The important role of system dynamics investigation on business model, industry and performance management

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Abstract

Purpose – This research studies the development of the evolving dynamic system model and explores the important elements or factors and what detailed attributes are the main influences model in achieving the success of a business, industry and management. It also identifies the real and major differences between static and dynamic business management models and the detailed factors that influence them. Later, this research investigates the benefits/advantages and limitations/disadvantages of some research studies. The studies conducted in this research put more emphasis on the capabilities of system dynamics (SD) in modeling and the ability to measure, analyse and capture problems in business, industry, manufacturing etc.

Design/methodology/approach – The research presented in this work is a qualitative research based on a literature review. Publicly available research publications and reports have been used to create a research foundation, identify the research gaps and develop new analyses from the comparative studies. As the

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literature review progressed, the scope of the literature search was further narrowed down to the development of SD models. Often, references to certain selected literature have been examined to find other relevant literature. To do so, a supporting tool (that connects related articles) provided by Google Scholar, Scopus, and particular journals has been used.

Findings – The dynamic business and management model is very different from the static business model in complexity, formality, flexibility, capturing, relationships, advantages, innovation model, new goals, updated information, perspective and problem-solving abilities. The initial approach of a static system was applied in the canvas business model, but further developments can be continued with a dynamic system approach.

Research limitations/implications – Based on this study, which shows that businesses are developing more towards digitalisation, wanting the ability to keep up with the era that is moving so fast and the desire to increase profits, an instrument is needed that can help describe the difficulties of the needs and developments of the future world. This instrument, or tool of SD, is also expected to assist in drawing future models and in building a business with complex variables that can be predicted from the beginning.

Practical implications – This study will contribute to the SD study for many business incubator research studies. Many practical in business incubator management to have a benefit how to achieve the business performance management (BPM) in SD review.

Originality/value – The significant differences between static and dynamics to be used for business research and strategic performance management. This comparative study analyses some SD models from many authors worldwide. Their goals behind their strategic business models and encounter for their respective progress.

Keywords Dynamic business model, Dynamic performance management, Enterprise architecture framework, Sustainability dynamics approach, Dynamic start-up business, Business management model for sustainability

Paper type Literature review

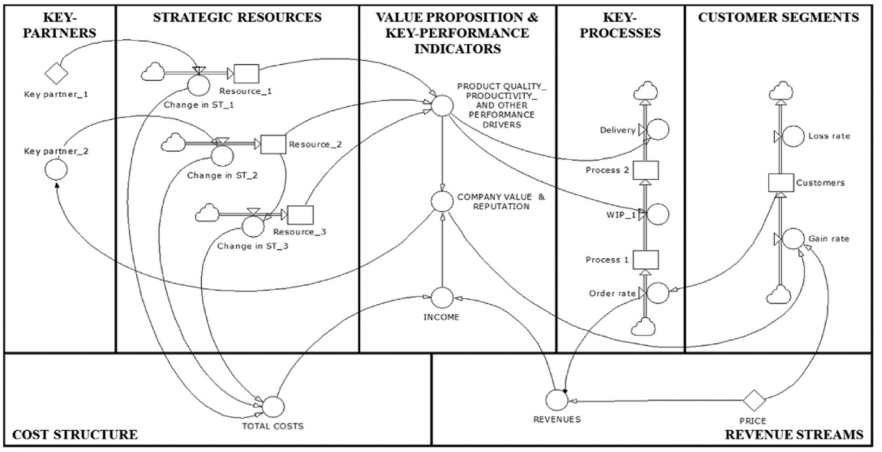
1. Introduction

Recently, the enterprise framework study has gained traction, forming a widely debated topic to investigate the boundary between regulation policy, governance, industry and business. Many investigations approach to progress and multiply (business model knowledge, business model plan, business model project, business model invention, circular business model and so on). The existing records identified that an increasing number of scientific researchers appeared in special editions of scientific publications, scientific seminars, training and scientific networks for academics (Foss and Saebi, 2017; Massa *et al.*, 2017) (see Figure 1).

Business process management has initiated the impact of optimisation and work efficiency for companies, businesses and industries until now. Still, the digitalisation transformation has required businesses to be flexible and affordable as well. In order to be a part of this digital era, submitting new levels of automation flexibility through the digitalisation of business process management itself is required.

Business performance management (BPM) is a part of the transformation in social management. So, BPM cannot be separated from the consumer and social world. It is necessary to assess whether the service capability provided is in accordance with the target in terms of the correct number, best expense and perfect moment. Measurement of results needs management to determine the targets and direct performance variables used to assess the results (the number, quality, productivity and result of services covered). Then these variables, the aims of performance, are determined to obtain the target. In the final stage, the business performance approach needs evaluation. All goals have been reached, and the next activities are needed to fulfil the predetermined review variables/criteria (Bouckaert and Halligan, 2008).

The system dynamics (SD) approach has a specific character compared to others. The SD methodology may establish a substantial perspective of how accurate situations might influence the firmness of a system in business performance and strategies (Sastry, 1997).



Key Partners: Telecom	**Key Activities:** Product development; Direct Marketing; Social Media Marketing	**Value Proposition:** Improving the user ability to write English texts; Providing a tool that merges multiple features of writing support (i.e. translator, vocabulary, spellchecker)	**Customer Relationship:** Product presentation during conferences and seminars in universities and schools; Social Media Marketing	**Customer Segment:** Students, researchers, freelances, translators, professionals operating in international markets
	Key Resources: Know How; Intellectual property; Highly qualified HR		**Channels:** Universities and schools conferences and seminars; Social Media Marketing; Viral Marketing	
Cost Structure: Hosting; Highly qualified HR (informatics engineers, web designer, marketing experts)		**Revenue Streams:** Pay per click referral FREE VERSION: Advertising. PREMIUM VERSION: Subscription (monthly, biannual, annual)		

Source(s): Cosenz and Noto (2017)

Figure 1.
The dynamic business model framework structure adopted from Ludwig's BM Canvas

SD arranges essential information and analyses for strategic forecasts based on a flexible understanding of external and internal adjustment (Morecroft, 2007; Bianchi and Bivona, 2002). The use of SD has provided a better understanding of the use of business models so that they can estimate the benefits or carry out scenarios for developing elements of a business model and see which scenario is the best. However, the development of the business model and the performance that follows is still at an early stage and has not provided a comprehensive understanding of the categories and potential development of business models and performance.

This comparative study aims to briefly review SD performance's structure and research methodology from some business models and management. Sustainability-supporting business models are studied in many forms, e.g. business models for sustainability (BMfS) and sustainability enterprise frameworks. All of the forms discussed are the entire parts of the organisation's value proposition and value creation logic.

2. Literature review

2.1 Goal or aim of business modelling

The enterprise framework serves as a final task to be applied in new business venture strategy, framing how a company will manage and how it will perform to achieve its objectives such as profitability, sales volume, improvement, new technology, new invention, social impact and value creation (Cosenz and Noto, 2018a, b).

The business modellings have been created with such elements as (1) characteristics of real companies, real company factors that guide empirically and conceptually for classifying worldwide phenomenon of corporations as a task of the dimensioned similarity/distinction on related strategic attributes, e.g. activities, resources, capabilities, stakeholder network and affiliated performance which form the value created/captured by the corporation; (2) cognitive or linguistic schemas shape the implicit cognitive anatomies showing from recently thinking models or mental patterns owned by executives in corporations. Cognitive anatomies contain theories and connections within the system that lead executive perception about the pattern of jobs and trading to demonstrate the crucial interrelationship and value creation connections at the businesses' trading linkage, and (3) formal and conceptual descriptions or representations of how a business performs. The business model description recognises attributes that they presume to be crucial in figuring out how a company performs.

