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DISRUPTIVE INNOVATION, A SUSTAINABLE STRATEGIC ENTREPRENEURSHIP IMPERATIVE IN THE 4th INDUSTRIAL REVOLUTION

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Abstract

Purpose: Disruptive innovation is recognised as a significant tool for fostering industrialisation and entrepreneurship. The purpose of the study was to establish the influence disruption innovation dimensions (product, process, marketing and manufacturing innovation) on both the fourth industrial revolution and sustainable strategic entrepreneurship within the manufacturing sector. Also, the study sought to determine how influence of the fourth industrial revolution influence sustainable strategic entrepreneurship. **Methodology:** A quantitative research approach was undertaken in this study. A cross-sectional survey of 150 randomly selected respondents was conducted between January and March 2023. The study population was made up of managerial employees within the manufacturing sector in Harare, Zimbabwe. A structured questionnaire with Likert type questions was distributed both electronically and physically to 150 randomly selected managerial employees between January and March 2023. **Findings:** The study results indicate that each of the selected disruptive innovation dimensions (product, manufacturing, marketing and process innovation) positively influence both the fourth industrial revolution and sustainable strategic entrepreneurship. Furthermore, the study proved that the fourth industrial revolution positively impact on sustainable strategic entrepreneurship. **Implications for theory and practice:** The study findings corroborate the disruptive innovation theory which claims that innovation establishes a new market and value network or enters a market from the bottom and eventually supplants long-established market-leading companies, goods, and alliances. Hence the current study supports the claim through the finding that disruptive innovation impacts on the 4th industrial revolution and sustainable strategic entrepreneurship. In order to promote industrialisation and entrepreneurship, the manufacturing sector is recommended to make an effort to foster activities that enhances product, process, marketing and manufacturing innovation. Also, the study suggests that the manufacturing sector should expand the innovation mind-set across entire firms, i.e. from the boardroom to the shop floor. Likewise, firms within the

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manufacturing in developing markets need to implement new and creative ideas in order to create and add value to their processes. To put it another way, businesses within the manufacturing sector for emerging markets should improve processes that involve a combination of company resources such as facilities, skills and technologies as these may impact on industrialisation and sustainable strategic entrepreneurship. These firms should also improve the marketing innovation by introducing some novel marketing strategies that involve major modifications in product design or packaging, product placement, product promotion, or pricing among others. **Originality and value:** Disruptive innovation is critical in modern business and it is regarded as a significant tool for fostering industrialisation and entrepreneurship. Research on factors that determine disruptive innovation's impact on 4th industrial revolution and sustainable strategic entrepreneurship has been unheeded. As a result, the current research tried to answer the essential question of how each component of disruptive innovation affects the fourth industrial revolution and sustainable strategic entrepreneurship. The impact of dimensions for disruptive innovation on the fourth industrial revolution and the effect of the fourth industrial revolution on sustainable strategic entrepreneurship were empirically investigated to answer this question. Several studies on innovation have been carried out in industrialised countries, with very little research conducted in low income nations and emerging markets, particularly in the Sub-Saharan area which include Zimbabwe. None of these studies studied the relationship among disruptive innovation, 4IR and sustainable entrepreneurship especially within the manufacturing sector. As a result, the research of this kind is critical because it adds to and validates existing innovation knowledge especially in growing markets. The current study deepens our innovation understanding on the elements of disruptive innovation particularly manufacturing, product, process and marketing innovation with regards to the manufacturing sector in the Sub-Saharan region. The fourth industrial revolution and sustainable strategic entrepreneurship are predicted by all the four dimensions of disruptive innovation.

Keywords: Disruptive Innovation, Fourth Industrial Revolution, Sustainable Strategic Entrepreneurship, Zimbabwe.

INTRODUCTION

Due to technological revolution, the business environment has become highly competitive across all industries (Kaondera et al., 2023). The move to the fourth industrial revolution (4IR) has seen an improvement in terms of industry operation and performance within sectors especially within developing markets (Srisathan et al., 2020). The driving forces for the 4IR are fast paced to the point of disrupting the way business is being done without looking at sector, industry or size of the business (Chikazhe et al., 2023). Entrepreneurship as the kingpin to industrialisation and economic development has not been an exception to the adoption of the new technologies such as artificial intelligence, machine learning and robotics which are slowly replacing humanity in business operations (Nyagadza et al., 2023).

