of the five banks. The positive relationship between the adoption of bank automation and operations costs is consistent with the theoretical arguments about the reduction of internal costs that other scholars have advanced [10,11,12]. Specifically, the results of the studies suggested that adopting bank automation to enhance customer experience is imperative to cut out unnecessary operations or processes [13]. Furthermore, these results validated the assertion that, despite the initial costs that may be incurred during the implementation of automation systems, the ultimate result is the benefit of sustainable cost reduction that comes with implementation [14].

4.1.5. Adoption of bank automation and efficiency: ABA → EFF

The standardised estimated path coefficient beta (β) for the relationship between the adoption of bank automation and efficiency is 0.69 (greater than 0) at p= 0.000 with a t-value of 12.94. Based on the theory built for the analysis of the path model results, there is support for *hypothesis 3*. These results suggest that the adoption of bank automation is a significant direct predictor of banking efficiency. The employees of the five banks (A, B, C, D and E) support the fact that when their banks adopt new technology practices, it is to contribute to the transformation of operations, and employees are able to deliver more customised services to clients in a manner that demonstrates the efficiency of the banks' activities.

4.1.6. Adoption of bank automation and flexibility of banking operations: ABA → FLEX

The SEM results displayed in Table 3 (*hypothesis 4*) show that the relationship between the adoption of bank automation and the flexibility of banking operations exhibited a strong positive relationship. This implies that technological-based practices related to the automation of service delivery, as initiated by each of the five largest banks in South Africa, directly affect the flexibility of their operations. This finding is consistent with the theory reported by [15, 16], who established constant volatility between the technologies implemented by companies, including banks and the degree of flexibility that could come along. This reinforces the hypothesised theory, favouring the causality effect of adopting bank automation on the flexibility aspects of banking operations.

4.1.7. Adoption of bank automation and generation of job losses: ABA → JLOSS

The regression coefficient of the direct path between the adoption of bank automation (ABA) and generation of job losses (JLOSS) (estimated standardised β value of 0.28 with a p-value of 0.000 and a t-value of 4.08) in the model provides strong significant support for *hypothesis 5*. This finding indicates that the higher degree of relative automation deployed by the banks has a direct positive effect on the level of generation of job losses. Specifically, more processes are automated in banking institutions. The more certain jobs are lost or potentially displaced within banks or outside the banks. This further asserts that the deployment of automation technologies is a potential source of job disruption within the banking industry. However, there is confusion between this section's results (ABA → JLOSS) and the finding of hypothesis 1 (ABA → JOBO). The secondary data analysis is considered to clarify the confusion (See Figure 2 and Table 4).

4.1.8. Adoption of bank automation and changing nature of work: ABA → CHAN

The finding exhibits that the adoption of bank automation has a solid and positive direct effect on the changing nature of work within the five largest banks (A, B, C, D and E) in South Africa (*Hypothesis 6*). This finding asserts that the increased use of technologies-based practices in conventional/traditional organisations, including banks, is becoming dynamic in the sense that employees with the ability to work across different functions and business environments are increasingly valuable. Therefore, organisations need to adjust how they view their employees.

4.1.9. Adoption of bank automation and productivity: ABA → PROD

The SEM findings displayed in Table 3 support strongly support *hypothesis 7*. This confirms that the more processes or activities are automated, the more productivity levels increase in the banks. Technologically-

based practices such as digitisation have a significant direct effect on the overall productivity of the five concerned banks. The efficient use of machines allows bank employees to speed up certain activities to serve more customers. Moreover, the overview of the annual banking integrated reports revealed that the digitisation of banking operations means that technological deployment becomes an essential and necessary stage in banking in terms of service delivery, thus meeting productivity targets.

4.1.10. Adoption of bank automation and wage inequality: ABA → WIN

The relationship between the adoption of bank automation and wage inequality received significant positive support in the model analysis. Accordingly, hypothesis 8 is supported by statistically significant results in the proposed model. This finding agrees that the adoption of advanced technologies provides exceptional and adaptable services to customers and, in some cases, can lead to inequality in wages for employees for any given organisation. The rise in the deployment of automated processes or activities significantly affects the conventional workforce's activities or procedures. Thus, some employees may be privileged compared to others within the banks. This is the reason some employees are able to reap the full benefits that come along with the adoption of bank automation. Consequently, *hypothesis 8* demonstrates that the more adoption of bank automation increases, the more the wage inequality phenomenon is observed across the five largest banks in South Africa. Furthermore, employees with the necessary and required skills (to match the automating era) are subject to receiving high monetary benefits, unlike the rest, who tend to lack the skills or knowledge to match up with the trending technology practices in service delivery.

