A SYSTEM DYNAMICS APPROACH TO POSTAL DIGITAL TRANSFORMATION DYNAMICS: A CAUSAL LOOP DIAGRAM (CLD) PERSPECTIVE

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ARTICLE INFO

Article details
Submitted by authors 9 Sep 2021
Accepted for publication 8 Jul 2022
Available online 14 Dec 2022

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DOI
http://dx.doi.org//10.7166/33-4-2592

ABSTRACT

Postal operators across the globe are faced with inescapable business model disruptions in the era of the digital economy, and Southern Africa is no exception. The advent of the digital age presents both opportunities and threats to business models of the industrial age, as digitalisation has led to the sustained decline of mail volumes as the core business of the postal service for the past 100 years. The replacement of traditional physical mail with electronic alternatives was a spectre that haunted the postal service for more than two decades; and the arrival of the digital age has accelerated the decline of mail volumes at an unprecedented speed as it spreads through almost every sector of society and as the digital economy becomes the preferred platform for conducting business. The digital economy requires postal operators to develop digital competitiveness, which entails investment in digital infrastructure and skills, and to transform their business model in the context of the digital age. The complex dynamics of the process of digital transformation necessitate a systems approach to understanding those dynamics. System dynamics can be a significant tool for comprehending behaviour, especially dynamic behaviour. This paper adopted a high-level modelling approach in which a dynamic hypothesis was developed through the articulation of a sub-system diagram that articulated the dynamic variables at play, a model boundary chart that articulated the nature of the variables (which are both exogenous and endogenous), and causal loop diagrams that explain the dynamic feedback relationship between the variables. This paper focused on the digital transformation imperatives to build the digital competitiveness of the postal sector in Southern Africa. The results point to the complex interaction of the variables that drive the digital competitiveness of the postal sector; and it is by comprehending these complexities that decision-makers and policymakers could steer the postal sector on to a digital-age path and into a sustainable future.

OPSOMMING

Posoperateurs regoor die wêreld word in die era van die digitale ekonomie gekonfronteer met onafwendbare sakemodel ontwrigtings - Suider-Afrika is geen uitsondering nie. Die koms van die digitale era bied beide geleenthede en bedreigings vir sakemodelle van die industriële era, aangesien digitalisering die afgelope 100 jaar gelei het tot die volgehoue afname van posvolumes as die kernbesigheid van die posdiens. Die vervanging van tradisionele fisiese pos met elektroniese alternatiewe was 'n tendens wat by die posdiens vir meer as twee dekades gespook het; en die koms van die digitale era het die afname van posvolumes teen 'n ongekende spoed versnel soos dit deur byna elke sektor van die samelewing versprei en namate die digitale ekonomie die voorkeurplatform word om sake te doen. Die digitale ekonomie vereis dat posoperateurs digitale mededingendheid ontwikkel, wat investering

in digitale infrastruktuur en vaardighede behels, en om hul sakemodel in die konteks van die digitale era te transformeer. Die komplekse dinamika van die proses van digitale transformasie noodsaak 'n sisteembenadering om daardie dinamika te verstaan. Stelseldinamika kan 'n belangrike hulpmiddel wees om gedrag te begryp, veral dinamiese gedrag. Hierdie artikel het 'n hoëvlak modelleringsbenadering aangeneem waarin 'n dinamiese hipotese ontwikkel is deur die artikulasie van 'n subsisteemdiagram wat die dinamiese veranderlikes gedefinieer het, 'n modelgrenskaart wat die aard van die eksogene en endogene veranderlikes definieer, en oorsaaklike lusdiagramme wat die dinamiese terugvoerverhouding tussen die veranderlikes verduidelik. Hierdie artikel het gefokus op die digitale transformasie-imperatiewe om die digitale mededingendheid van die possektor in Suider-Afrika uit te bou. Die resultate dui op die komplekse interaksie van die veranderlikes wat die digitale mededingendheid van die possektor dryf; en dit is deur hierdie kompleksiteite te begryp dat besluitnemers en beleidmakers die possektor op 'n digitale-era-pad en in 'n volhoubare toekoms kan stuur.

1. BEYOND MAIL: AN INTRODUCTION

Ranganathan and Dey [1] argued that it is obvious that the postal service sector is caught in a vicious cycle of poor financial performance that triggers a lack of digital investment, thus preventing either improvements in the quality of service or further expansion, which produces even lower levels of use of the sector and declining mail volumes because of digitisation, which further reinforces the vicious cycle of declining mail volumes, poor financial performance, low investment, and poor quality of service. The postal sector performs an essential task in fostering socio-economic development. Affordable, cost-effective, and universal postal services significantly reduce transaction costs between economic agents, giving them entry to the substantial communication and infrastructure network that the postal sector has globally. In this sense, the postal sector actively contributes to the achievement of the United Nations' sustainable development goals [2].

Lasi *et al.* [3] argued that the industrial sector has always been vital to the economic development of countries; and since the end of the 18th century, organisations have gone through mammoth changes that have revolutionised how goods are produced and services are rendered, and that have yielded numerous benefits, predominantly related to efficiencies and productivity. The postal sector, because of its sheer size and impact, is noteworthy for the employment that it supports and the proportion of GDP that it generates. It has played a significant role in the industrial age – or, as it is commonly called, the machine age [1]. Today, after three preceding industrial revolutions, the combination of advanced technologies and the internet age is completely transfiguring the industrial landscape. It is labelled the 'Fourth Industrial Revolution' (or, in its application in industry, 'Industry 4.0') [4].

The advent of the Fourth Industrial Revolution has brought the world to the cusp of the digital era that is transforming society and organisations across the world at unprecedented speeds. Organisations that are at the forefront of the digital innovation curve are known as 'adopters', while laggards that resist innovation are eventually swept away by the digital tide that is disrupting business models and changing the face of business as we know it.

The United Nations Conference on Trade and Development [5] argued that, although the changes in digital disruption and transformation differ, all nations are being affected by these tectonic-like shifts. The postal sector is not immune to these sweeping and unprecedented shifts, which have prompted the postal sector around the world to expand its services well beyond the original service of postal operators, which was the delivery of mail [6], and to venture into new digital business models with the aim of excelling in the four dimensions of postal development, defined as reliability, relevance, resilience, and reach.

Fonseca [7] postulated that the Fourth Industrial Revolution is characterised by enhanced digitalisation and the integration of industrial manufacturing, logistics processes, the use of the internet, and 'smart' items (machines and products). The adoption of information and communications technology (ICT) is integrating the physical and cybernetic worlds into what are called cyber-physical systems (CPSs), which consist of the online networking of social machines, thus connecting ICT with mechanical and electronic components that communicate among themselves through a network. Digitalisation is greatly reducing the costs of amassing, storing, and processing data, thus transforming commercial activities around the world. Digital technologies open the way for micro-, small, and medium-sized enterprises, especially those in developing countries, to take part in the global market through e-commerce. UPU [8] argues that digital revolution requires changes to existing legal and regulatory frameworks, and has enormous implications for the transformation of the postal sector.

Renowned digital innovations, spearheaded by organisations such as Amazon, Spotify, Apple Music, Airbnb, Netflix, Alibaba, and TiVo, are disrupting business models in their respective industries. Despite the perceptible influences of digital innovations and the resultant digital transformation and its disruptive impact on business models across all industries, the academic literature has not focused on digital transformation in the postal sector. Another notable shortcoming in the body of knowledge is the lack of sufficient literature on the modelling of digital transformation dynamics in a dynamic setting to understand fully the interaction of digital transformation variables.

In this paper, we endeavour to explore and reflect on the digital transformation dynamics and to invigorate future research by offering strategic direction in the field of postal digital transformation dynamics. This paper is grounded on three objectives: first, to identify the endogenous and exogenous variables that are at play in the postal digital transformation dynamics; second, to demonstrate overtly the dynamic feedback links between the variables in each sub-system; and third, to articulate a research agenda that directs future research on postal digital transformation dynamics.