Disruptive innovation is viewed as a way of doing new things or focuses on a redefinition of a firm’s performance levels resulting in the creation of new markets (Nuseir et al., 2020). Chapman (2021) states that technological change is either disruptive or sustaining. Where disruptive innovations cause a shift in technological paradigm and business routines, it creates new products that cause a demise of existing ones while the sustaining innovations reinforce the business routines and develop existing products). The emergence of the Covid-19 pandemic has placed another dose of pressure on businesses worldwide placing a need to review business models.

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Never before has the need for entrepreneurs to quickly adopt new technologies been more important, especially given the shutdown of business in most business circles. High unemployment rates in most developing nations (pre-lockdown) have had a significant impact on entrepreneurs, who are now fighting for survival.

The current environment worldwide therefore calls for entrepreneurs to continuously adopt new technologies to change the processes product, marketing and manufacturing strategies in order to position their businesses in tandem with the prescriptions of the 4IR (Yusheng and Ibrahim, 2019). Disruptive innovation is fostered through adopting new ways of enhancing products quality (Kennedy & Kundu, 2022), processes and manufacturing using state of the art or smart technologies (Nuseir et al., 2020).

Entrepreneurs in the manufacturing sector, Zimbabwe included, can only be sustainable if they walk alongside the same pace with 4IR which dissolves the use of out-dated systems and processes in their operations. The smart world requires entrepreneurs to have a disruptive mind where maintaining the status quo should be a thing of the past, but rather be always trying new things in their businesses. The implementation of disruptive innovation requires the creation of new business models and management plans, the presence of new favourable framework conditions (Chapman, 2021).

Manufacturing entrepreneurs are known for importing finished products which they later repackage using their brand names. In China, entrepreneurs fail to have a foothold in the market because they rely on manufactured products from other enterprises (Chen & Pao, 2017). The era for retail entrepreneurs should be displaced through the adoption of technologies that enhance production of high quality products. Manufacturing entrepreneurs, like the furniture industry are finding it difficult to make innovative breakthroughs as compared to established organisations which bar them to compete even at a national level (Chapman, 2021).

The lack of smart technologies in their manufacturing processes leads to low quality products sold at low prices as well. Sawik (2019) added that entrepreneurs have been known for abandoning innovation by imitating existing products from established firms which leads to no value addition to the consumers. As a result of the technological advancement, it is difficult for entrepreneurs to continue imitating products and remain competitive, rather they should view disruptive innovation as the only way to sustainable entrepreneurship (Chen et al., 2017).

Chapman (2021) states that small and medium-sized businesses in most developing countries are at risk of collapsing if they do not adapt to the digital disruption, legal constraints, and economic upheaval that are fundamentally changing their industries. According to Nuseir et al. (2020), entrepreneurs must adopt new technologies as soon as possible to get a competitive advantage, whereas Rajapathirana et al. (2018) suggests incentivising the usage of 4IR technologies to boost corporate competitiveness.

To enhance industrialisation for an emerging economy such as Zimbabwe, its high time entrepreneurs adopt modern technologies and start manufacturing own products as most firms are relying on selling finished products which they get from developed countries that

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have responded to the demands of the 4IR. It is evident therefore that if a country is not innovative it will also lose business which may be taken to other nations hence the sustainability of its manufacturing industry continues to suffer. It is upon this backdrop that this paper looks at how disruptive innovation influences 4IR and sustainable strategic entrepreneurship for the manufacturing sector in Zimbabwe. The major objectives for this study were to establish the effect of disruptive innovation on both 4IR and sustainable strategic entrepreneurship and to ascertain whether 4IR has a positive influence on sustainable strategic entrepreneurship.

LITERATURE REVIEW

The study was underpinned by Christensen (2018)'s disruptive innovation theory. Disruptive innovation theory establishes a new market and value network or enters a market from the bottom and eventually displaces long-established market-leading companies, goods, and alliances. Thus, the manufacturing sector in Zimbabwe is faced with technological innovation advancement challenges due to traditional methods of conducting business hence there is need to speed up the adoption process to enhance sustainable entrepreneurship.