2.2 The ability and benefit of system dynamics

If some theories and business practises in the world of operation strategies validate, then SD structure supports and specific advice to framework and analyse social organisations that are dynamic, complicated, and unpredictable, in addition to the observation of framework to figure and strategy simulation for governance for adjustment (Davis *et al.*, 2007; Morecroft, 2007; Cosenz and Noto, 2016; Torres *et al.*, 2017; Forrester, 1961; Sterman, 2000).

Dynamic business models (DBMs) provide an essential understanding of strategy formation and venture capital by figuring out how crucial enterprise framework or business model attributes interconnect to construct and maintain competitive advantages from time to time. This condition happens by providing methodological assistance to start-ups by applying their company ideas to proper conceptual representations of how they should operate.

Although not like other modelling simulation methods, the methodology of SD could deliver an essential insight into how accurate the conditions, such as strategies, could influence the steadiness of a system for a start-up company and its achievement (Sastry, 1997). SD could deliver suitable analysis and information for strategy arrangement based on a flexible perspective on both external and internal adjustment (Morecroft, 2007; Bianchi and Bivona, 2002).

SD modelling can enhance performance measures in district authorities to support a commonly held perspective of the appropriate organisational structure and behaviour among stakeholders in local strategic planning. The SD model benefit locates achievement measurement in the wider perspective of the organisation. The acknowledging impact of the SD model can simplify the policy and process, influencing particular outcomes, and the output may not be "simple" in the system (Bianchi *et al.*, 2008). The SD method admits to accomplishing a structure-and-behaviour analysis according to the reinforcing loops underpinning the improvement that could be supported and recognised by appropriate improvement policies. Furthermore, strengthening loops could be connected to relating balancing loops that support an originated boundary to develop the organisation under investigation. Policymakers can promote long-term growth by recognising and reversing the balancing loops (Bianchi and Tomaselli, 2015).

SD delivers data that could assist with the operation of dynamic complications, calculation of intangibles, recognising postponements, acknowledging the connection in the long and short term, and arranging appropriate organisation limits in strategic planning. After getting into that matter, to assist policymakers with proper perspective to understand the problem, to cope with feedback structure generating achievement and also to recognise possible strategies to revise the structure for developed achievement, they applied SD modelling to assist an acknowledgement of (1) how achievement movers can influence end-results; (2) how achievement movers can, finally, be impacted by the application of policymaker end to influence the accumulated strategic resources and depletion mechanisms; and (3) how the stream of strategic assets are influenced by final outcomes (Bianchi *et al.*, 2018).

The proposed methodology supports tiny company leaders to predict scenarios and produce good outcomes. The decision support system generated subjective and objective factors, creating a direct, uncomplicated model of understanding acquired by the specialist board. Furthermore, the integrated use of SD contributed to detailed analyses of some alternative scenarios. Inherently, the proposed model's unique nature requires consideration as it does not allow for a decision without an important adjustment (Marques *et al.*, 2020).

2.3 Dynamic business model

A DBM provides a deep insight into the strategic application of business venturing by illustrating how crucial business model variables synergy is to generate everlasting competitive advantages. A DBM is demonstrated as a strategy device to properly outline theoretical representations of how a system runs and generates a new value. This model assists start-ups in putting their business ideas into action by providing a methodical approach to how businesses should operate. The Business Model Canvas (BMC) consists of nine pillars connected to the main element of business dynamics underpinning value creation processes: (1) Key partners that embrace the core stakeholders included in the value creation processes, particularly, the person who admit an enterprise to operating; (2) Key activities which illustrate the main jobs and processes to create value added; (3) Key resources, i.e. the tangible and intangible assets connected with the important success variables to be bought and growth in business routines and, later, mobilised in value creation processes; (4) Value proposition, i.e. the relation between consumer wants and the value produced by the company to gratify them; (5) Consumer relationships that describe how the organisation connects with its consumers and the formulas to restrain the consumers; (6) Channels which describe how goods/service allocation is managed; (7) Consumer segments, i.e. the structure of the consumer level; (8) Cost structure, the structure of charges connected with an enterprise preference with a particular goal on resources gain; and (9) Revenue flows, an illustration on goods/service value and expected sales volumes (see Table 1) (Cosenz, 2017).

SD modelling irradiates the critical causal connections between the BM factors recognised in the construction blocks, providing us with a holistic understanding of enterprise strategy and execution. The causal connections form closed feedback loops (reinforcing or balancing) that define enterprise system behaviour over time (Cosenz and Noto, 2018a, b). Enterprise sustainability relies on a proactive and anticipatory attitude to sequences of emerging and voluntary transformation. It should provide the dynamic consistency label to the enterprise's ability to continue and construct its achievement while revising its enterprise framework (Cosenz and Noto, 2015; Bivona and Cruz, 2021).

To cope with the above BMC limitation, SD modelling establishes valuable methodological assistance to enterprise modelling (Hajiheydari and Zarei, 2013; Bianchi *et al.*, 2015; Groesser and Jovy, 2016; Cosenz and Noto, 2017). The SD methodology was generated in the early 1960s and late 1950s at M.I.T. by Jay Forrester. This theory is used for simulating and modelling complicated social systems and physical experimentation with the

Table 1.
A connection chart between BMC and DPM

		Business model canvas elements								
		Key partner	Key resources	Value proposition	Key activities	Channel	Customer relationship	Customer segments	Cost structure	Revenue Streams
Dynamic performance management elements	Strategic Resources	√	√						√	
	Performance Drivers			√						
	End results			√			√		√	√
	Activities and Processes				√	√			√	
	Products						√			√
	Clients						√	√		√
	Objectives			√			√			

Source(s): Cosenz (2017)

frameworks to construct strategies for adjustment and operation (Forrester, 1961). It is also used to describe fundamental SD frameworks according to a feedback perspective of enterprise systems, shown as a closed border, i.e. realising all the critical factors connected to the problem being explored. SD modelling, in particular, is applied to the system of map level to deliver and measure an insight into the quantification of the connection to create a group of equations and behaviour-driving processes that shape the fundamentals for simulating feasible system behaviours over time. SD frameworks are effective kits to assist with perspective and support the feedback interrelationship of complicated operating systems. The methodology of the proposed model for operational can assist both decision-making and enterprise planning (Bianchi *et al.*, 1998). In the application world, businesspeople could utilise all of these models to examine various schemes and investigate what may have been made – or made – under the alternative of dissimilar future and old opinions and across various result options (Gozali *et al.*, 2018; Sterman, 2000).

The dynamic business model has been a complicating factor because Ludwig's founders at the beginning applied a linear, biased and static definition of the dynamics of Ludwig's company. Then, they also identified it as challenging to fully acknowledge the protocol underpinning the design of the DBM according to feedback loops (Torres *et al.*, 2017). Groesser and Schwaninger (2012) remarked that easy-to-use graphic illustrations could create a wrong result by establishing the false image that framework is an easy and speedy process. Meanwhile, some users usually find out challenging to structure uncomplicated insight frameworks to reflect highly convoluted systems of the enterprise (Cosenz, 2017).

2.4 Dynamic performance management

The advantage of dynamic performance management (DPM) is that it assists policymakers in describing and applying for local strategic programs. DPM is expected to cope with some weaknesses of conventional performance management techniques (Bianchi *et al.*, 2017; Bivona and Cosenz, 2021). This theory, based on the dynamics modelling system used for performance management, can help to address such flaws (Bianchi and Tomaselli, 2015). Insight of SD modelling is a settled application that can be useful to advise on the acknowledging of processes and mostly relies on visual representation (Wolstenholme, 1999).

The complexity of SD is because of a variety of elements. The critical things are numerous policymakers who put a different value on policy results (Gozali *et al.*, 2020), demanding policy trade-offs in space and time; numerous service tracks influencing the results; decision structures that are consecutively related, introducing rigidity into the system; a time gap between the system's results and the stakeholder decisions; significant nonlinear cause–effect connections; and the uncontrollability and unpredictability of external variables (as provided by policymakers) that can influence the results of the system (Bianchi, 2016).