4.1.11. Adoption of bank automation and skill-biased technical change: ABA → SKILL

According to [41], an important feature of technological progress is that it tends to be skill-biased. It increases demand for certain skills in the banking labour market while decreasing demand for others. The integration of automated machines into certain banking operations has, for example, decreased the demand for humans at certain levels of the service delivery chain while increasing the demand for skills associated with the development, advisory, consultancy and maintenance of machines such as ATMs. The direct relationship between the adoption of bank automation (ABA) and Skilled-biased technical change (SKILL) is non-negligible. That being the case, *hypothesis 9* is supported by statistically significant results in the proposed model of the study. From this perspective, implementing bank automation systems to enhance customers' experiences tends to disrupt the banks' operations because certain employees receive benefits or advantages on the basis of their skills. This implies that employees with the most needed skills are favoured because of their potential value-added spectrum. Therefore, this creates a significant biased gap between skilled and low-skilled employees. The confirmed correlation between the adoption of bank automation and skill-biased technical change demonstrated that the more banks integrate a consistent approach into the deployment of service delivery automation, the more unbalanced demand for skilled employees is created within the banks. The descriptive statistics also found that less-skilled employees (31.8 per cent) were not content with the practices of service delivery automation. The conceptual differentiation in this instance is that, ideally, the adoption of automation was supposed to be advantageous for all employees regardless of the position occupied or the division of activities.

4.2. Secondary data analysis

To bring additional insights and clarity to the results of the primary data (SEM), the secondary data analysis was considered. It was necessary to review and trim the initial framework to fit the approach of the secondary data analysis because the information selected was useful only for some variables. This, therefore, speaks to some of the effects of disadvantages related to the use of secondary data in research. According to [42], the primary data are usually collected with a concrete idea in mind, such as answering a research question or meeting certain objectives. Thus the current secondary data may be inappropriate due to the nature of circumstances or phenomena. In this case, the current secondary data may lack certain quality specifics because the data were originally collected for different purposes or had a different scope. [42] suggested that when secondary data are deemed inappropriate to answer the research questions of the study, the same secondary data can be used to partially provide some elements of the answer to the research questions of the proposed model. Consequently, the framework was subjected to trimming to make the secondary data meaningful to the study. Thus the banks' annual integrated reports and fact sheets were analysed with an emphasis on the number of employees and the number of branches/outlets from 2018 to 2021, as displayed in Figure 2 and Table 4.

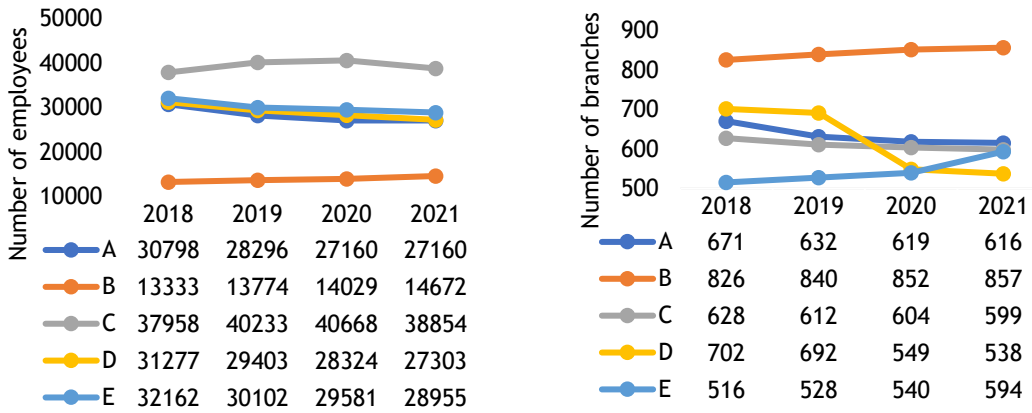

Figure 2. The trend in the number of employees and branches per year from 2018 to 2021