The research questions that arise from the three research objectives are:

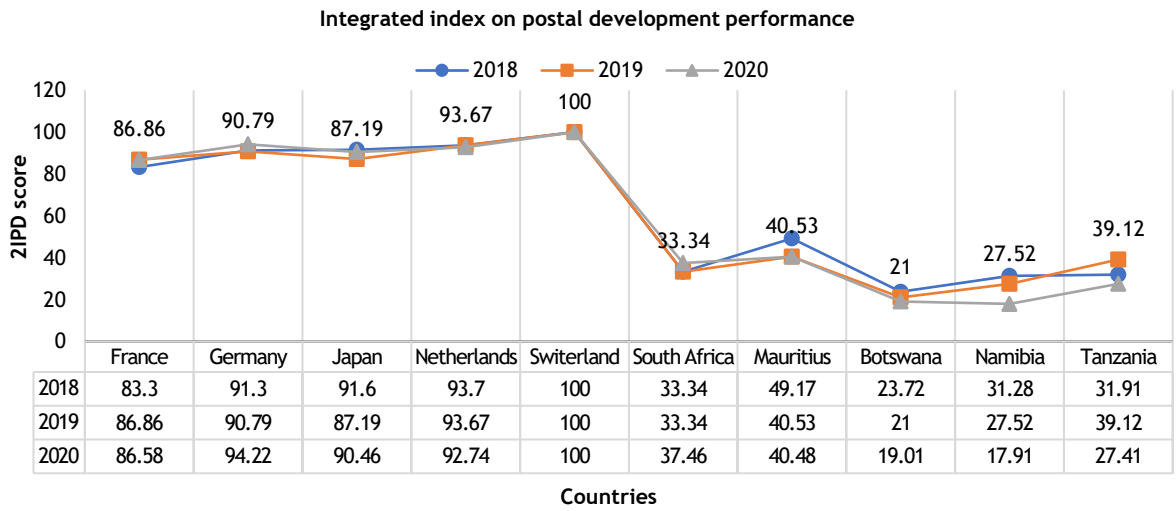
(a) What endogenous and exogenous variables are at play in the postal digital transformation dynamics?

(b) What are the dynamic feedback links between variables in the holistic system and in the sub-systems?

(c) What future research could be triggered to stimulate and support further work on postal digital transformation dynamics?

1.1. Problem articulation

The crises that have befallen designated postal operators (DPOs) in Southern Africa have precipitated the near collapse of the postal sector because of poor performance on the four performance indicators on the integrated index for postal development (2IPD). This is supported by the score that each postal operator in Southern Africa obtained on the 2IPD. The calamity is depicted in Figure 1, which articulates the conundrum faced by Southern Africa, mirrored against the performance of the postal sector in developed countries.



	France	Germany	Japan	Netherlands	Switerland	South Africa	Mauritius	Botswana	Namibia	Tanzania
2018	83.3	91.3	91.6	93.7	100	33.34	49.17	23.72	31.28	31.91
2019	86.86	90.79	87.19	93.67	100	33.34	40.53	21	27.52	39.12
2020	86.58	94.22	90.46	92.74	100	37.46	40.48	19.01	17.91	27.41

Figure 1: 2IPD performance

The incontestable fact revealed in Figure 1 is the massive gap between postal operators in developed countries and those in Southern Africa. Switzerland remains the undisputed leader with its unparalleled and solid performance in its integrated index on the postal development score, which measures four dimensions: reliability, relevance, reach, and resilience. According to UPU [9], 'reliability' reflects performance in speed and predictability of delivery across all the key segments of physical postal services. 'Reach', on the other hand, synthesises global connectivity by evaluating the breadth and depth of a postal operator's international network. The 'relevance' dimension measures the intensity of demand for the full portfolio of postal services relative to the best performers in each category of postal activity and considers elements such as the number of international transactions and the number of post offices. Last, 'resilience' indicates the level of diversification of revenue streams, as well as the capacity to innovate and deliver inclusive postal services. The capacity to innovate and diversify into new revenue streams, as measured by the resilience dimension, means that leading postal operators such as Swiss Post are leading the charge in the postal sector in the digital transformation arena. It is not by mistake but by design that Swiss Post is the unparalleled leader in the 2IPD score.

The underperformance by the postal sector in Southern Africa is fuelled by many dynamics, including inflexible or rather outdated business models that are not adapting with the necessary traction to the digital age that is enormously disrupting current business models. Business models of the 19th and 20th centuries cannot compete in the 21st century; and this results in most postal operators in Southern Africa posting losses every year. The unsustainability of DPOs leaves the governments in their respective countries with no option but to bail them out at a considerable cost to taxpayers.

The next section reviews the literature on system dynamics, which is an insightful tool to understand dynamic behaviour, which, in this study, is in the context of postal digital transformation dynamics.

2. LITERATURE REVIEW

Although some postal operators have been innovative and successful in their endeavours, there are very few, if any, scientific studies that demonstrate how that success has been achieved and sustained by postal operators that are at the top of the Universal Postal Union's 2IPD and the digital readiness index. This study seeks to use a system dynamic approach to show how the postal sector in Southern Africa can achieve digital competitiveness by understanding complex systems in the postal sector in the context of digital transformation, and by ascertaining how dynamics interact with one another causally in a dynamic setting.

The United Nations Conference on Trade and Development [5] asserted that the digital economy continues to advance rapidly, propelled by the capacity to collect, use, and analyse colossal amounts of machine-readable information (digital data) about practically anything. These digital data arise from the digital footprints of personal, social, and business activities taking place on various digital platforms. Global

digitalisation has altered not only the economic but also the social vision of the world. The digital era is defined by unceasing flows of data encompassing information, knowledge, ideas, and innovations. Having completed industrialisation, developed countries are successfully digitalising their economies and are rapidly developing innovative technologies, with artificial intelligence, automation, and digital platforms being pervasive [10]. This contention correlates with postal operators in developed countries performing well on the 2IPD.

Kane *et al*. [11] argued that the ability to reimagine enterprises is attained in large measure by a clear digital strategy that is supported by leaders who foster a culture that is able to change and invent the new. It comes as no surprise that Swiss Post has continued to dominate the first position on the 2IDP over time: Swiss Post realises that it is not technology that drives digital transformation, but strategy. Strategy is a complex phenomenon that requires a systems approach because of the complex interaction of dynamic variables.

The Universal Postal Union (UPU) [12] argued that, although the public might instinctively link 'posts' with letters and stamps, their span of activities is much wider. Beyond the ordinary delivery of letters, many postal operators all over the world have been building significant enterprise capabilities in areas as diverse as parcels and logistics, financial services, and even e-government, healthcare, and other public services. The winds of change that are sweeping around and radically changing the world as we know it, disrupting business models in every industry, undoubtedly arrived in the postal sector's backyard. The advent of these winds of change has brought the postal sector opportunities as well as threats. The reality is that the postal sector should transform to remain relevant as it competes with native digital companies in different areas of their product portfolio. To be able to compete effectively, postal operators need to speed up the digitalisation of their products and services. UPU [8] means that postal operators that have not fully digitalised need to do so with the necessary urgency, or risk being excluded as digital service providers for e-government, e-commerce, and e-finance services.

Mokgohloa *et al*. [13] identified ten postal digital transformation variables at work in a dynamic setting in Southern Africa: digital ecosystem capability, adoption, shared vision maturity, digital culture maturity, customer insights, diverging interests, operational excellence capability, digital investment capability, digital capabilities, and digital competitiveness capability. The research aims to understand the dynamic feedbacks between these variables by defining a dynamic hypothesis through the articulation of system boundary and development influence diagrams or causal loop diagrams. The work then reviews system dynamics as an approach to understanding feedback behaviour in a dynamic setting.

2.1. System dynamics

To explore the current state of research in the domain of system dynamic modelling in the context of digital transformation, the literature review delves into the application of causal loop diagrams (CLDs) to understand the cause-and-effect relationships and feedback processes between variables. This view was reinforced by Palanta et al. [14] argues that a causal diagram is a conceptual tool for the elucidation of the association between variables, in which the effects can be traced to the original cause through a set of related variables. Andersen et al. [15] suggested that a CLD is a diagrammatic artefact that captures the causal model and feedback structure underlying a problem situation.

This section of the paper aims to provide an overview of system dynamics and to provide a review of system dynamics' CLDs that have been implemented in the domain of digital transformation.

2.1.1. A snapshot of system dynamics

Sterman [16] argued that well-intentioned energies to resolve persistent difficulties often create unforeseen side effects. Actions based on decisions taken provoke unforeseen reactions, and the result is policy resistance, which can be defined as the tendency for interventions to be defeated by the response of the system to the intervention itself. Maldonado [17] suggests that system dynamics is better positioned to fix this blind spot that characterises human mental models, which completely miss the mark because of their inability to see the whole. System dynamics modelling has been developed as a method and tool (a) to elicit such feedback loops to discover the main growth, balancing, and erosion (stagnation) mechanisms driving the dynamic behaviour of socio-economic systems; (b) to reproduce – that is, to simulate – the system's dynamic behaviour using differential equations; and (c) to test and design better policies that lead to improved system performance.