Fourth Industrial Revolution (4IR)

Industrial revolution is a period of technological progress that share a common set of traits and are linked to and occurring at the same time as broader social upheaval (Philbeck & Davis, 2018). The fourth industrial revolution portrays a society in which people use connected technology to enable and govern their lives as they move between digital realms and offline realities (Yin et al., 2020). To understand it better, there is need to have brief overview of the sequences of the industrial revolutions.

The 4IR has brings changes on business management and it is believed to continue to shape the future of business and no one has control over the disruption that comes with it (Xu et al., 2018). Opportunities that come with the fourth industrial revolution include the Internet of things (IoT), improved quality of lives through robotics, integration of different technics and domains, the more active role of artificial intelligence (AI) and lower barriers between inventors and markets (Xu et al., 2018). The fourth industrial revolution has the potential to increase income by allowing businesses to try out new ideas. However, the revolution may result in more inequality, especially if labour markets are disrupted. As automation increasingly replaces labour across the economy, the net displacement of workers by machines may widen the gap between capital and labour returns (Yin et al., 2020). In such a society, people who can create new ideas and innovation will become the most valuable and scarcest resource (Kennedy & Kundu, 2022).

Sustainable Strategic entrepreneurship

Sustainable strategic entrepreneurship is a fairly new discipline which is best understood by defining its components (Nyagadza et al., 2023). Strategic entrepreneurship is a term that refers to a company's efforts to capitalise on today's competitive advantages (;

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Montiel-Campos, 2023) while simultaneously looking for breakthroughs that will pave the way for tomorrow's competitive advantage (Lachapelle & Cloutier, 2020). This framework is built on the premise that strategic management and entrepreneurship are complimentary professions, and that wealth creation is the product of their combined efforts (Karlsson et al. 2019). The dimensions of strategic entrepreneurship are an entrepreneurial mind-set, entrepreneurial culture, entrepreneurial leadership, strategic resource allocation, creativity, and innovation (Xu et al., 2018).

The firms' ability to achieve what they can as a result of balancing exploitation and exploration is based on on-going innovation (Philbeck & Davis, 2018). They also discovered that enterprises can obtain value from low-quality or outmoded products even while using highly efficient processes, resulting in a durable competitive advantage from a mix of product, process, and administrative advances.

The link between sustainable development and enterprise has been identified as sustainable entrepreneurship (Xu et al., 2018). Sustainable development is defined as the process of addressing current demands without jeopardizing future generations' ability to meet their own needs. Thus, according to Yavarzadeh et al. (2015) sustainable entrepreneurship seeks to provide marketable solutions and to act as change agents who recognize and exploit chances for long-term growth. It can therefore be argued that sustainable strategic entrepreneurship refers to tenable advantage seeking and opportunity seeking activities that guarantee continuous business success.

Disruptive innovation

Disruptive innovation is defined as the introduction of a service or product into a well-established market that exceeds earlier offers and, in most cases, at a lower cost, dislodging market leaders and altering the industry (Christensen et al., 2018). Disruptive innovation is innovation that disrupts an established trajectory of performance improvement in an industry or reshaping the meaning of performance (Yin et al., 2020).

It is a tool that enables firms to communicate with their customers through the services and products offered. Furthermore, Zhao et al. (2018) supports that through disruptive innovation, firms are able to harness new ideas and innovations that can help in creation of new markets (Sawik, 2019) and can also be a breakthrough for expanding to new markets. This study understands disruptive innovation as encompassing product, process, marketing and manufacturing innovation.

Research has shown that although disruptive innovation is an important innovation strategy for companies, which can bring success and growth, most incumbents do not prioritise disruptive innovation projects in practise (Aksoy, 2017: Nazzaro et al., 2019).

This is attributable to the limited potential gains of a disruptive innovations from existing markets; the difficulties in predicting the size of the potential future market and the small size of emerging markets which cannot meet the development costs of new products in the early days. However, incumbents can set up separate business units to experiment potential disruptive innovation projects.