The SD model establishes qualitative study and rational structures for the next level of model designing. A DPM illustration and the impact graphic are translated into a quantitative SD stock and flow simulation model, by applying correct district information to help strategic study, coordination and performance management in the "multi-actor" situation. Even more, this model identifies feedback loops with critical policy application. SD irradiates how this dynamic influence of interferences in "secondary" agencies can be a key in decreasing the NEETs' number (under 25s "Not Educated, Employed or Trained), demonstrating the need for connecting policymakers and leaders encountering services for young people (SYP). A DPM approach may also assist policymakers in answering the policy obstacles that convoluted SD often represent. The qualitative SD modelling approach is built to apply and develop a full DPM system where little certain information and sources can be gathered; qualitative modelling assists in modelling a complicated dynamic system,

expanding a more sophisticated simulation framework and increasing preliminary policy figures for policy achievement and result measurement (Bianchi *et al.*, 2013; Bianchi, 2016).

2.5 The importance of the enterprise architecture framework

In the previous study, there were three departments in the enterprise architecture (EA) framework: (1) EA; (2) linkage architecture and (3) technology architecture. The most recent study has reached zones that use the semantics of business vocabulary and rules (SBVR) (Kang *et al.*, 2010) from a significant proof to achieve and connect the department of EA based on strategic business planning. IT and HR combine EA with the business's circumstances to play an important role in EA dynamics. Actually, building an EA requires the use of business modelling tools, having an enterprise ontology and possessing an architectural blueprint.

Many argue that the business model can help start-ups produce better decisions and solve problems within a limited time (Stirna and Zdravkovic, 2015). A particular example that should be deliberated when an enterprise model (EM) is implemented is how to interpret EM and how the created models can significantly impact business. Another consideration is that the EM needs to be oriented on modelling the future and assisting in enterprise and company alteration. Until now, not many businesses are attempting to generate valuable goods that their firms should possess and obtain (Stirna and Zdravkovic, 2015). The meta-model approach has two ultimate factors: (1) modelling method, which has to recognise (a) modelling procedure and (b) modelling language; and (2) modelling mechanisms, which illustrate the underpinning factors of how the model will be done mathematically and logically. This theory has been implemented to promote an applicable model for business engineering (Hinkelmann, 2015).

The conceptual framework can help in identifying and designing the concepts, assisting us in acknowledging how to focus on variables that influence enterprises (Robinson, 2011; Mylopoulos, 1992). The past path may help forecast the future result via a learning stage. Still, it could not accurately acknowledge past data or forecast future demand. The ultimate objective of this hard work is to achieve the highest possible wisdom level in the decision-making process. Researchers illustrate their acknowledgement of the term by applying a specific language driven by their perspective of the fact, which is truly what the theoretical framework is most likely. People generate the semantics for a theory to capture a more logical and formal perspective of the fact, which could promote the cognitive opinion. This theoretical framework can be described as robust and formal in the last 3 decades by applying syntactically and semantically mature framework notations (Duan and Cruz, 2011; Gregory, 1993).

2.6 Business model for sustainability

The environmental business model for sustainability entrepreneurial thought must assist the production of valuable solutions in overcoming circumstances and social obstacles (Senge *et al.*, 2007). A growing number of start-ups and business leaders are promising to positively impact the economy and society while not negatively impacting the environment (Starik and Kanashiro, 2013). The BMfS companies contribute to solving societal and environmental solutions through the embodiment of a successful enterprise (Schaltegger and Wagner, 2011). Hence, the economic value of production is both a means for creating value for the community and ecological circumstances and also a goal in itself (Hockerts and Wüstenhagen, 2010).

Until now, the sustainable value of production has mostly been reached through innovation in process, product and technology (Hansen *et al.*, 2009). The proposed study has many ways to acknowledge, build and analyse these enterprise frameworks. Many studies learn about how successful companies can change their current EM to a BMfS (Sommer, 2012), or how the researchers could generate enterprise for sustainability cases

(Lüdeke-Freund, 2014). In particular, the researchers do not describe how the natural environment, value creation and profit creation (captured value) can reciprocally equip and strengthen one another.

Enterprise frameworks could be translated into complicated and dynamic systems (e.g. Demil and Lecocq, 2010). The partial modelling approach should decrease complexity and obtain multilevel systems, which involves dividing a big model into some micro models (Abdelkafi and Täuscher, 2016). Consolidating sustainable development into the further enterprise framework increases complexity (Porter and Derry, 2012). The result has three enterprise framework elements: (1) customer value proposition, (2) value creation and (3) value capture.

The expanded framework fulfils the four conditions needed in the "conceptual development" part. Firstly, the SD model helps policymakers acknowledge how the EM could influence natural circumstances. Two kinds of impact are recognised as a direct influence through the environmental value creation and value proposition ability and an indirect influence via the consumer's behaviour. In achieving a rapid elimination of the negative influence on the circumstances, generating an environmental value proposition and changing the value creation ability is much better than altering the consumer's behaviour. Secondly, the framework discloses the direct and mostly indirect influence of the original circumstances of the company. The environment influences the enterprise framework directly due to its influence on the company's value creation ability and indirectly through the trust of the consumers and policymakers. Third, the SD model demonstrates the different kinds of stocks and flow diagrams that connect the ultimate stakeholders of a BMfS. The critical inventories are the company's value proposition and environmental value proposition, which is the value proposition delivered to stakeholders interested in the circumstances, the value creation ability, value capture and ecological capital. Fourth, the framework stands for critical feedback loops describing the logic of a BMfS from a stakeholder view. For example, feedback loops could create self-reinforcing ecological trust in the policymaker or the consumer, directing an EM change to support more sustainability. Other than that, two important connections have been identified that could affect postponements in the entire system: from the circumstances to the policymaker and from the policymaker to the enterprise framework (Abdelkafi and Täuscher, 2016).

The appropriate enterprise framework elements can guide and strengthen feedback loops (Sanchez and Ricart, 2010; Casadesus-Masanell and Ricart, 2007). Current enterprise framework references identify the fundamental strengthening feedback loops between value generation and profit creation (e.g. Abdelkafi and Täuscher, 2016). The value-based perspective usually embraces value capacities and their constituent variables. Generally, a minimum of three main value elements are involved: (1) customer value proposition; (2) value creation, value architecture or business infrastructure; and (3) value capture or profit generation. (4) value communication, (5) value delivery is consolidated into the overall value creation ability of the enterprise and (6) organisation value (Abdelkafi, 2012). Lüdeke-Freund (2014) delivered four components in the theme of enterprise framework for sustainable innovation: value proposition, supply chain, consumer interface and economic framework. Lüdeke-Freund (2010, p. 21) illustrates a BMfS as an enterprise framework that generates a benefit in competition through ultimate consumer value and provides a sustainable improvement of the community and enterprise.

Concerning sensitive matter from a framework is to change the value of its parameters, change its structure and develop trust by examining the unpredictability that is frequently connected with parameters. The SD framework must be validated via a sequence of examinations oriented on construction, culture and strategic application (Senge and Forrester, 1980; Groesser and Schwaninger, 2012). In the past few eras, the SD framework has been

integrated with tactical achievement administration systems established to be successful in nourishing the process of strategic learning and, as an outcome, assist in decision-making and achievement development based on a systemic standpoint (Bianchi, 2012; Bianchi *et al.*, 2015; Cosenz, 2014; Cosenz and Noto, 2016). This theory is recognised as DPM and aims to help the decision-making mechanism via good governance between performance measurement records and strategy modelling. Actually, the application of SD to performance management aids enterprise analysts in identifying both drivers and sources that guide a given achievement structure over time and, as a result, delivers in increasing the mechanism of diagnosis that allows enterprise leaders to deliver effective movement and policies focused on penetrating the lack between the reality and the high achievement standard. This theory is based on three interconnected perspectives: (1) an instrumental perspective, (2) an objective perspective and (3) a subjective perspective (Bianchi, 2016).