Maldonado [17] postulated that the modelling process in system dynamics is iterative between all five main steps: (a) problem articulation; (b) dynamic hypothesis; (c) model formulation; (d) model testing (validation); and (e) policy formulation/evaluation. Richardson [18] contended that modelling is a feedback process, not a linear sequence of steps, and that models go through continuous iteration and recurrent questioning, testing, and refinement. Simulation models are informed by mental models and by information garnered from the real world. Strategies, plans, structures, and decision rules used in the real world can be categorised and tested in the virtual world of the model. Sterman [19] suggests that the feedback loops from experiments and tests conducted in the model alter our mental models and lead to the design of new strategies, new plans, new structures, and new decision rules. These new policies are then executed in the real world, and feedback about their effects leads to new understandings, and further advances both our formal and our mental models.

Sterman [19] postulated that the most salient characteristics of the system dynamics approach are unquestionably the stocks and flows and feedback loops. These visible elements stand out and command our attention. But it is worth noting that feedback loops are a result of the endogenous point of view. Richardson [18] argued that the causality of the system can be driven solely by either endogenous forces or exogenous forces. These forces affect the system, irrespective of the boundaries that are drawn. When building a model, one needs to understand how variables in the causal loop behave and where the forces affecting that behaviour are exogenous or endogenous. Figure 2 illustrates this idea. System dynamics attempts to find endogenous reasons for phenomena. Sterman [19] theorises that the word 'endogenous' implies 'arising from within'. An endogenous theory generates the dynamics of a system via the interaction of the variables and agents represented in a model.

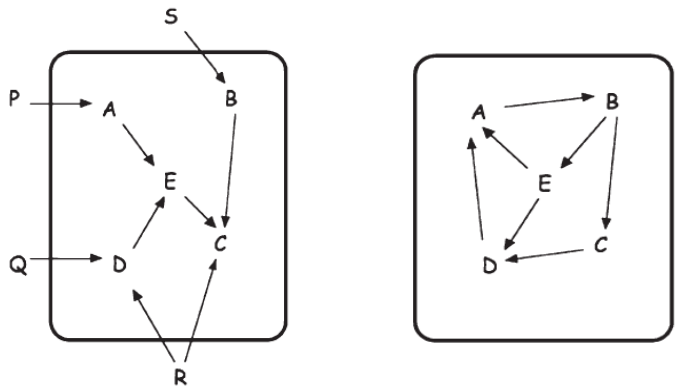


Figure 2: Left: Exogenous view of system structure: causality traced to influences outside the system boundary. Right: Endogenous view: causality remains within the system boundary [18]

Morecroft [20] argued that a causal loop diagram is a visual tool for the feedback-systems thinker; such diagrams show cause-and-effect relationships and feedback processes. Sterman [16] and Haraldsson [21] suggested that CLDs describe reality through causalities between variables and how they form a dynamic circular influence. According to Haraldsson [21], CLDs are a tool for systematically identifying, analysing, and communicating feedback loop structures. It is systematic thinking that enables the communication of complex information in a simplified circular loop feedback structure. CLDs promote continuous thinking. Richardson [18] argued that CLDs are flexible and useful tools for diagramming the feedback structure of systems in any domain. Causal diagrams are simply maps that show the causal links among variables. A causal diagram consists of variables connected by arrows denoting the causal influences among the variables, and the important feedback loops are also identified in the diagram [19]. Delgado-Maciel [22] suggest that CLDs use oriented graphs to identify feedback loops. It also has a polarity that denotes the type of influence, whether positive or negative.

2.1.2. Previous work on the application of CLDs in digital transformation dynamics

Saha [23] postulated that digital transformation is a vital component of strategic thinking for the public and private sectors, and that the factors driving digital transformation range from the ubiquity of technology to the demand for newer business models and delivery excellence. The imperative for transformation has never been greater; and the reality for many is to move with, if not lead, the change

or be left behind. This view was reinforced by Arpe and P. Kurmann [24], who proposes that digital transformation affects digital business strategy or digital strategy.

Several researchers have described the concept of digital transformation dynamics through the development of CLDs. For instance, Saha [23] argues that governments around the globe are experiencing transformative power in revitalising public administration, overhauling public management, fostering inclusive leadership, and moving their civil service towards greater efficiency, transparency, and accountability. The author argued that there is sufficient evidence that the adoption of technology reduces corruption, which results in greater trust in government. This trust, he argued, helps a country to build a future-ready government, thereby creating a strong reinforcing cycle. On the other hand, Hidayatno [25] conceptualised a systemic relationship structure that could highlight the interactions between public policies and key parameters of Technology 4.0 adoption through CLDs. The author proposed five reinforcing loops that are vital for the adoption of Industry 4.0, which is inspired by digital transformation: economic growth, technology acceptance, demand for efficiency, supply chain pressure, and cost of goods.

Tsai and Hung [26] explored, through system dynamics, the factors that affect the adoption and diffusion of cloud computing and, using a CLD, described the interaction of these factors in a dynamic setting. The factors identified by the authors are service quality, the degree of maturity of infrastructure, price, the degree of technological maturity, research and development (R&D) investments, R&D personnel, economic climate, market growth, market decline, information security, perceived risk, competitive technology, the diffusivity of cloud applications, and maximum market penetration. The CLD captured the complex interaction between these factors in a dynamic setting, which would be a helpful tool for policymakers.

Casalino and Armenia [27], using the system dynamics methodology, explored how the digitisation of documents in public administrations represented a new perspective – that of the 'digital administration' – that could bring great benefits. Through their analysis, the authors revealed the variables that were at play in a dynamic setting in the form of a CLD. They articulated two different worlds in the form of the 'citizen world' and the 'public administration world'. The CLD was used to show that the two worlds looked separate, but that they had a symbiotic relationship, as each 'world' influenced the other. The authors considered variables such as the IT literacy of citizens, internet use capabilities, network broadband size, and general aspects of the use of online services on the side of the 'citizen world'; while on the side of the 'public administration world', variables such as document flow for digital and recorded documents, digitally archived documents, the skills of the public administration staff, and the ICT infrastructure of the public administration were taken into account to develop a CLD.

2.1.3. Postal dynamics variables

In their research paper, entitled "Grounded theory (GT) approach to digital transformation in the postal sector in Southern Africa", Mokgohloa et al. [13] applied a grounded theory approach to synthesise the literature on technology adoption and digital transformation to develop their theory. The authors applied the GT approach to synthesise data, resulting in the emergent dimensions that described digital transformation and technology adoption in the postal sector in Southern Africa. The diligent method of theoretical sampling, constant comparison, and theoretical coding resulted in thirteen dimensions that were further refined until theoretical saturation had been reached. Ten themes emerged that were grounded on constructs/concepts with associated allocated codes that were assigned in the GT process. The ten themes were (i) adoption, (ii) shared vision, (iii) digital competitiveness, (iv) digital ecosystem, (v) digital capability, (vi) digital investment, (vii) diverging interests, (viii) customer insights, (ix) digital culture, and (x) operational efficiency.

The outcome of the GT process briefly discussed above is shown in Table 1 and Table 2 below. Table 1 depicts the variables, codes, and emergent categories, while Table 2 depicts the emerging themes and coded concepts (variables).