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RESEARCH HYPOTHESES AND RESEARCH MODEL DEVELOPMENT

Disruptive innovation and industrial revolution and sustainable strategic entrepreneurship

Innovation is key to industrialisation (Cho et al., 2018). In their study, Qian et al. (2018) concluded that innovation positively influences industrialisation. Moreover, Cunningham et al. (2019) settled for almost similar results as they agreed that innovation and industrialisation are positively related. Related studies (Zach et al., 2020; Ellis et al., 2019; Zhu et al., 2017) investigated the effect of innovation on entrepreneurship and confirmed a positive relationship between the two variables. The current study introduces sustainable strategic entrepreneurship which makes it unique. Based on the debate and conclusions from these earlier studies, it can also be hypothesised that:

H_1: Disruptive innovation has a positive impact on the 4th industrial revolution

H_2: Disruptive innovation has a positive effect on sustainable strategic entrepreneurship

Effect of dimensions of disruptive innovation on industrial revolution

Hughes et al. (2021) carried out a study that sought to establish how innovation contributes to technological advancement. The study settled that industrialisation is a result of entrepreneurial efforts like product development and improvement. In a related study, Makanyeza and Dzvuke (2015) concluded that only product innovation and organisational innovation positively impact on company performance, whereas process and marketing innovation had no meaningful impact on firm performance. Likewise, Canh et al. (2019) researched on the influence of invention and firm performance. Only marketing and process innovation were found to positively influence firm performance. Cho et al. (2018) also looked at the repercussions and future directions for the development of industrial revolution-related policies, as well as the strengthening of international collaboration. The study results confirm that policies related to the industrial revolution influence cooperation within various countries. Also, Paek and Lee (2018) examined vital source of sustainable competitive advantage for a business. The study established that a firm's position and evolutionary path results from product and marketing innovation only. Ooi et al. (2018) conducted a research to establish the link between manufacturing and industrial revolution in the Malaysian economy. The study results proved a positive relationship between incremental innovation and the industrial revolution. As a result, it is clear that the findings from earlier studies differ in how each of the dimensions of innovation influences industrial revolution, necessitating the conduct of additional tests to confirm this occurrence. This study unbundled innovation to come up with four dimensions and test them separately which makes it unique from prior related studies. Thus, it can be suggested that:

H_{1a}: Product innovation positively influences 4^{th} industrial revolution

H_{1b}: Process innovation positively affect 4th industrial revolution

H_{1c}: Marketing innovation positively influences 4th industrial revolution

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H_{1d}: Manufacturing innovation has a positive effect on 4th industrial revolution

Effect of dimensions of disruptive innovation on sustainable strategic entrepreneurship

Tuan et al. (2016) found that organizational, process, and marketing innovations all contribute to firm growth, while product innovation had little effect. A Study by Nambisan et al. (2018) examined the processes at play regarding innovation and entrepreneurship. The results of both studies indicate a positive relationship between only product innovation performance and entrepreneurship. Also, Lafuente et al. (2018) analysed the ideal trajectory for innovation. The study results show that entrepreneurial and innovation orientation are among configurations of product innovation. Similarly, Karlsson et al. (2019) conducted a study to determine the relationship between diversity, innovation, entrepreneurship and development. The study established that all the factors under study were related to each other. Moreover, Nambisan et al. (2019) carried out a study to further understand how powerful digital technologies transform innovation and entrepreneurship. It was discovered that innovation and entrepreneurship are transformed by digital technologies.