The main benefit of the DBMfS canvas depends on its dynamic origin, as opposed to the essentially static development driven by the existing business model kits in the BMfS reference (Dentchev *et al.*, 2018). The model reveals a fundamental explanation of the relationship among the components of a BM and how main enterprise values accrue from the interaction among key resources, processes and stakeholders. Furthermore, this suggestion model provides a consolidated perspective of the main value proposition approach, according to the connection between value drivers, production and result. The logic of all these management kits for drawing BMfS depends on the concept that the main invention must be moved toward producing social and/or environmental advantages in enterprise management, therefore changing the orientation of the value proposition to the community and the circumstances (Cosenz *et al.*, 2020).

2.7 Static and dynamic business model

The strategic operation sector flourishes in many strategy kits (e.g. BMS, SWOT analysis, Balanced Scorecards, Boston Consulting Group matrix) compiled as the division of a broader strategic action compared to the strategy itself (Spee and Jarzabkowski, 2009). They consist of "techniques, tools, methods, models, frameworks, approaches and methodologies available to assist decision-making in tactical operations. Table 2 shows the differences between a static business model and a dynamic business model in several factors.

Although all frameworks are imperfect illustrations of the fact (Greenberger *et al.*, 1976), engaging stakeholders can develop model precision and validity and foster the harmonising of the key players' behaviour models and group agreement about what actions should be taken (Vennix, 1996).

The business needs to be modelled from the start to get a picture of what variables make up the system of the business to be developed. The description of these business variables or factors can be obtained from the static business model. In addition to business descriptions, business models have capabilities and benefits such as modelling simulation, strategy formation, etc. that affect business achievement and performance measurement. The formation or setting of a business strategy will also have a significant influence on the architectural picture of the model that has important adjustments. These adjustments give an overview of the dynamics of the business model as a result of performance measurement. All business models cannot be separated from their role in social obstacles and ecological circumstances, which are intended for environmental solutions.

3. Methodology

The methodology in this study consists of seven case studies, two qualitative studies, two quantitative studies, two project base, and two literature studies or theoretical stage on some type of business. Some of the above studies are applied in an interview with the experts.

No.	Factor	Static business model	Dynamic business model
1	Complexity	The static business model provides a non-detailed picture (Massa *et al.*, 2017)	The methodology of System Dynamic is a method for capturing the dynamic factors of complicated society and organisational systems (Forrester, 1961; Sterman, 2000). The dynamic business model provides a complex picture (Burton and Obel, 1995; Sterman, 2000; Rachmawati and Kim, 2022; Zhou *et al.*, 2022; Varga-Csajkás *et al.*, 2023; Song *et al.*, 2022; Liu *et al.*, 2022a, b; Jing *et al.*, 2022; Colivicchi and Iannucci, 2022; Reike *et al.*, 2023)
2	Formality	Implicit, informal (Massa *et al.*, 2017)	Formalised in the diagram, design, mathematical or symbolic modelling (Massa *et al.*, 2017), and associated framework measurement (Bianchi, 2002; Richmond, 1997; Varga-Csajkás *et al.*, 2023; Mismetti *et al.*, 2022)
3	Flexibility	The perspective of conventional BM representations (Cosenz and Noto, 2018a)	Rapid and flexible approach (Demil and Lecocq, 2010). Study unpredictability and uncertainty of enterprise fields. Predicting and proactively sort voluntary and arising adjustments (Demil and Lecocq, 2010; Chesbrough, 2010; Saraf and Shastri, 2023)
4	Capturing	To build typologies as a strategy for the coherence between critical enterprise framework factors (Demil and Lecocq, 2010)	System dynamic frameworks are produced for a particular managerial problem and constructed by figuring the enterprise system construction to create and convey an acknowledging of behaviour driving processes, also the measurement of the cause and effect interactions to generate a series of equations that placed the preliminaries for simulating feasible system behaviours over time (Warren, 2008; Varga-Csajkás *et al.*, 2023; Koul *et al.*, 2022; Riaz *et al.*, 2023; Khan and Hassan, 2022; Lane and Rouwette, 2023)
5	Relationship	Describing static relationship (Demil and Lecocq (2010)	Strategic Changes, arising opportunities value creation in the market. Structure the relation between critical interdependencies and value creation. (Demil and Lecocq, 2010 Chesbrough, 2010; Abdelkafi and Tauscher, 2016; Baden-Fuller and Haefliger, 2013; Loock and Hacklin, 2015; Perkmann and Spicer, 2010; Magretta, 2002; Rachmawati and Kim, 2022; Zhou *et al.*, 2022)
6	Advantages	Attractive insights (Demil and Lecocq, 2010; Chesbrough, 2010)	Achieving new goals or gaining sustainable competitive advantages. (Demil and Lecocq, 2010; Andries *et al.*, 2013). Give new advantages to the entrepreneur via business model innovation based on updated information (McGrath, 2010; Cosenz and Bivona, 2021; Varga-Csajkás *et al.*, 2023; Saraf and Shastri, 2023; Sosna *et al.*, 2010)
7	Perspective	Specific sectors of the main enterprise framework factors (Demil and Lecocq, 2010; Chesbrough, 2010)	Fulfil different functions (Demil and Lecocq, 2010)
8	Problem Solving	An effective way to analyse the consistency of a given firm (Demil and Lecocq, 2010)	To integrate change and ensure performance over time (Demil and Lecocq, 2010; Liu *et al.*, 2022a, b; Varga-Csajkás *et al.*, 2023)

Table 2. Overview of the differences between a static business model and a dynamic business model of several factors

Based on Table 3, many SD models are applied to some types of business, such as start-ups (Cosenz, 2017; Cosenz and Noto, 2018a, b; Bianchi *et al.*, 2018), family businesses (Marques *et al.*, 2020), government (Bianchi and Tomaselli, 2015), sustainability businesses (Abdelkafi and Täuscher, 2016; Cosenz *et al.*, 2020) and trading companies (Marques *et al.*, 2020). IT or software company (Cosenz *et al.*, 2022), health industry (Del Vecchio *et al.*, 2022; Liu *et al.*, 2023), construction (Riaz *et al.*, 2023). The stakeholders in BPM (Cosenz and Noto, 2018a) are the company, manufacturing, production, environment, decision-maker, consumer, investor and supplier (Bianchi *et al.*, 2015).

This method evaluates some case studies in the SD method application. Among fifteen case studies that have been explored, experimental and reference techniques can be drawn. The criteria were determined as the reference technique. In the case of another reference technique with different stories, the different criteria should be analysed. However, this study has no statistical power or validation. The method of this comparison study should therefore anticipate application in business practice. This was an important reason to point to the use of predefined criteria defined within a desired future business context. This study presents a methodology for comparison in some case studies. This comparison study caters to similar business processes across several case studies in SD method applications; hence, process variants may manifest due to the differences in the nature of businesses, heterogeneity in the types of cases, etc.

An in-depth comparison is conducted once the case study compares to the other case studies. To illustrate this, the application of some SD comparison techniques detects significant differences among ten SD case studies and overall performance. The technique detects significant differences among ten SD case studies and overall performance. The results of this technique identify those parts of the Benefits/Advantage and Limitations/Weaknesses of SD case study applications. Using this technique, we contained and obtained valuable insights.

4. Comparison study

Business model design is a branch of study and practise devoted to developing a master plan of a business (business and IT) variables, indicators, ideas, and assisting kits and methodologies to enrich enterprises with a holistic view of the management construct and culture. Usually, the stages of business design are strategic, practical, organisational, communication and technical stages. Table 3 shows the comparison study of SD performance business models and management.