Table 1: Emerging categories, variables, and codes [13]

Emergent Categories	Variables and codes
Individual factors	Relative advantage (A), Compatibility (B), Complexity (C), Trialability (D),
	Attitude towards the behaviour (E), Subjective norms (F), Intention towards behaviour (G)
	Perceived usefulness (H), Perceived ease of use (I), Attitude towards uses (J), Behavioural intention (K), actual system use (L)
	Subjective norms (M), Voluntariness (N), Image (O), Output quality (P), Job relevance (Q), Results demonstrability (R), Perceived usefulness (H), Perceived ease of use (I), Intention to use (S), Usage behaviour (T)
	Performance expectancy (U), Effort expectancy (V) Social influence (W), Facilitating conditions (X), Gender (Y), Age (Z), Experience (AA), Voluntariness of use (AB), Intention to use (AC), Use behaviour (T)
	The characteristics of the innovation (AD), The characteristics of the population (AE), The actual relative advantage of using the innovation (AF), Learning of the actual relative advantage (AG)
Organisational factors (Enabling)	Perceived benefits (AH), Organizational readiness (Enablers) (AI), External pressure (Regulations) (AK), External pressure (Competition) (AL)
	Industry characteristics & market structure (AM), Technology support infrastructure (AN), Government regulation (AK), Formal and informal structures (AO), Communication processes (AP), Organisational size (AQ)
	Harnessing the competence base (AS), Organisational intelligence (AT), Creativity and idea management (AU), Organisational structures (AO) and systems (AV), Culture and climate (AW), Management of technology (AX), Innovation new stream (AY), Innovation mainstream (AZ), Innovation capability (BA), Innovation performance (BB)
	Strategies (AR), Customer relationships (BE), Business models (BF), Corporate structures (AO), and inter-organisational processes (BG) Customer & product knowledge (BH), Defined responsibilities (BI), Collaborative organisation with flat hierarchy (BK), Empowering leadership (BL)
	Market competition (AL), Follow market trends (AL), Increasing pressure from competition (AL), Business model innovation (BM)
	Value creation (BN), Business processes (BO), Training (BP), Change management (BQ), Culture-leadership-values (AW), Innovation capability (AU-AY-AZ-BB), Transformation capability (BR), Customer centricity (BS), Operational excellence (BT)
	Reducing the error rate (BU), Improving lead times (compliance with market conditions) (BV), Improving efficiency (BW), Ensuring reliable operation (e.g., less downtime) (BX)
	Vertical integration (ET), Horizontal integration (EU), Innovation push (BB)
	Deviant logic (FB), Discovery (FC), Development (FD), Diffusion (FE), Impact (FD), Adoption (FE)
	Digital maturity (FF), Digital readiness (FG), 2IPD (FH), Firm performance (BC)
Organizational factors (Inhibiting)	Inadequate organisational structure and process organisation (AO), Contradictory interests in different organisational units (BY), Resistance by employees and middle management (BZ), Lack of conscious planning: Defining goals, steps and needed resources (CA), Lack of vision and strategy (AR), Poor digital savvy culture and vision (BJ), Organisational readiness (Inhibitors) (AJ)
Technological factors (Enabling)	Technology availability (CB), Technology characteristics (CC), IT excellence (CJ), Interoperability (CD), Virtualisation (CE), Decentralisation (CF), Real-time capability (CG), Service orientation (CH), Modularity (CI)
Technological factors (Inhibiting)	Lack of a unified communication protocol (CK), Lack of back-end system for integration (CL), Lack of willingness to cooperate (at the supply chain level) (CM), Lack of standards (including technology and processes) (CN), Lack of proper common thinking (CP), Unsafe data storage systems (CQ), The need for large amounts of storage capacity (CR)

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Table 1: Emerging categories, variables, and codes [13] (cont.)

Environmental factors (Internal)	Staff (CZ), Financial capacity (DA) Process improvement (ER), Workplace improvement (ES), Cost reduction (EW) Employee support (EZ) Digital innovation (FA) Management support (EV), Customer demands (EX), Resource constraints (DE), Poor transition towards digital culture (DF), Limitations of IT infrastructure (DG) Lack of sufficient internal expertise required to develop e-services (DH), Custom clearance (DI), Poor digital culture (DJ), Corruption (DL), Unnecessary red tape (DN), Micromanaging (DT), Lack of cultural knowledge (DU), Resistance to change (DV), Fear of technology (DW), Lack of relevant local content (DX), Lack of maintenance culture (DY), Lack of language skills (DZ), Low income (EA), Lack of investment (EB), Low return on investment (EC), High initial costs (ED), High risk on investments (EE)
Environmental factors (External)	Legal and regulatory framework (AK), Public trust (DC), National policy alignment (DD), Political commitment (DB) Network (Spectrum) (CY), Supply chain transformation (EY) Market pressure (AL), Laws & regulatory framework (AK), Slow customer adoption of digital services (DK), Corruption (DL), Lack of political will (DM), High taxes (DO), Lack of regional initiatives (DP), Political instability (DQ), Lack of proper planning or coordination (CA), Monopoly (DR), Invisible hand (DS), Perceived lack of privacy (EF), Insecurity (EG), Lack of proper legal framework (AK), Poor regulation (AK), Lack of software and hardware (EH), Inadequate of electricity supply (EI), Lack of internet exchange points (EJ), Scarcity of technical personnel (DH), High illiteracy rates (EK), Lack of ICT skills (DH), Lack of Research & Development outputs (EL), Increasing labor shortages (EM), Reducing human work (EN), Allocating work force to other areas (higher added value) (EO), Lack of appropriate competences and skilled workforce (EP), Longer learning time (training of staff) (EQ)

Table 2: Emerging themes and coded variables (concepts) [13]

Emergent Themes	Coded variables (concepts)
Adoption	A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, S, S, T, U, V, W, X, Y, Z, AA, AB, AC, AD, AE, AF, AG.
Shared vision	AR, BI, BK, AH, AO, AP, BF, AO, BL, BQ, BR, CA, AR, CK, CN, EZ, EV, DH, DX, DC, DD, DB.
Diverging interests	BY, BZ, CM, CP, DL, DN, DT, DV, DQ, DS.
Digital competitiveness	AT, BN, BO, FD, FH, BC, CG, FA.
Customer insights	BE, BH, BS, EX.
Digital ecosystem (UPU standards and systems)	AM, AI, AL, AK, DK, DP, DR.
Digital capabilities	AN, BA, BM, AU, AY, AZ, BB, ET, BB, FE, FF, CB, CC, CJ, CD, CE, CF, CG, CQ, DG, DI, CY, EF, EG, EH, EJ, DH, EL, EN.
Digital investment	AI, DA, DE, EA, EB, EC, ED, EE, DK, EM.
Operational efficiency	AX, AY, AZ. AQ, AS, BG, BP, BT, BU, BV, BW, BX. CG, CL, CQ, CZ, ER, ES, EW, CA, EH, DH, EO, EP.
Digital culture	AW, FD, FB, FC, FE, FG, BJ, AJ, DF, DJ, DU, DW, DY, DZ, EQ.

Additional cases of the application of system dynamics in policy design have been identified in the domains of military strategy, environmental protection, healthcare, service delivery, the energy sector, the water sector, and the adoption and diffusion of technologies. The application of system dynamics to capture complex dynamics in policy design and the adoption and diffusion of technology can be found in several areas of research, as shown in the literature review. The emerging themes set out in Table 2 are further explored and their relationship is articulated as a CLD to understand the complex interactions between the variables (the emergent themes, in this case).

3. RESEARCH METHODOLOGY

Zefeiti and Mohamad [28] argued that research methodology is a general research strategy that delineates the way research is to be undertaken. It includes a system of beliefs and philosophical assumptions that shape the understanding of the research questions and underpin the choice of research methods. Ragab and Arisha29] , The development of a new theory can be addressed using either of two research approaches: the deductive approach, which can best be described as a step-down process towards theory testing; or the inductive approach, which can best be described as a step-up process towards theory building [29].

Ragab and Arisha [29] suggested that the deductive process follows a highly organised methodology, and often scrutinises causal relationships between variables to explain a certain phenomenon and to generate generalisable findings, while inductive theory-building begins with specific observations in which patterns and relationships are identified to form a theory about a certain phenomenon.

This paper adopted an inductive logic (theory testing) approach through system dynamics modelling. Muller [30] proposes that high-level models such as system dynamics models have the modest aims of strengthening insights and analysing complex phenomena, communication, and decision-making. Fisher et al. [31] proposes that system dynamics models have limitless opportunities to act as 'flight simulators' that decision-makers could use as a training environment to conduct research and to understand the complexity of the environments they model. This proposition is supported by Kozina and V. Kirinić [32] who argue that management of digital transformations and, more specifically, of the effects of digital business transformations are becoming increasingly complicated in today's business environment, where competition and technological revolutions are dynamic and change happens at a faster pace than before.