Several studies have also attempted to establish the direct relationship between innovation and entrepreneurship (Christensen et al., 2018; Ellis et al., 2018; Lounsbury et al., 2019). Zhang (2020) studied the relationship between application-oriented innovation and entrepreneurship education within the construction discipline. The study results indicate that education positively influences innovation and entrepreneurial skills. A similar study by Chin et al. (2019) proposed a framework that can be used to study entrepreneurship sustainability challenges. It was concluded that innovation within the manufacturing sector has a relationship with entrepreneurship. Also, Reynolds and Uygun (2018) studied the importance of innovation in promoting entrepreneurship. The results of the study indicate that the demand-driven innovation and technological upgrading supports the growth of entrepreneurs. Furthermore, Cornelius et al. (2021) examined the role of innovation by shop-floor employees. The study confirmed a positive relationship between employee-driven manufacturing innovation and entrepreneurship development. Hence none of these earlier studies considered the dimensions for disruptive innovation and their relationship with sustainable strategic entrepreneurship. As a result, performing this research contributes to a better understanding of this phenomenon. Therefore, it can be hypothesised that:

H_{2a}: Product innovation has a positive influence on sustainable strategic entrepreneurship

H2b: Process innovation has a positive effect on sustainable strategic entrepreneurship

H2c: Marketing innovation positively influences sustainable strategic entrepreneurship

H2d: Manufacturing innovation has a positive effect on sustainable strategic entrepreneurship

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Industrial revolution on sustainable strategic entrepreneurship

Prior studies have examined the relationship between industrialisation and entrepreneurship (Carvalho et al. 2018; Naude, 2017; Petrillo et al., 2018). Considering the debate and prior studies, none of these studies sought to establish whether the fourth industrial revolution has a positive influence on sustainable strategic entrepreneurship. As a result, conducting this research helps us better comprehend this phenomenon. Thus, it can be proposed that:

H_3: The Fourth Industrial Revolution has a positive influence on Sustainable strategic entrepreneurship

The following research model is provided based on the stated research hypotheses.

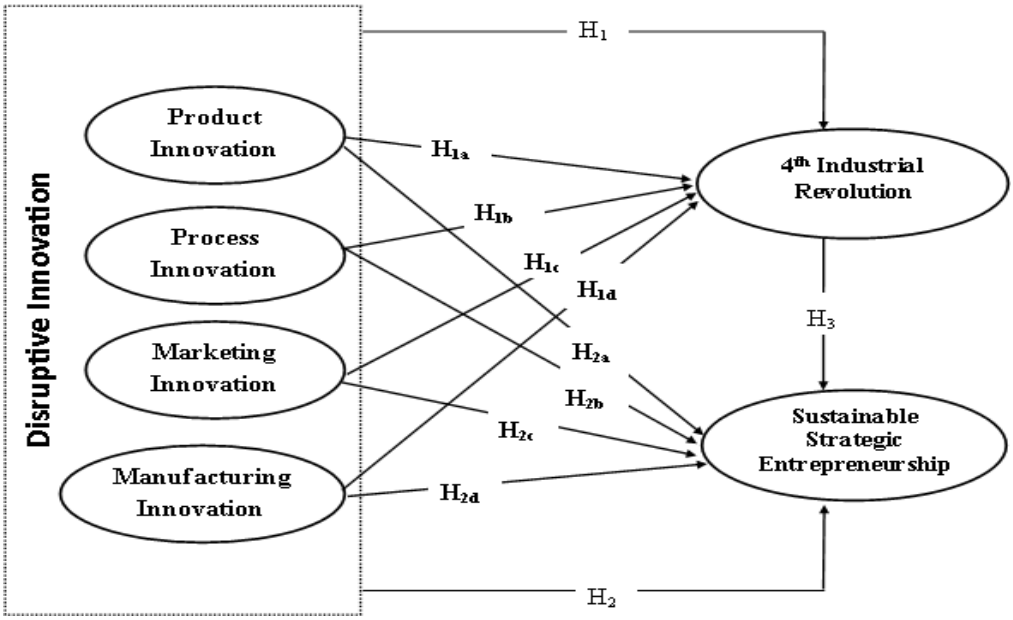

Figure 1: Research Model

Source: Author (2023)

METHODOLOGY/RESEARCH METHODS

Questionnaire design and measures

Data were collected using a structured questionnaire with Likert type questions ranging from 1-Strongly Disagree to 5-strongly agree. The questionnaire was divided into six sections to cover all study variables i.e. Sustainable Strategic Entrepreneurship (SSE), Product (PROD), Process (PROC), Marketing (MI) and Manufacturing Innovation (MAN) together with the 4th Industrial Revolution (IR). Items used in developing the questionnaire, items were borrowed from previous related studies and were modified to suit the current study.