5. Discussion

Prediction of the strategy formulation and insight from the perspective of internal factors (outcome, value creation, culture, communication, profitability, operation, growth, technological innovation) and external factors (social impact, value creation, competitive advantages). Understand external factors, such as unpredictability, uncertainty, and uncontrollability. In detail, dissect critical elements supporting a company's success (procedures, resources, capabilities, network, outcomes, stakeholders) and the best methodology that supports business success. Forming an understanding of the mechanisms of dynamic consistency, dynamic complexity and interdependence of models that influence the mental, perspective, mindset and way of communicating management in the organisation. Understand the conceptual modelling technique, modelling language, modelling procedure and modelling mechanism that form cognitive arguments from patterns, data structures and past information to obtain a future model representing the accuracy, maturity and realistic nature of the model obtained. Solutions and creations are obtained by the learning process, strategic development, cause and effect analysis, performance measurement, performance improvement, decision-making process and corrective action.

Table 3. Comparison study of system dynamics performance business models and management

No	Year	Author	Research area	Research object	Conclusion	Benefit/Advantage	Limitation/Weaknesses
1	2016	Abdelkafi and Täuscher	Enterprise framework for Sustainability	A case study from Bettervest GmbH, a start-up from Germany, which was built in the year 2012	The framework links four sections: the company, the society, the policymaker and the consumer. It describes the work of business models for sustainability and how these firm frameworks can be started	Four requirements were composed in the "Conceptual Development" context. Firstly, SD helps policymakers in acknowledging how the enterprise framework operates. Second, direct and indirect impacts through the customer's behaviour and the natural environment on the firm. Third, the critical factors are the company's value proposition and circumstances value proposition, which support the stakeholder's apprehension about the circumstances. Fourth, the framework illustrates critical feedback loops describing the logic of the stakeholder's view of BMfS	The VBN concept does not encompass any social impacts or network links among people. It has proven that some consumers' decisions and executive or business activities are driven by social conditions, which are not within the final version This research ignored the system characteristics that cause firms to illustrate and apply BMfS successfully
2	2015	Asif *et al.*,	SD framework for product multiple lifecycles	The literature review is based on a qualitative study	The modelling's main goal is to help decision-makers in the product's multiple lifecycles (PML). The framework clearly reveals a connection among material reserve, supply, business achievement and the requirement to adopt the Product Multiple Lifecycle theory	SD simulation delivers the decreasing dependency on the material that can gain strategically and make a company less inclined in material scarcity and charge volatility. In the same analysis, Sutherland *et al.* (2008) assumed that the reproduction of car machines can save energy by up to 90%. Lund and Hauser (2010) stated that reproduction could save energy and material in general, by up to 80%. Goldey *et al.* (2010) assumed that the reproduction of IT appliances decreases material and energy expenditure, reducing the greenhouse gas emissions effect	Decision-makers have to not make their regulations via the simplest estimating physical availability of substances. Additionally, they need to consider other externalities that can save the material-producing nations from exporting materials to the global market. PML may be a model to reduce dependency on material assets. However, the most effective worldwide efforts can enhance the situation considerably

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Table 3.

No	Year	Author	Research area	Research object	Conclusion	Benefit/Advantage	Limitation/Weaknesses
3	2015	Carmine Bianchi	A dynamic performance approaches	The research of the Municipality of Caltagirone, a little city in Catania county, Italia	The analysis reveals that Dynamic Performance Management knowledge can help local strategic planning by permitting policymakers to plan the short-term of a long-term plan. The other side assists the connection of strategic aims to appropriate goals achievement at gauging expected and arising targets	The benefit of utilising this model is that it puts the achievement calibration within the wider perspective of the system (Bianchi *et al.*, 2008). System dynamics (SD) modelling can enhance PM in local government to flourish a shared perspective of the relevant system's construction and behaviour among stakeholders in local blueprint arrangement The SD method allows a construction-and-culture analysis based on which the strengthening circles underpinning development can be recognised and nourished by an appropriate improvement scheme. Also, strengthening circles can be coordinated with interaction balancing circles, which establish a source of limit to developing the explored system. By immediately discovering and against balancing circles, policymakers can nourish sustainable improvement	There is a gap of reference discussing the particular complication of the field. First, the blueprint work is not ultimately focused on a single organisation but rather on a geographic area. Second, this needs management between different organisations and a result perspective to explore how adopted strategies will affect the area's achievement. Third, a trade-off analysis (in both time and place) is required: a strategy might help local achievement in the short term, but it may also guide to unintended results in the long term. Fourth, the complexity mentioned above suggests the need for a feedback perspective. And a poor recognition of policy results This work has no qualitative modelling to enhance the DPM method for the local blueprint program

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No	Year	Author	Research area	Research object	Conclusion	Benefit/Advantage	Limitation/Weaknesses
4	2016	Bianchi	Young people service transformation in Applied Dynamic Performance approach	A case study for the Young People's council in Surrey County Council	This research has discovered a journal and practical model for creating a model to help decision-makers resolve	A DPM diagram and an impact chart are translated into a quantitative system dynamics stock and flow simulation model using accurate local information to assist strategic studying, connection and achievement governance. Such a framework establishes qualitative study and rationable construction for the next modelling process. The qualitative system dynamics modelling approach and application of the whole DPM system. Qualitative modelling helps conceptualise a system's dynamic complication, augmenting previous policy models and improving more advanced simulation frameworks for calibration and strategic development	This work is less detailed and has no quantitative analysis.

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No	Year	Author	Research area	Research object	Conclusion	Benefit/Advantage	Limitation/Weaknesses
5	2017	Cosenz	Supporting start-up business model design through system dynamics modelling	This research interviewed six young potential Italian businessmen for four hours for each meeting). They include a young potential Italian businessman, an I.T student and his software developer partner	The framework that connects technology invention and business performance consider the competitive dynamics, the effect of technology on firm framework creativity and the operation of technology invention. This perspective discovers how the Dynamic Business Model may support potential businessmen with a lean performance approach and performance equipment to be applied even during the company's lifespan	To overcome the above BMC shortages, the SD framework contributes a valuable methodological approach to the enterprise framework (Cosenz, 2015; Groesser and Jovy, 2016 Hajiheydari and Zarei, 2013). Following the SD approach, frameworks are based on a feedback perspective of enterprise systems, shown as a closed limit related to the investigated phenomenon SD frameworks are important kits to assist knowledge and leverage the feedback connection of complicated administration systems. The frameworks also offer a work methodology to assist both enterprise planning and decision-making (Bianchi *et al*., 1998).	Considering the rivalry and other external power that impact a company's sustainability (e.g. previously restricted data) is foundational to the designing unpredictability and dynamic complexity that describe today's market segments (Demil and Lecocq, 2010). In this regard, the BMC is a static model and needs additional methodological assistance to better design such a dynamic complication Additionally, the following important factors are still unsettled: what are the impacts of growth in key resources on key activities, the consumer base, charges and incomes? Is there a linear or nonlinear connection between these factors? Is there any trade-off in organising a competitive advantage between the short and long-run? And how to successfully organise them?

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No	Year	Author	Research area	Research object	Conclusion	Benefit/Advantage	Limitation/Weaknesses
							These problems restrict a comprehensive knowledge of how the enterprise is run and, as an outcome, do not nourish the strategic learning process of key players or third parties involved in the enterprise's improvement Eventually, the BMC fails in establishing a connection between the enterprise blueprint scheme and achievement arrangement and measurement. Brinckmann *et al.* (2010) underline that the form of a BP can be intended to impact a company's achievement, while Delmar and Shane (2003) irradiate a positive connection between enterprise planning and new company achievement. The illustration and application of a BM must be intended not only to inform and acknowledge how the company is intended to run and generate value to the prospective venture capitals, but also as a kit to be utilised regularly, adaptable to contextual adjustment, with the two-fold goal to develop entrepreneurial skill and arrange achievement (Berends *et al.*, 2016)

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Table 3.