Albin and Forrester [33] argued that defining the model's boundary entails choosing the elements that are vital to generating a behaviour of interest, as set by the model's purpose. This view was reinforced by Edson [34], who postulate that setting the boundary of the system or the problem of interest is one of the essential characteristics of a systems thinking assessment, and that all systems are defined by their boundaries, which drive behaviour based on the underpinnings of system's structure [35],[33]. The model boundary is based on eight of the ten variables that are at the core of postal digital dynamics. The eight variables are digital ecosystem capability, digital investment capability, adoption, digital culture maturity (an integrator), shared vision maturity (an integrator), operational excellence capability, digital capabilities, and digital competitiveness. Customer insights, diverging interests, and digital ecosystem capability are exogenous variables; however, digital ecosystem capability is included in the model, as it is the principal object of postal digital transformation dynamics, and it is influenced by the other variables. The system dynamics approach requires the researcher to unearth the substantial collected system elements that have an impact on the problem under investigation; and this is articulated in the dynamic hypothesis.

3.1. Dynamic hypothesis formulation

Hassan [36] asserted that the dynamic hypothesis is a conceptual model that archetypally comprises a causal loop diagram and a sub-system diagram that analyses the system qualitatively, and that is meant to describe the behaviour of the system and the relationships among its variables that develop its reference behaviour mode [37]. Three mapping tools were used to advance this dynamic hypothesis: the sub-system diagram, the model boundary chart, and influence diagrams (causal loop diagrams). As this paper describes the conceptual model, the stock and flow maps will not be outlined. The proposed postal digital transformation dynamics model seeks to illustrate the causal relationships among postal digital transformation variables in the digital transformation process. The dynamic hypothesis comprises fourteen reinforcement loops and three balancing loops that link digital ecosystem capability, adoption, shared vision maturity, digital culture maturity, customer insights, diverging interests, operational excellence capability, digital investment capability, digital capabilities, and digital competitiveness capability.

3.1.1. Sub-system diagram

Figure 3 categorises the architecture of the system under study into several sub-systems. Each sub-system is controlled by a certain variable, as indicated by the variable name in each box of Figure 3. The main control variables of each sub-system and the interactions between each of them will be identified in the causal loop diagrams.

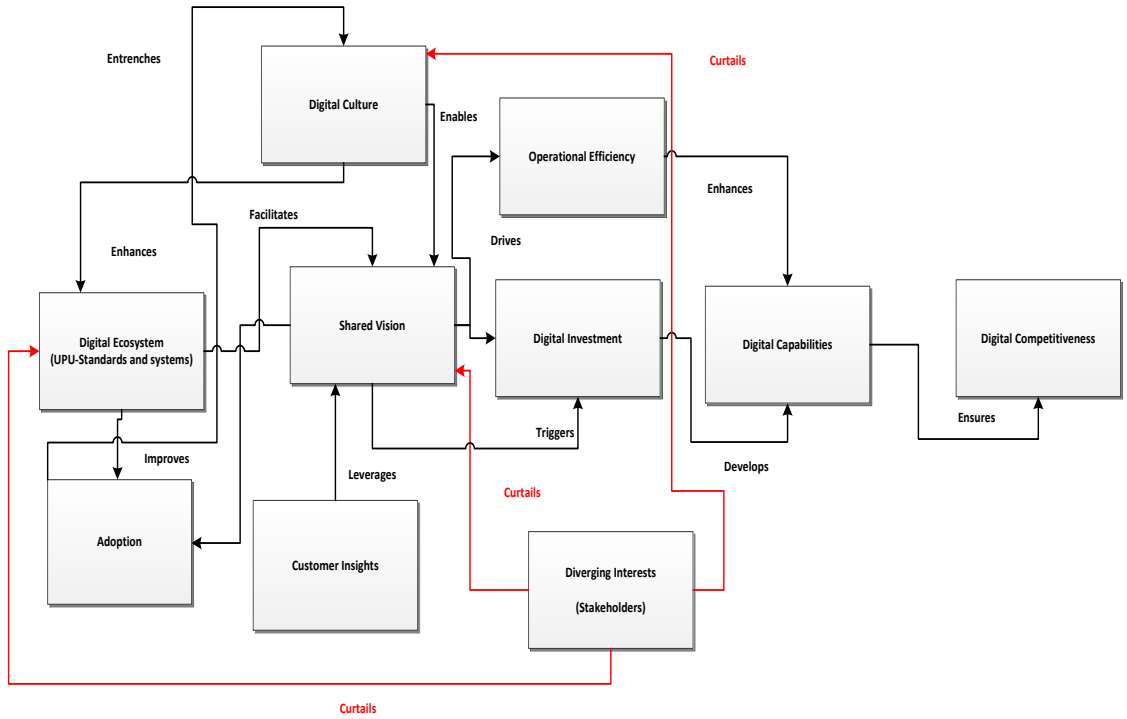

Figure 3: System architecture map (SAM) of the postal digital transformation dynamics

3.1.2. Model boundary chart

The model boundary chart identifies the scope of the model under study by classifying the variables into endogenous, exogenous, and excluded variables, as set out in Table 3. This sorting is vital to distinguish the model boundary in respect of the type of each variable and the relationships among variables.

The variables depicted in Figure 2 are entwined in a loop. This looping provides an endogenous explanation for behaviour and permits the system structure to determine behaviour instead of exogenous variables that externally determine behaviour. The endogenous variables (those inside the boundary) are digital culture maturity, shared vision maturity, adoption, digital investment capability, operational excellence, digital capabilities, and digital competitiveness, while the exogenous variables (those outside the boundary) are digital ecosystem capability, diverging interests, and customer insights. The exogenous variables are not affected by the endogenous variables but have an impact on them. The exogenous variables characterise the context in which the postal sector operates but over which the organisation has no direct control; depending on the context, some of the variables could be endogenous, but, in another dimension, they could be exogenous. The endogenous and exogenous variables are shown in Table 3.

Table 3: Endogenous and exogenous variables

Endogenous variables	Exogenous variables
Adoption	Diverging interests
Shared vision maturity	Customer insights
Digital investment	Digital ecosystem capability
Operational excellence	
Digital capability	
Digital competitiveness capability	
Digital culture maturity	

4. FINDINGS AND DISCUSSIONS

4.1. Findings

The dynamic hypothesis asserts that digital competitiveness capability is a function of the variables that underpin the postal digital transformation dynamics in Southern Africa. The dynamic hypothesis is articulated as a causal loop diagram depicted in Figure 4, and it elucidates the ten postal digital transformation variables.

As a whole, the model comprises ten variables interacting with each other in a dynamic setting. The ten variables (dynamics) thus articulated are adoption, digital ecosystem capability, digital culture maturity, shared vision maturity, customer insights, digital investment, digital capability, operational excellence, digital competitiveness, and diverging interests, as illustrated in Tables 1 and 2; and they are the result of a diligent grounded theory (GT) process. In Figure 4, the causal loop diagram variables and the causal relationships among the postal digital transformation variables are defined and articulated. Positive signs are given to proportionate relationships, while negative signs indicate inverse relationships. The polarity of a feedback loop (i.e., positive, or negative) is characterised by a logical interpretation (whether the loop reinforces or reduces behaviour). Variables within positive loops will continue to increase in intensity; therefore, positive loops are self-reinforcing. Variables within negative loops, on the other hand, will become stable with time; therefore, negative loops are self-balancing. Feedback loop structures, when illustrated, are converted into stock-flow diagrams to facilitate system dynamics modelling. The modelling aspect is beyond the scope of this paper.

4.2. Discussion

4.2.1. Systems view of postal business transformation dynamics in Southern Africa

Hassan [36] proposed that, as defined in system dynamics, a causal loop diagram (also called an 'influence diagram') is an effective technique to illustrate clearly the dynamic feedback relationship between variables in each sub-system. This view is reinforced by Duggan [38], who argues that a feedback loop is a chain of circular causal linkage in which the level of a stock affects a flow, which in turn alters the stock. In contrast to model conceptualisation or a sub-system diagram, the causal loop diagram permits the researcher to distinguish the variables and the various linkages between them to be employed in the simulation model. The system dynamic model was developed, using the established logical linkages, through stocks and flows, as contended by Duggan [38].

The proposed CLD is the first step in addressing the problem of the 'digital transformation' gap in the postal sector in Southern Africa. The CLD attempts to conceptualise the multidimensional phenomenon of the adoption and diffusion of a digital transformation agenda in the postal sector in Southern Africa. Thus, the CLD examines the factors that drive digital transformation in the postal sector, an industry in which ICT reigns supreme, with the aim of understanding better the relationships between these factors in a dynamic setting.