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Table 1 shows constructs, items, and sources.

Table 1: Constructs, items, and sources

Construct	Items and Codes	Sources
Product Innovation - PROD	The firm frequently introduce new products.	Lafuente et al. (2018) Nambisan et al. (2019)
	The firm develops new product features.	
	The firm reposition its existing products.	
	The firm uses new products to penetrate markets	
	The firm enhances existing products	
Process Innovation - PROC	The firm continuously change its manufacturing processes	Chin et al. (2019) Uygun (2018)
	The product design is constantly renewed basing on customers' needs and competitive products.	
	The firm offers greater efficiency in its procurement processes	
	The firm continuously upgrades our equipment to meet customer needs	
	The firm has flexible processes to accommodate changes in the environment	
	The firm's processes enhance continuous improvement of products and services	
Marketing Innovation -MI	The firm innovates its marketing programs to stay ahead of the market.	Karlsson et al. (2019)
	The firm continuously builds and improves relationships with customers.	
	The sales techniques are always revised with new methods proposed.	
	The firm implements innovative marketing programs.	
	The firm looks for ways to develop new business models.	
	We look for ways to improve our promotion methods.	
Manufacturing Innovation - MAN	Management support drives innovation	Carvalho et al. (2018) Naude (2017)
	An innovative culture is inculcated in the organisation	
	Employee attitudes are harnessed towards innovation	
	Innovative skills are continuously enhanced	
	Continuous learning is fostered in the organisation	
	Innovation awareness is enhanced throughout the organisation	
Sustainable Strategic Entrepreneurs hip - SSE	The firm believes in harnessing advantage seeking and opportunity seeking behaviours in the organisation	Cornelius et al. (2021) Nambisan et al. (2019)
	The firm develops continuous competitive advantages through continuous organisational renewal	
	The firm balances exploration and exploitation activities	
	The firm balances resources between exploration and exploitation activities	
	There are continuous streams of innovation within the firm	
	There is continuous value creation in the organisation	
4th Industrial Revolution – IR	Human centred technologies are scaled up	Carvalho et al. (2018) Naude (2017) Petrillo et al. (2018)
	There is continuous reinvention	
	Sustainable systems are created	
	Work tasks are simplified	
	Operational efficiency is enhanced	

Source: Author (2023)

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Sampling and data collection

A quantitative research approach was undertaken since it is best suited in most social research situations, such as those that need the identification of factors that impact a result. Quantitative research also makes it easier to understand research frameworks and ideas. The survey was conducted using a cross-sectional survey. The study population included managerial employees within the manufacturing sector in Harare, Zimbabwe. Harare was chosen because of its centrality and hosting of many manufacturing companies in Zimbabwe. The manufacturing firms that provided respondents were randomly chosen from both the light and heavy industries. The structured questionnaire was distributed electronically and physically to 150 randomly selected managerial employees between January and March 2023. The response rate was 90%. Thus, 135 questionnaires were returned and could be used. The study's sample profile is shown in Table 2 below:

Table 2: Sample Profile

Profile Characteristic		Frequency	Percent (%)
Gender	Male	95	70.4
	Female	40	29.6
Age	Less than 30	25	18.5
	30-39	65	48.2
	40-49	29	21.5
	50-59	10	7.4
	60+	6	4.4
Nature of business	Carpentry	7	5.2
	Industrial Supplies	68	50.4
	Light Engineering	25	18.5
	Machinery and Tools	20	14.8
	Metal Engineering	15	11.1
Business experience	< 1 year	12	8.9
	2 – 5 years	78	57.9
	6 – 10 years	29	21.3
	> 10 years	16	11.9

Source: Author (2023)

From the results in Table 2, it can be noticed that male respondents constituted the bulk (70%) of respondents. The majority of respondents (69.7%) were aged between 30 and 19. Industrial supplies were the main supplier of respondents that participated in the study. Lastly, most respondents had experience that ranged between 2 and 5 years.