No	Year	Author	Research area	Research object	Conclusion	Benefit/Advantage	Limitation/Weaknesses
6	2017	Cosenz	A dynamic business modelling approach to design and experiment with new business venture strategies	A case study of Ludwig, a start-up company, built in 2014 and domiciled in Palermo, Italy	The Enterprise Framework's key performance indicator is experimental skill and knowledge. Traditional approaches to designing a firm framework are still far from inclusive of the probability of fast experimenting with alternative strategies and investigating the related script in terms of the ability to make a profit, arise, new creation, society effect etc	The dynamic Business Model result has been a complicated factor because Ludwig's founders at the beginning applied a linear, biased and static definition of the dynamics of Ludwig's business. Then they also identified it challenging to fully acknowledge the protocol underpinning the design of the DBM according to feedback loops (Torres *et al.*, 2017). Groesser and Schwaninger (2012) remarked that user-friendly graphic illustration could create a wrong result by establishing the false image that the framework is an easy-to-use and speedy process. While some users usually find out challenging in structuring uncomplicated insight frameworks to reflect highly Convoluted systems of the enterprise	The accuracy of the analysis made in constructing its DBM and measuring the systemic interrelationship among the framework factors. The prevailing references to simulation-based techniques propose that all frameworks are an imperfect description of the actual condition. Since they are constructed on the assumption, their validity depends on the extent to which these assumptions are matched (Richardson, 2013; Sterman, 2000; Morecroft, 2007). The identified assumptions on which a framework can be adapted in order to assess the sensitivity and consistency of an observed outcome to particular assumptions. Key findings from unassociated data systems can be consolidated into one framework as inputs or else for framework measurement

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No	Year	Author	Research area	Research object	Conclusion	Benefit/Advantage	Limitation/Weaknesses
7	2018	Cosenz	New Enterprise investor strategies by SD	A case study of Ludwig, a start-up company that was built in the year 2014 and domiciled in Palermo, Italy	Illustrate the operating enterprise and innovation for its stakeholders, e.g. firm venture and competition council have institutionalised Business Models' use to review a firm idea's validity and the generated profit to finance it	1 Innovation through a fine-tuning process-oriented to support new market opportunities and/or strategy re-formulation 2 In uncertain and unpredictable environments, arising strategies may inspire an immediate initiation of activity to foster from emerging opportunities in the market 3 BM should embrace a fast and adaptable theory to rearrange BM to take benefit of these opportunities and effectiveness in achieving new aims	The requirement to apply more applied skills and science to the DBM model and its success in delivering business initiatives and enterprise strategy framework that support problems for both students and practitioners
8	2018	a. Carmine Bianchi	Lean Dynamic Performance approach by SD	A case study from Artisan, a new firm of the start-up, established company and micro-giant firm	This journal's conceptual model shows authentic empirical research to learn about lean, dynamic performance management systems that might support start-ups with a bunch of key performance motives that aid them in accentuating the right move in every of the four review criteria A lean PM system in small and micro firms can combine the advantage of a structured with a flexible and selective approach. The 'lean' attribute is used here to characterise a different approach in applying PM to small and micro firms compared to larger organisations	System Dynamics modelling has been applied to help acknowledge: (1) how final outcomes can be influenced by achievement drivers; (2) how achievement drivers can, in turn, be influenced by the implementation of policy levers intended to affect strategic resource accumulation and depletion processes; and (3) how final-outcomes impact the flows of tactical assets	The obstacles in devising and carrying through an appropriate review of the arising enterprise frameworks and recognising other options. This condition could be happened because of a shortage of well-developed skills in enterprise framework or simply the inherent problems in modelling this for a highly new invention and novel construction Their value is restricted in terms of helping policymakers illustrate a critical character design over time and framing and evaluating the causal construction influencing them

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No	Year	Author	Research area	Research object	Conclusion	Benefit/Advantage	Limitation/Weaknesses
	2022	b. Liu *et al.*,	System Dynamics for supplier selection	Survey Subject-matter experts	The System Dynamics model for supplier selection was developed by considering profitability, productivity, social transparency, and customer satisfaction in three stages. First stages based on Theoretical Framework and Literature Review. Second stages Subjective model and third stages dynamic model of supplier selection	System dynamics can asses indicator affecting supplier selection and provide a dynamic model for supplier selection Finally System Dynamics help to achieve more competitive power and customer satisfaction	For the good result, the data, information and the indicator, variable, factors should be updated
	2022	Zhou *et al.*,	system dynamics in engineer-to-order supply chains industry	project-based production	SD develop and analyse an ETO Model by applying system dynamics and control engineering approaches. First, required to set the boundary and its positioning in the dynamics of production planning and control systems. Second, Define, analyse distinguished variables and features for an ETO archetype. Third, need to set the satisfies targeted system state requirements	SD can develop an ETO Model which can automatically control the production to maintain the lead time, at the same time we conclude that holistic system level order book controller is much effective than a local controller in production planning and control	Many assumptions about Capacity limitation and constraint. And the result of this research is only for the ETO Industry model

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Table 3.

No	Year	Author	Research area	Research object	Conclusion	Benefit/Advantage	Limitation/Weaknesses
9	2019	Federico Cosenz	Support for sustainable enterprise models	A case study from Patagonia, a firm domiciled in Ventura, California, United States and running a business in outdoor apparel and gear manufacturing	The Dynamic Business Management for Sustainability theory may support decision-makers in creating sustainability-related goals built upon the core of worth invented by certain motives. So it can create the improvement of sector-specific or type-specific strategies for sustainability. Many manufacturing areas (e.g. electronics, clothes and consumer goods) or sort of firms (e.g. start-ups, small and medium-firm and large firms) respond differently to sustainability motives' achievement	The main benefit of the DBMfS canvas depends on its dynamic origin, as against the naturally static level taken by the existent BM kits in the BMfS references (Dentchev *et al.*, 2018). The proposed model also offers a consolidated perspective of the main concept of value proposition, basically constructed on the connection between value drivers, production and results. The logic of all these management kits for modelling BMfS depends on the concept that the important innovation must be mobilised towards creating social and/or environmental advantages in enterprise management, therefore shifting the centre of the value proposition to the community and the circumstances	First, the approach of the DBMfS theory still does not permit the quantitative model's management. Second, although the model example nurtures a developed understanding of the model, the empirical approach should describe the framework's validity. Third, the particular kinds of information that are required to be illustrated in the framework, each one of the BM elements, are still not determined and require further refinement. Specifically, the feasibility to measure and simulate a DBMfS is quite difficult due to the major complication of capturing reliable information on the long-term results (i.e. sustainable value) created by a system
10	2020	Marques *et al.*,	A dynamic family enterprise accretion	Seven experts from many business backgrounds (i.e. automotive, accounting, team building, and industrial and electronic equipment trading)	A black line shows the beginning framework. The outcomes show that four sectors have the best increasing centrality worth, namely: (1) Psychosocial criteria; (2) Firm Policies and Management; (3) Connections or linkage; and (4) Family sectors. The effect of the improvement is a factor in the framework as a whole"	The decision support system generated involved both subjective and objective factors, which generated a clear, simple reflection of the understanding acquired from the panel of experts gathered for this research The proposed methodology permits small-enterprise executives to predict alternatives and make better conclusions. Naturally, the proposed model's idiosyncratic origin requirements must be taken into consideration as it does not permit for Extrapolations without the needed adaptations	The methodologies applied were subjective and context-dependent, so ultimate warning is required when extrapolating the outcomes achieved. Despite these constraints, this research's findings offer a critical approach and practical contributions that can further the improvement of the affiliated reference. On a theoretical level, the proposed FCM-SD model is process-oriented and constructivist, indicating that the proposed system can be applied as a learning process

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Table 3.