The variables that underpin digital transformation dynamics are articulated as a dynamic hypothesis in Figure 4. At the core of the postal digital ecosystem, its capability, is the quest by the UPU to create a digital ecosystem through the business processes, standards, and systems in which the postal sector transacts. The digital ecosystem entrenches a deep digital culture that enables a shared vision, while the shared vision is leveraged on customer insights and the digital culture maturity of stakeholders. Adoption of the systems, standards, and protocols of the UPU, which epitomises the digital ecosystem, entrenches a deep and robust digital culture, while that culture enhances the digital ecosystem and enables a shared vision. An unambiguous shared vision among stakeholders drives operational efficiencies and triggers digital investment. Digital investment develops digital capabilities, while operational excellence enhances digital capabilities. Digital capabilities ensure digital competitiveness, which incorporates factors such as digital innovation and digital disruption. Diverging interests are illustrated in Figure 4 which represent inhibitors that range from individual to organisational inhibitors. These inhibitors curtail a shared vision, digital culture, and digital ecosystem, and ultimately negatively affect the path towards digital competitiveness. Customer insights, the digital ecosystem, and the digital culture are inputs to a shared vision that ensures the development of digital capability through operational excellence and digital investment, which together result in digital competitiveness. It is crucial to mitigate diverging interests to achieve digital competitiveness, which guarantees the sustainability of the postal sector.

At this stage, the dynamic conceptual model is used as a framework to obtain understanding of the interaction of the ten variables in a dynamic setting in the context of the postal sector in Southern Africa. The conceptual model elucidates the logical relationship between the variables and is a critical step towards the construction of a system dynamic model to simulate the interaction and resultant dynamics between diverse variables in a dynamic setting. This paper aims to develop the CLDS as the initial step towards a fully-fledged system dynamics model and to validate the appropriateness of the variables and the rationality of the linkages between the variables. The CLDs are intended to provide insights to policymakers on the factors that drive or inhibit digital transformation in the postal sector in Southern Africa. These insights would help policymakers to appreciate the complex dynamics at play, and to respond with informed policy to drive the competitiveness of the postal sector in Southern Africa.

Sterman [19] suggested that the quickest method to decide whether a loop is positive or negative is to count the number of negative links in a loop, and argued that, if the negative links are even, then the loop is positive, while an odd number makes the loop negative.

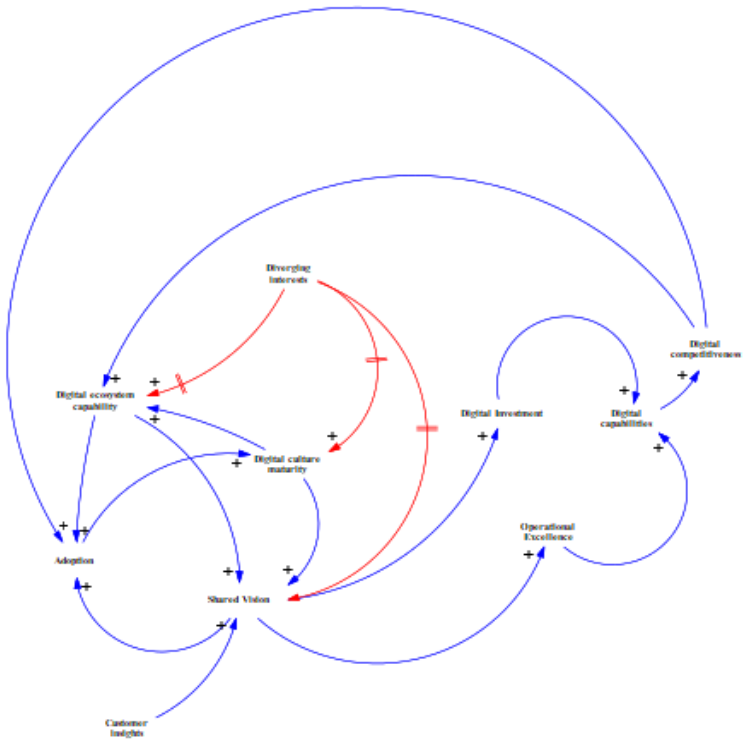

Figure 4: Dynamic hypothesis of the postal digital transformation dynamics CLD

The dynamic hypothesis shown above is further explained in Table 4 to elucidate the linkages and to provide an explanation of the reference mode behaviour of the linkages.

Table 4: Description of postal digital dynamics links

Link	Explanation
Diverging interests relating to digital culture maturity link.	This link suggests that diverging interests in the postal sector in the region will likely negatively affect the maturity of a digital culture. The delay mark on the loop signifies time delays. The diverging interests are likely to negatively impact digital culture maturity.
Diverging interests relating to digital ecosystem capability link.	This link suggests that diverging interests in the postal sector in the region will most likely affect effective and efficient participation in the digital ecosystem. The delay sign signifies time delays for the behaviour to take hold.
Diverging interests relating to shared vision link.	This link suggests that diverging interests in the postal sector in the region impede convergence and buy-in into a shared vision or shared purpose.
Digital ecosystem influence on digital adoption link.	This link suggests that the digital ecosystem of the postal sector in the region will positively influence digital adoption.
Digital adoption influences digital culture links.	This link suggests that digital adoption will positively influence digital culture, as more stakeholders adopt digital transformation pathways; the digital culture of stakeholders will increase.
Digital culture influence on digital ecosystem link.	This link suggests that, as the digital culture matures in the postal sector in the region, the postal digital ecosystem will improve significantly as more users, suppliers, and aggregators become part of it.
Digital ecosystem influence on shared vision link.	This link suggests that a sound and mature digital ecosystem will positively influence shared vision among stakeholders.
Shared vision influence on digital adoption link.	This link suggests that a convergence of purpose in the form of a shared vision in the postal sector in the region positively impacts digital adoption by stakeholders of the sector.
Digital culture influences shared vision links.	This link asserts that a maturing digital culture will augment buy-in and unity of purpose through a shared vision among stakeholder participants in the postal sector in the region.
Shared vision influences operational excellence link.	This link asserts that a shared vision among stakeholders and decision-makers in the postal sector in the region will heighten operational excellence within the business processes of the sector.
Shared vision influences digital investment links.	This link asserts that a shared vision among stakeholders and decision-makers in the postal sector in the region will trigger investment in digital technologies.
Digital investment influences digital capabilities link.	This link reveals that investment in digital technologies in the postal sector in the region will ensue in increased digital capabilities in the region.
Operational excellence influences digital capabilities link.	This loop reveals that operational excellence in the postal sector in the region will boost digital capabilities in the region.
Digital capabilities influence digital competitiveness link.	This link asserts that the more the postal service is digitally capable, the more digitally competitive will be the postal service.

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Table 4: Description of postal digital dynamics links (cont.)

Link	Explanation
Digital competitiveness influence on digital ecosystem capability link.	This loop reveals that digital competitiveness will positively influence a robust digital ecosystem.
Customer insights influence shared vision links.	This link reveals that the incorporation of customer insights – as in the voice of the customer – will push the postal industry in the region to find a unity of purpose that is espoused as a shared vision among stakeholders in meeting and exceeding customers' requirements.
Digital competitiveness capability influence on adoption link.	This link reveals that digital competitiveness capability will positively reinforce adoption.

According to Figure 4, digital competitiveness – which is the ultimate objective of the postal digital transformation process – will likely influence adoption and the digital ecosystem capability variables. Table 5 articulates eight reinforcing loops, which begin with digital competitiveness and follow different paths in the quest to develop digital capabilities that enhance digital competitiveness.