RESULTS

Exploratory factor analysis (EFA), convergent validity, and discriminant validity were used in the scale validation process. This was executed in SPSS V22 and AMOS V22. Kaiser-Meyer Olkin (KMO) and Bartlett's Test of Sphericity were used to establish the sample

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adequacy prior to exploratory factor analysis. Table 3 show the results obtained from Kaiser-Meyer Olkin (KMO) measure and Bartlett's Test of Sphericity.

Table 3: KMO and Bartlet's Test Results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.897
Bartlet's Test of Sphericity	Approx. Chi-Square	19497.879
	Df	489
	Sig.	.000

Source: Author (2023)

The results in Table 3 show that the sample met minimum conditions and were acceptable (Heale & Twycross, 2015). It was therefore necessary to perform exploratory factor analysis. Varimax rotation was used as factor analysis was performed. Thus, the total variance explained by the data was 69.988% and the solution gave six components (PROD, PROC, MI, MAN, SSE & IR) and no items was deleted as a result of low or double loadings.

For this examination, the study used convergent and discriminant validity to analyse data validity, as recommended by Field (2009).

Convergent validity

To obtain better estimates, the measurement model was estimated using Maximum Likelihood Estimation (MLE). As a prerequisite for convergent validity measurement, the model fit indices were examined. The findings indicate that the preconditions for convergent validity requirements were met. Thus, the model fit indices suggested by the measurement model were appropriate (CMIN//DF = 4.008; GFI = .901; AGFI = .921; NFI = .911; TLI = .907; CFI = .915 and RMSEA = .062) (Hooper et al., 2008).

The results for standardised factor loadings (λ), individual item reliabilities (IIRs), Critical ratios (CRs), Cronbach's alpha (α) and composite (CRel) reliabilities also met the minimum conditions. Thus, Cronbach's alpha (α) together with the composite reliabilities (CRel) achieved a cut-off value of more than 0.6 in all constructs as recommended by Kuo et el. (2009). Moreover, Standardised factor loadings (λ) produced results which were above the recommended cut-off point of 0.6 for all items, and critical ratios (CRs) produced results that were substantial and significant at $p< 0.001$ (Fornell & Larcker, 1981). Also, all individual item reliabilities were above 0.5 as commended by Hooper et al. (2008).

Discriminant validity

As for discriminant validity results, squared inter-construct correlations (SICCs) were matched to Average variance extracted (AVEs) to determine discriminant validity). Discriminant validity is acceptable when the average variance extracted values are above 0.5 (Wang, 2013) and greater than the squared inter-construct correlations (Henseler, et al., 2014). Table 4 shows the results for discriminant validity test results.

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Table 4: AVEs and SICCs

Construct	PROD	PROC	MI	MAN	SSE	4IR
PROD-Product Innovation	**.622**					
PROC- Process Innovation	.398	**.598**				
MI-Marketing Innovation	.401	.368	**.702**			
MAN-Manufacturing Innovation	.477	.397	.411	**.638**		
SSE-Sustainable Strategic Entrepreneurship	.397	.295	.349	.473	**.675**	
4IR-4th Industrial Revolution	.346	.291	.344	.480	.479	**.617**

Note: Diagonal elements in bold represent AVEs

Source: Author (2023).

All AVEs figures in Table 4 were greater than the corresponding squared inter-construct correlations and they were also greater than 0.5. As a result, all of the requirements for discriminant validity were met. The results obtained from convergent and discriminant validity tests satisfied minimum conditions and allowed hypotheses tests to be conducted.

Research hypotheses test results

Following the identification of the factors that underpin the constructs, the study hypotheses were tested in AMOS V22 to discover the nature of the relationships between variables (PROD, PROC, MI, MAN, SSE, and 4IR).

Using Maximum Likelihood, structural equation modelling was performed to examine H_1 and H_2. Disruptive innovation was treated as a second order construct during H_1 and H_2 hypotheses tests. The structural model displayed a good fit. Table 5 indicates the results for the model fit.