No	Year	Author	Research area	Research object	Conclusion	Benefit/Advantage	Limitation/Weaknesses
11	2022	Del Vecchio *et al.*,	System Dynamics for E-Health Management	ICU Patients in hospitals in the adoption of Electronic Health Records (EHR)	SD contributes to the debate related to the adoption of new approaches and techniques in the field of e-health by providing useful simulations for the effective decision-making of health care managers and decision makers. Even more important is probably the emerging evidence of its applicability in strategic planning and, therefore, prior to the start of investments and executive projects, especially in situations involving a lack of information, such as in less developed contexts, in which insufficient data can be obtained from previous application cases	The adoption of an SD approach as a quantitative forecasting method able to evaluate the effects of digital health care on humans with the standards of organizational efficiency represented the main contribution offered by the study to the advancement of research and practice and highlighted the benefits of its adoption for the optimization of e-health services	With the adoption of IT systems containing a large amount of information and personal data on patients, new opportunities have emerged, as well as new challenges. The awareness issues of privacy in computer data are significantly evolving the organization's laws and regulations must adhere The limitations alongside its advantages regarding new assessment scenarios: are its scalability, the ability to extend the model both regarding hospital structures and wards and toward other healthcare delivery methods, and the possibility of integrating additional variables to simulate the adoption of further technologies or effects resulting from their implementation that have not yet been considered
	2023	Liu *et al.*,	Diseases SARS-CoV-2 management	Theoretical Study	Conclusion and solutions are obtained for various arbitrary parameter counts. Specific vaccine procedures and treatments for infectious diseases are very important as the process of receiving vaccinations are seen as effective tools for eradicating SARSCoV-2 in the human community	The system dynamics can explore more the deep problem of Sars-Cov-2 about increasing population density of affected disease, the trend of the human behaviour with the infected disease, dynamic of infected population, what is the influencing factors with the declining number of the infected human population, how many people have received vaccination and what is the effect after getting vaccinated	The data and information should be accurate and sufficient enough to execute Sars-Cov-2 Research. The results of the model using the generalized derivatives are much more precise and more accurately describe real-world phenomena

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No	Year	Author	Research area	Research object	Conclusion	Benefit/Advantage	Limitation/Weaknesses
12	2023	Riaz *et al.*,	Construction	Respondent (preliminary questionnaire survey and a detailed questionnaire survey).	Pave the way for creating a strategy or policy or quality-oriented environment, which is more feasible for Total Quality Management implementation and enhances the quality performance of construction projects in developing countries	The SFD was developed to connect causal relationships and polarity and subsequently used to develop the SDM. Top management commitment, continuous improvement, and quality of education regarding TQM and the TQM (converging stock) were specified as four notable stocks of this SDM. The combination of influence matrix, CLD and SFD assisted in developing the SDM simulated through VENSIM software over five years. Over time, the existing three accumulated stocks under the influence of reinforcing interrelationships illustrated exponentially increasing behaviour of the TQM as the converging stock	System Dynamics Model is not applied to real projects/case studies in both developed and developing countries which can compare the results and advance the body of knowledge

Table 3.

This article investigates SD in performance business models and management in the last 7 years. This comparative study analyses some SD models from many authors worldwide. Their goals are behind their strategic business models and encounters for their respective progress. This study presents policy recommendations on how the next study should be assessed for creating further SD in performance business models and management studies. This approach may serve as a checklist for new researchers in the field.

The measurement of BPM relates to profitability, growth, innovation, social impact, experimental skill (Cosenz and Noto, 2018a, b), networking, psychosocial factors (Marques *et al.*, 2020), quality, quantity, efficiency, outcome and technology development (Cosenz, 2017). The sector of the industry in Table 3 includes the gear industry (Cosenz *et al.*, 2020), automotive industry (Marques *et al.*, 2020), electronics, apparel, consumer goods, gear industry (Cosenz *et al.*, 2020), software development (Cosenz, 2017).

5.1 Sustainability model

The SD sustainability model can quickly decrease the negative impacts on society, the environment and customer behaviour. The business model can help decision-makers understand that BM can affect the natural environment, directly and indirectly, and impact customer behaviour for strategic formulation. It helps decision-makers create an environmental value proposition and value creation capacity for the problem of resource scarcity. In BMfS, the stock and flow diagram is different from other businesses from a stakeholder's perspective and is concerned with an environmental value proposition, ecological capital, value creation capacity and value capture. BMfS provides a different feedback loop (environment – the decision-maker – business model) that can induce self-reinforcing ecological beliefs in the decision-maker and customer that lead to more sustainable business model development. The correspondence loop and balancing loop show the limit of the BMfS model in its growth by detecting counteracting balancing loops to foster sustainable development.

5.2 System dynamics in lean manufacturing

SD in strategic formulation increases the manufacturing sector's efficiency, effectiveness, and productivity, profitability (Liu *et al.*, 2022a, b), customer satisfaction, social transparency and addresses issues such as scarcity of raw materials, capital costs, energy, equipment and greenhouse gas emissions. The increase in productivity occurs with an increase in production yields and outputs.

5.3 System dynamics in government

SD enriches the understanding and analysis of behaviour, relevance of system structure, and shared views of stakeholders in managing long-term governance strategies, both locally and internationally. It is also able to properly identify the proper strategic formulation to produce relationship correspondents.

5.4 Social dynamic approach

The next model needs a logical structure and qualitative study of dynamic social modelling, converting local information, past data, management factors and performance targets to the mathematical diagram, correspondence graph, behaviour structure and simulation model. The implication of the policy has dynamic complex system effects in helping young people with services in education, workshop, training, and employment and reducing the number of policy resistance. To conceptualise the system's dynamic complexity, it should develop a preliminary policy design to measure and simulate the model for policy improvement.

5.5 System dynamics in a start-up business

SD modelling simulates the complexity of physical and social systems and provides a valuable methodology for supporting business models. The set of equations describes phenomena, map system structure, feedback interrelationship and communication loops, behaviour driving process, and complexity management system to help decision-makers understand business operation methodology and strategic business planning formulation. The alternative scenario helps entrepreneurs in exploring and understanding the assumption and perspective for many future prediction business conditions. Deep understanding should be explored in the complexity of DBM construction when the false impression usually develops in simple analysis and quick results and outcomes for highly complex business systems. The unpredictable, uncontrollable and uncertain environment usually emerges in strategies, anticipated, and opportunities for new market development. To take advantage of the business model, reformulate possible scenarios and achieve new goals, it should adopt a rapid and flexible approach. In addition, it may help businesspeople interpret the results from these studies in their decisions in daily practice.

SD in the static BMS approach show a deeper interpretation and connection between business model variables or factors or dimensions. The ultimate business value is obtained from the interplay of key resources, processes and stakeholders, which integrate the fundamental relationship between outcomes, outputs and value drivers in SD. The ultimate innovation should have a value proposition in business operations that benefits the social and environmental world.

5.6 Differences between dynamic business models and dynamic performance management

In unpredictable and uncertain environments, the arising strategies may produce a prompt initiation of action to prosper from emerging opportunities in the business. Therefore, BM representations should adopt a flexible and rapid approach to reformulate BMs to get benefit from these opportunities, as well as to explore associated tactics and strategies to test their effectiveness in obtaining the new targets. By interpreting BMs as complex and dynamic systems, Demil and Lecocq (2010) remark that "firm sustainability tends on reacting and anticipating sequences of voluntary and new improvement, naming the label "dynamic consistency" to this firm capacity to nurture and build its performance while changing its business model. In particular, with the intent to explore the business sustainability and the environmental impact of its operations, the approach suggested by Abdelkafi and Täuscher, 2016 and Zhou *et al.* (2022) aims at using SD (or better system thinking) to build and graphically represent partial BM causal-loop diagrams which consist of (1) the firm; (2) natural environment; (3) decision-makers and (4) customers.