Table 5: Description of postal digital dynamics loop

Loop	Explanation
R1: Digital competitiveness – digital ecosystem maturity – shared vision – operational excellence – digital capabilities	This loop suggests that digital competitiveness will reinforce digital ecosystem maturity, which will strengthen shared vision, resulting in improved operational excellence, which will augment the digital capabilities.
R2: Digital competitiveness – digital ecosystem maturity – shared vision – digital investments – digital capabilities	This loop suggests that digital competitiveness will reinforce digital ecosystem maturity, which will strengthen shared vision, resulting in an improved digital investment that will augment the digital capabilities.
R3: Digital competitiveness – adoption – digital culture maturity – shared vision – operational excellence – digital capabilities	This loop suggests that digital competitiveness will enhance the adoption of digital technologies, which will strengthen digital culture and will marshal stakeholders to converge and have a shared vision. A shared vision will enhance operational excellence, which will augment digital capabilities.
R4: Digital competitiveness – adoption – digital culture maturity – shared vision – digital investments – digital capabilities	This loop suggests that digital competitiveness will enhance the adoption of digital technologies, which will strengthen digital culture and will marshal stakeholders to converge and have a shared vision. A shared vision will prompt digital investments, which will augment digital capabilities.
R5: Digital competitiveness – digital ecosystem maturity – adoption – digital culture maturity – shared vision – operational excellence – digital capabilities.	This loop suggests that digital competitiveness will enhance digital ecosystem maturity, which will support the adoption of digital technologies, resulting in an improved digital culture. A matured digital culture will enhance shared vision among stakeholders, which will enhance operational excellence and augment digital capabilities.
R6: Digital competitiveness – digital ecosystem maturity – adoption – digital culture maturity – shared vision – digital investments – digital capabilities.	This loop suggests that digital competitiveness will enhance digital ecosystem maturity, which will support the adoption of digital technologies, resulting in an improved digital culture. A matured digital culture will enhance shared vision among stakeholders, which will trigger digital investments, which will augment digital capabilities.

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Table 5: Description of postal digital dynamics loop (cont.)

Loop	Explanation
R7: Digital competitiveness – adoption – digital culture maturity – digital ecosystem maturity – shared vision – operational excellence – digital capabilities.	This loop suggests that digital competitiveness will enhance adoption, which will result in an improved digital culture. A matured digital culture will enhance digital ecosystem maturity, which will support a shared vision among stakeholders, resulting in improved operational excellence, which will augment digital capabilities.
R8: Digital competitiveness – adoption – digital culture maturity – digital ecosystem maturity – shared vision – digital investments – digital capabilities.	This loop suggests that digital competitiveness will enhance adoption, which will result in an improved digital culture. A matured digital culture will enhance digital ecosystem maturity, which will support a shared vision among stakeholders, triggering digital investments that will augment digital capabilities.

Digital ecosystem capability, which is the engine that drives digital competitiveness, is discussed below to explore the dynamic hypothesis further.

4.2.2. Digital ecosystem capability dynamics

The UPU [39] suggested that the digital ecosystem is a platform that facilitates the digital economy and digital postal development. The digital ecosystem encompasses companies, persons, information, procedures, and machines and devices (IoT), which can be collectively characterised as stakeholders or actors that are connected by their mutual use of the digital platform; while [40] argues that digital ecosystems are loosely connected networks of the interacting organisations that are digitally linked and aided by modularity, and that influence and are influenced by one another's service offerings. Gurumurthy and Khetan [41] suggest that, digital ecosystem drives value along three paths: creating new revenue-generating sources, streamlining cost, and catalysing the speed of technology adoption. Skog [42] argued that digital ecosystems are complex and dynamic webs of interdependent digital technologies, consumers, providers, aggregators, government, and regulators, and span industry boundaries to include assorted actors and technologies from several industries.

A report by the World Economic Forum (WEF) [43] argued that maximising value from digital investments is centred on five key enablers: (a) agile and digital savvy leadership that maintains a strategic vision, purpose, skills, intent, and alignment across management levels to ensure a nimble decision-making process and innovation; (b) a forward-looking skills agenda that instils a digital mind set in the workforce by making innovation the focus of training and employment programmes; (c) ecosystem thinking that embeds collaboration of stakeholders in the value chain; (d) data access and management that drives competitiveness through a strong data infrastructure and warehouse capability, united with the correct analytics and communication tools; and (e) technology infrastructure readiness, which is concerned with developing the vital technology infrastructure to ensure strong capabilities in the cloud, cybersecurity, and interoperability. The insights that can be extracted from the WEF report are that digital investment in the context of digital ecosystem capability and digital talent and digital infrastructure are two ingredients that would facilitate an effective and efficient digital ecosystem, propelled by an agile and digital savvy leadership (shared vision and digital culture maturity) that would drive competitiveness through digital capabilities.

The digital ecosystem capability dynamics are shown in Figure 5, and the links are explained in Table 6, while the loop descriptions and their explanations are set out in Table 7.

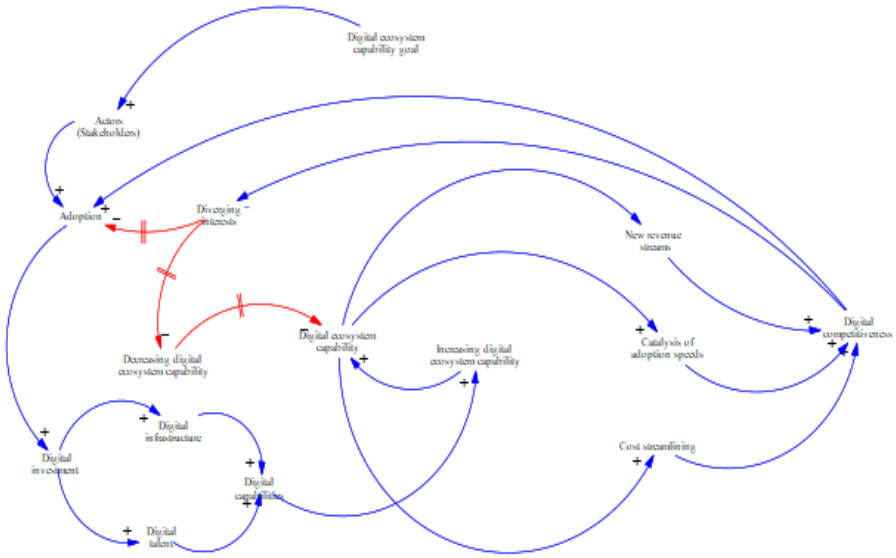

Figure 5: CLD of digital ecosystem capability dynamics for the postal sector in Southern Africa

Table 6: Description of digital ecosystem capability dynamics

Links	Explanation
Digital ecosystem capability goal influence on actors' efforts link.	This link reveals that the digital ecosystem capability goal will likely prompt actors to take positive steps to attain the digital ecosystem capability goal. The actors are all stakeholders in the digital ecosystem: postal operators (both management and employees), policymakers, regulators, aggregators, technology providers, government (shareholders), and consumers.
Actors (stakeholders) influence on adoption link.	This link reveals that the actions of actors in pursuit of the digital ecosystem capability goal will likely result in the adoption of various digital technologies that are pervasive in the digital economy.
Adoption influence on digital investment link.	This link reveals that, as the adoption of digital technologies grows, digital investments are triggered to sustain the movement towards the digital capability goal.
Digital investment influence on digital talent link.	This link reveals that an upsurge in digital investment will yield a creased investment in digital talent.
Digital investment influences digital infrastructure links.	This link reveals that an upsurge in digital investment will increase investment in the digital infrastructure.
Digital infrastructure influences digital capabilities link.	This link reveals that, as digital infrastructure is deployed, it will increase digital capabilities.
Digital talent influences digital capabilities link.	This link reveals that, as digital talent rises, it will contribute to an improvement in digital capabilities.
Digital capabilities influence an increasingly digital ecosystem capability link.	This link reveals that an upsurge in digital capabilities will contribute to the increased digital ecosystem capability of the system.

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Table 6: Description of digital ecosystem capability dynamics (cont.)

Links	Explanation
Increasing digital ecosystem capability influence on digital ecosystem capability link.	This link reveals that an increasing digital ecosystem capability will plausibly lead to an enhanced digital ecosystem capability.
Digital ecosystem capability influences new revenue-generating streams link.	This link reveals that digital ecosystem capability will positively contribute to diversification into new revenue-generating streams to enhance competitiveness.
Digital ecosystem capability influence on catalysis of adoption link.	This link reveals that digital ecosystem capability will positively contribute to the acceleration of adoption efforts by stakeholders to enhance competitiveness.
Digital ecosystem capability influence on streamlining of costs link.	This link reveals that digital ecosystem capability will positively contribute to streamlining costs to enhance competitiveness.
Catalysis of adoption speeds influence on digital competitiveness link.	This link reveals that catalysis – or rather, the acceleration of the adoption speed by actors – will positively contribute to digital competitiveness.
Costs streamlining influence on digital competitiveness link.	This link reveals that streamlining costs will positively contribute to digital competitiveness.
New revenue-generating streams influence digital competitiveness link.	This link reveals that diversification into new revenue-generating streams will positively contribute to digital competitiveness.
Digital competitiveness capability influence on adoption link.	This link reveals that a heightened digital competitiveness capability will plausibly influence adoption by actors.
Diverging interests influence adoption.	This link suggests that an increase in diverging interests among stakeholders will negatively impact adoption by stakeholders (actors).
Diverging interests influence digital ecosystem capability.	This link suggests that an increase in diverging interests among stakeholders will negatively impact the capability of the digital ecosystem.
Digital competitiveness influences diverging interests.	This link suggests that increasing digital competitiveness will reduce diverging interests among stakeholders.