Table 4. The number of bank branches and employees per year from 2018-2021

Bank	Number of branches/outlets					Number of employees				
	2018	2019	2020	2021	% difference (2018-2021)	2018	2019	2020	2021	% difference (2018-2021)
A	671	632	619	616	-8	30798	28296	27160	27160	-12
B	826	840	852	857	4	13333	13774	14029	14672	10
C	628	612	604	599	-5	37958	40233	40668	38854	2
D	702	692	549	538	-23	31277	29403	28324	27303	-13
E	516	528	540	594	15	32162	30102	29581	28955	-10
TOTAL	3343	3304	3164	3204	-4	145528	141808	139762	136944	-6

It is important to note that the interpretation of the summarised information presented in Figure 2 can take different forms depending on the purpose of the research and the inferential understanding and other factors may influence the current results to some extent, but without denial service delivery automation is the central factor in this context. Thus in 2018, there were 3343 bank branches (for all five banks) fully functional countrywide, against 3204 branches in 2021; that is a significant decrease of 4 per cent in the total number of bank branches (Table 4). Alternatively, 139 bank branches were closed between 2018 and 2021 for all five banks together. As the banks reduce the number of branches around the country, this implies that the possible job opportunities that can arise at those branches are displaced or lost because the banks' physical footprint is no longer available. Adversely, bank B and Bank E registered an increase in the number of branches with a difference percentage of 4 per cent and 15 per cent, respectively. The increase in the number of branches for Bank B could be justified by the fact that the bank is a novice and still has to establish its footprint across the country and make itself known to customers despite being part of the Big Five. For Bank E, the increase is due to their new objective of reaching communities in rural areas to deliver services to clients who do not often have access to urban facilities. Furthermore, by the end of December 2021, there were a total of 136944 employees compared to 145528 employees in 2018. That is a decrease of 6 per cent in the number of employees across the five banks countrywide. Besides, this indicates that the bank's current strategy is to move towards an automated environment, which negatively affects the bank's physical footprint, despite Bank B slightly increasing its number of employees across the countries. It is equally essential to note that the COVID-19 pandemic impacted the physical footprint of the banking industry as a whole because some branches were temporarily shut down during that period and, later on, shut down completely.

However, this interpretation seems to conflict with the primary finding for hypothesis 1, which supports that "the adoption of the automation system in the bank generates more new job opportunities than job losses". Alternatively, the more a bank adopts new automation technologies, the more job opportunities are created. To bring clarity to the statement, it is clear that the banks are inclined to digitisation and

digitalisation; this tends to generate new types of job opportunities that did not exist before to accommodate the banking transformation. Banks are now forced to put more effort into building digital platforms to serve more customers. In this case, new types of job opportunities arise from the adoption of automation (which are not within reach of all employees), while some other job opportunities are lost due to the shutting down of branches. In addition, this suggests that despite a few new job opportunities being generated by the adoption of automation, but only a few employees qualify to potentially take on those new opportunities and other employees are simply excluded and face potential job losses due to the automation-based landscape. Thus the adoption of bank automation still has the overall tendency to generate job losses across the industry.

5. CONCLUSION

The model identified the adoption of service delivery automation (SDA), with the adoption of bank automation as its expression, as the measurement predictor for the nine dependent measurement factors: the creation of job opportunities, operations costs, efficiency, flexibility, generation of job losses, changing nature of work, productivity, inequality in wages, and skill-biased technical change. The finalised SEM results demonstrated that the relationship between the exogenous variables in the model factor 'adoption of bank automation' and the latent variables under each model factor was found to be statistically significant. Therefore, service delivery automation, as an umbrella concept to the adoption of bank automation is a direct predictor for the nine latent model factors. It was also possible to create a discrepancy between positive influence/impact and adverse influence. Specifically, on the one hand, the primary objective of these banking institutions adopting automation into processes or operations is to improve productivity, reduce operations costs, efficiency and flexibility in operations, and create new types of job opportunities. This means the more technology-driven practices are incorporated into the banking operating systems, the more these variables increase; they can be referred to as having a positive impact. On the other hand, side-effects have been created along with the positive impact of service delivery automation, whereby the greater the level of SDA, the more job losses are generated, the more change in the nature of work, and the more there is inequality in wages, and the more imbalance is created in labour skill requirements (skill-biased technical change). Accordingly, the additional insights of the historical statistical information inferentially alluded that the closure of certain bank branches, which implies certain job opportunities being lost in the process, is the result of integrating automation-based practices into the banking operating landscape.

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