5.7 System dynamics in health industry management

SD contributes to the debate related to the adoption of new approaches and effective tools in the field of e-health by providing useful simulations for the effective decision-making of health care managers and decision-makers for strategic planning and, therefore, prior to the start of investments and executive projects, especially in situations involving a lack of information, such as in less developed contexts, in which insufficient data can be obtained from previous application cases.

5.8 System dynamics in construction industry

Despite the diversity and novelty of construction projects, the utilisation of sophisticated quality management methods such as total quality management (TQM) is lower. This study aimed to address the intricacy and causality resulting from implementing TQM in the construction sector, especially in developing countries, using the system thinking approach.

First, dynamic business innovation modelling has evolved as a key activity to reflect new business venture strategy by framing the way a firm will operate and how it will function in achieving its goals in DPM such as financial or economic (profitability, ROI, NPV, IRR, etc), productivity (efficiency, lead time, etc), environmental (energy saving, emission, etc), growth, innovation, social impact (CSR, Employee rate) (2018a). In the initial stage, start-ups experiment with their business models and, as a result, discover the most effective strategies, especially in terms of business sustainability and profitability (2018d). So a different DPM measurement will produce a different dynamic business innovation model.

Second, conversely, the DBM approach adopts a flexible and broader perspective on how a business works and produces value, which may also contain environmental and sustainability purposes. In addition, the possibility to simulate model behaviour over time may better contribute to fostering both the decision-making process and strategic learning (Aspara *et al.*, 2010). By adopting dynamic business model innovation (DBIM) as a strategy that will yield superior performance (DPM), other conceptual approach resists the idea that such innovation would have uniformly positive performance implications (e.g. Simpson *et al.*, 2006). In any case, conclusive (empirical) evidence about the issue is sparse. Delays in adapting the business model will result in different management performance (DPM) results.

Third, about replication. A firm's approach to replication can be considered to be a highly important strategic decision related to that business model innovation (Aspara *et al.*, 2010). Specifically, once having discovered and refined a new business model, replicators may create further value "by choosing the necessary components to replicate that model in suitable geographical locations" (Winter and Szulanski, 2001). Considering that a firm's profitable growth may, thus, benefit not only from the firm's initial innovations but also from their replication (Szulanski and Jensen, 2008), the lack of attention paid to replication in earlier research constitutes.

Forth, the DBM is a qualitative approach to designing BMs and, consequently, it allows entrepreneurs to simulate the outcomes emerging from alternative strategies (Cosenz and Noto, 2018a, b). Thereby, the emerging framework may effectively improve entrepreneurs' strategic learning processes and, as a result, support them in designing more sustainable strategies (Boons and Lüdeke-Freund, 2013). This responds to the need of adopting strategy tools able to experiment with BMs to design strategies for management and change. The Ludwig's case study has illustrated how to build a DBM, as well as the different outcomes achievable by setting and experimenting with alternative investment policies through simulation. The different dynamic business models in the company will perform different outcomes.

Fifth, the research gaps by presenting an empirical study that examines the financial performance implications of the strategic emphasis on business model innovation – as accompanied with vs lacking the simultaneous strategic emphasis on replication. We also examine how the performance management implications differ between smaller and larger firms (Aspara *et al.*, 2010) and the analysis of the differences in average profitable growth across firms that differ on the relevant dimensions. For larger firms, the results indicate that a strategy that puts a high emphasis on business model innovation but low or no emphasis on replication is associated with lower average performance management than a strategy that does not pursue business model innovation at all. Even a strategy with high emphases on both business model innovation and replication had only marginally higher average performance management than a strategy that does not pursue business model innovation at all. In other words, not all firms will be better off pursuing business model innovation – traditional means of competing and doing business may yield equally good results for many firms. The larger and the smaller companies will perform different outcomes in DPM.

6. Conclusions

Many businesses and industries reformed their business operation in the digitalisation era, including business strategy, policy, administration, business process and performance management (Cosenz *et al.*, 2021). All of the papers in Table 3 applied the SD modelling approach. Some papers apply to BMS, sustainable business models, business performance and industry management. Many of the papers are based on the case study approach, especially in start-up companies. One paper can develop an SD modelling approach using a literature study approach, but mostly, all of the papers have a contribution to Local and National Strategy and Policy.

The dynamic business model is very different from the static business model in terms of complexity (detailed, complex, whole system), formality (graphic, mathematical, symbolic, measurement), flexibility (anticipating, changes, reacting, emerging, uncertainty, unpredictability, uncontrollable), capturing (phenomena, mapping, simulation, causal interaction), relationship (critical interdependency, structure, relation, value creation), advantages (competitive advantages, innovation model, new goals, updated information), perspective and problem-solving abilities (changes integration). SD provides the integration of deeper insight, good representation, objective and subjective variables, detailed analysis, possible alternatives, improved adjustment and anticipated scenarios for making a better decision.

The advantages of the SD application can give subjective and objective information about critical factors for decision-makers; direct and indirect impact for the customer; feedback to the policymakers; identification of the origin condition; performance measurement for the stakeholders; share new perspectives and insight; the needs of the new improvement; the limitation of the source; support for the qualitative study; future graphics and simulation; assist better planning and goals; connecting all the factors; social and environmental advantages; predicting some alternatives and a learning process for the whole system.

Despite all of the advantages of SD application, some constraints should be managed, such as material feedback and export information to the suppliers; demand management; complexity or complicated factors; restricted data; unrecognised problems; need to identify the assumption; adaptable and adjustment situation; need for accuracy and validation measurement; more outcome observation; uncertain and unpredictable environment; and the major complication of capturing reliable information on the long-term results.

7. Future research

The initial approach can be through a static system used in the canvas business model or other static frameworks, but further developments can be continued with a dynamic system approach in developments in business sustainability, lean manufacturing, family business, social service and enterprise, government and start-up businesses, etc. Although the empirical analysis here focused on the literature review, the methodological insights and conclusions described in this paper can be explored in many contexts. Many depth exploration have been conducted that can imply a SD approach to many new creative business ideas, new invention and technology innovation, DPM tools and review, mental and emotional entrepreneurship spirit, and material and physical limitation resources. As a decision support system, the SD approach can provide intervention and challenge for scholars, business practitioners (small, micro, enormous enterprise), researchers, government and policymakers, and educators in the beginning (preliminary policy development) and the maturity phase of the activities. A dynamic focus in strategy process model development and tools allow decision-makers to monitor consistency and decide to adjust for their business profitably. Since the SD approach implied in the recent research is tremendously flexible, the decision-support system-generated could be modelled with other equations.

In the future, SD application could explore some case studies, such as qualitative and quantitative studies on some types of business. Startups, family businesses, government, social services, sustainability and environmental businesses, and trading companies can all benefit from SD applications. The stakeholder can apply SD application in BPM and can get a better understanding of the direct and indirect impact on the enterprise. This information is critical for decision-makers, financial services, financial institutions, government agencies, consumers, investors, shareholders, suppliers, etc.

Based on this study, which shows that businesses are developing more towards digitalisation, wanting the ability to keep up with the era that is moving so fast and the desire to increase profits, an instrument is needed that can help describe the difficulties of the needs and developments of the future world. This instrument, or tool of SD, is also expected to assist in drawing future models and in building a business with complex variables that can be predicted from the beginning.

The start-up company's SD performance business models and management can be used as a case study, while government, business players or decision-makers can be used for further study. Further studies and any of these statements should focus on providing many benefits and contributions to enrich business research. The outstanding contribution could be applied to the local government of the country. Any further study could be continued depending on the world situation, business situation and business trends.

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