Table 7: Description of ecosystem capability loops

Loop	Explanation
R1: Diverging interests – decreasing digital ecosystem capability – digital ecosystem capability – new revenue streams – digital competitiveness.	This loop suggests that increasing diverging interests among stakeholders will reinforce a decreasing digital ecosystem capability, which will curtail new revenue-generating streams and negatively impact digital competitiveness.
R2: Diverging interests – decreasing digital ecosystem capability – digital ecosystem capability – cost streamlining – digital competitiveness.	This loop suggests that increasing diverging interests among stakeholders will reinforce a decreasing digital ecosystem capability, which will curtail cost streamlining and negatively impact digital competitiveness.
R3: Diverging interests – increasing digital ecosystem capability – digital ecosystem capability – catalysis of adoption speed – digital competitiveness	This loop suggests that increasing diverging interests among stakeholders will curtail an increasingly digital ecosystem capability, which will slow down or bring to a grinding halt adoption speed and negatively impact digital competitiveness.

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Table 7: Description of ecosystem capability loops (cont.)

Loop	Explanation
R4: Diverging interests – adoption – digital investment – digital talent – digital capabilities – increasing digital ecosystem capability – digital ecosystem capability – new revenue streams – digital competitiveness.	This loop suggests that increasing diverging interests among stakeholders will curtail digital investments, which will which reduce digital talent. A lack of digital talent will reduce digital capabilities, which in turn will result in a decline in the capability of the digital ecosystem. A decline in the capability of the ecosystem will curtail new revenue streams and negatively impact digital competitiveness.
R5: Diverging interests – adoption – digital investment – digital talent – digital capabilities – increasing digital ecosystem capability – digital ecosystem capability – cost streamlining – digital competitiveness.	This loop suggests that increasing diverging interests among stakeholders will curtail digital investments, which will which reduce digital talent. A lack of digital talent will reduce digital capabilities, which in turn will result in a decline in the capability of the digital ecosystem. A decline in the capability of the ecosystem will curtail cost-streamlining measures and will negatively impact digital competitiveness.
R6: Diverging interests – adoption – digital investment – digital talent – digital capabilities – increasing digital ecosystem capability – digital ecosystem capability – catalysis of adoption speeds – digital competitiveness.	This loop suggests that increasing diverging interests among stakeholders will curtail adoption by stakeholders, which will trigger a reduction in digital investments, which will reduce digital talent. A lack of digital talent will reduce digital capabilities, which in turn will result in a decline in the capability of the digital ecosystem. A decline in the capability of the ecosystem will slow down the catalysis of adoption speeds and will negatively impact digital competitiveness.
R7: Diverging interests – adoption – digital investment – digital infrastructure – digital capabilities – increasing digital ecosystem capability – digital ecosystem capability – new revenue stream – digital competitiveness.	This loop suggests that increasing diverging interests among stakeholders will curtail adoption by stakeholders, which will curtail digital investments. A lack of digital investments will reduce digital capabilities, which in turn will result in a decline in the capability of the digital ecosystem. A decline in the capability of the ecosystem will curtail diversification into new revenue streams and will negatively impact digital competitiveness.
R8: Diverging interests – adoption – digital investment – digital infrastructure – digital capability – increasing digital ecosystem capability – digital ecosystem capability – cost streamlining – digital competitiveness	This loop suggests that increasing diverging interests among stakeholders will curtail adoption by stakeholders, which will curtail digital investments. A lack of digital investments will reduce digital capabilities, which in turn will result in a decline in the capability of the digital ecosystem. A decline in the capability of the ecosystem will curtail cost-streamlining measures and will negatively impact digital competitiveness.
R9: Diverging interests – adoption – digital investments – digital infrastructure – digital capabilities – increasing digital ecosystem capability – digital ecosystem capability – catalysis of adoption speeds – digital competitiveness	This loop suggests that increasing diverging interests among stakeholders will curtail adoption by stakeholders, which will curtail digital investments, which will lead to poor digital infrastructure. A lack of digital infrastructure will reduce digital capabilities, which in turn will result in a decline in the capability of the digital ecosystem. A decline in the capability of the ecosystem will slow down the catalysis of adoption speeds, which will negatively impact digital competitiveness.

4.2.3. Insights from causal loop diagrams

The dynamic hypothesis presented in Figure 5 illustrates the postal digital transformation dynamics that are at play in Southern Africa. The digital transformation objective is to develop a digital ecosystem capability that is capable, through the adoption of digital technologies, investment in digital infrastructure and digital talent, incorporating customer insights to understand better the needs of the 21st-century customer, ensuring operational excellence, cultivation of shared vision maturity and digital culture maturity, and managing diverging interests to build the digital competitiveness of the sector.

The high-level modelling approach is articulated through a dynamic hypothesis that is defined by the three tools: the sub-system diagram, the boundary model chart, and the causal loop diagrams. The causal loop diagram depicted in the dynamic hypothesis suggests that an improvement in digital competitiveness will improve the adoption of the digital transformation paradigm by stakeholders, which will improve both digital culture maturity and the shared vision of stakeholders. A matured digital culture and shared vision among stakeholders will trigger digital investments and drive operational excellence. Digital investments and improved operational excellence will build digital capabilities, which will drive up digital performance and result in the digital competitiveness of the sector.

5. CONCLUSIONS AND RECOMMENDATIONS

The world is on the edge of a digital revolution that is transforming society as we know it at unprecedented speeds and disrupting business models, all which force organisations to innovate, adapt, or die. The postal sector is not immune to these disruptive changes and has been compelled to move beyond mail as its primary business to avoid total collapse because of dwindling mail volumes that in turn trigger poor financial performance and poor investment levels that obstruct operational excellence, which in turn produces poor quality of service and low digital competitiveness.

The idea of a vicious cycle is undergirded by declining mail volumes as a result of the advent of the digital age, initially because of digitisation, then followed by digitalisation and then digital transformation, which disrupts 19th- and 20th-century 'machine-age'-oriented business models. The decline in mail volumes triggered poor financial performance in the postal sector, which caused low investment levels in the sector, resulting in poor quality of service, which reinforced the sustained low mail volumes.

The 2IPD performance shown in Figure 1 points to the Southern African postal sector being at a turning point; and it is required to transform to remain resilient, reliable, and relevant, and to expand its reach. Improvement in the four 2IPD pillars drives the competitiveness of the postal sector. To be able to remain competitive, the postal sector, with the necessary sense of urgency, should transform its business model by implementing digital transformation and understanding the postal digital transformation dynamic variables that drive the business transformation process. Understanding how these variables interact and influence one another will offer deep insight to decision-makers and policymakers on how best to navigate the minefield by developing a digital ecosystem capability that drives the digital competitiveness of the postal sector in Southern Africa.

The gap identified in this research is the limited academic literature that delves deep into the interaction of digital transformation dynamics in the postal sector. In addition, there is a lack of comprehension by decision-makers of how the digital transformation dynamics relate to one another and the dynamic behaviour they generate over time. This lack of a systems approach results in the erroneous assumption that it is technology that propels digital transformation. However, that assumption is far from the truth: it is a digital strategy that drives digital transformation. This lack of comprehension of postal digital transformation dynamics as a system inhibits digital competitiveness and a robust digital ecosystem as a result of low shared vision maturity, a low digital culture, and lower levels of digital investment, all of which prevent operational excellence and inhibits the digital capabilities that are propelled by the adoption of digital technologies, thus triggering digital disruption and resulting in digital competitiveness.

As a recommendation for future research, the overall conceptual model captured as a causal loop diagram or 'influence' diagram illustrating the interaction of variables in a dynamic setting will be used to develop the system dynamics model in which stocks and flows for each variable will be articulated and quantified. The model is envisaged to guide decision-makers in the postal sector and policymakers in government on how best to navigate the digital disruption minefield that continues to disrupt business models in every sector of society.

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