Table 5: Measurement model fit indices

Fit indices	Actual Results	Commended Results	Sources
$\chi 2$ / DF	2.09	≤3.000	Hair et al. (2010); Hooper et al. (2008)
GFI	.897	>0.900	
AGFI	.902	>0.900	
NFI	.913	>0.900	
TLI	.940	>0.900	
CFI	.922	>0.900	
RMSEA	.062	<0.080	

Source: Author (2023)

Likewise, the structural equation modelling was conducted to test $H_{1a\text{-}d}$, $H_{2a\text{-}d}$, and H_3. A good fit was also exhibited for the structural model (CMIN/DF=2.814; GFI=.899; AGFI=.901; NFI=.942; TLI=.915; CFI=.921; RMSEA=0.040) (Hair et al., 2010; Hooper et al., 2008). Hypotheses tests; H_1, H_2, $H_{1a\text{-}d}$, $H_{2a\text{-}d}$, and H_3 were conducted and the results are shown in Table 6 and 7 below:

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Table 6: Results of Hypotheses testing (H_1, H_2 and H_3)

Hypotheses	Hypothesised Relationship	SRW	CR	Remark
H_1	Disruptive innovation → 4th industrial revolution	.329	11.234***	Supported
H_2	Disruptive innovation → sustainable strategic entrepreneurship	.277	7.464***	Supported
H_3	4th Industrial Revolution → Sustainable strategic entrepreneurship	.482	15.221***	Supported

Notes: SRW standardized regression weight, CR critical ratio, ** significant at $p < 0.05$, *** significant at $p < 0.001$

Source: Author (2023).

Results shown in Table 6 indicate that aggregately, disruptive innovation has a positively influences both the 4th industrial revolution and sustainable strategic entrepreneurship. Thus, both H_1 and H_2 were supported. Also, the results indicate that the 4th industrial revolution positively influences sustainable strategic entrepreneurship confirming that H_3 was supported. Results for H_{1a-d} and H_{2a-d} are presented in Table 7 below;

Table 7: Results of Hypotheses testing (H_{1a-d} and H_{2a-d})

Hypotheses	Hypothesised Relationship	SRW	CR	Remark
H_{1a}	Product innovation → 4th industrial revolution	.297	2.487***	Supported
H_{1b}	Process innovation → 4th industrial revolution	.401	9.674***	Supported
H_{1c}	Marketing innovation → 4th industrial revolution	.198	5.647***	Supported
H_{1d}	Marketing innovation → 4th industrial revolution	.283	11.354***	Supported
H_{2a}	Product innovation → sustainable strategic entrepreneurship	.365	10.574***	Supported
H_{2b}	Process innovation → sustainable strategic entrepreneurship	.402	9.456***	Supported
H_{2c}	Marketing innovation → sustainable strategic entrepreneurship	.295	8.471***	Supported
H_{2d}	Manufacturing innovation → sustainable strategic entrepreneurship	.513	13.578***	Supported

Notes: SRW standardized regression weight, CR critical ratio, ** significant at $p < 0.05$, *** significant at $p < 0.001$

Source: Author (2023).

Results in Table 7 indicate that all dimensions for disruptive innovation (product, process, marketing and manufacturing innovation) have a positive effect on both 4th industrial revolution and sustainable strategic entrepreneurship. Therefore, H_{1a-d} and H_{2a-d} were all supported.

DISCUSSION

Disruptive innovation is critical in modern business and it is regarded as a significant tool for fostering industrialisation and entrepreneurship. Nonetheless, research on the factors that determine disruptive innovation's impact on 4th industrial revolution and sustainable strategic entrepreneurship has been unheeded. As a result, the current research sought

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to answer the essential question of how each component of disruptive innovation affects the fourth industrial revolution and sustainable strategic entrepreneurship. The impact of the selected dimensions for disruptive innovation on the fourth industrial revolution and the effect of the fourth industrial revolution on sustainable strategic entrepreneurship were empirically investigated to answer this question.

Several studies on innovation have been carried out in industrialised countries, with very little research conducted in low income nations and emerging markets, particularly in the Sub-Saharan area which include Zimbabwe. None of these studies studied the relationship among disruptive innovation, 4IR and sustainable entrepreneurship especially within the manufacturing sector. As a result, the research of this kind is critical because it adds to and validates existing innovation knowledge especially in growing markets. The current study deepens our innovation understanding on the elements of disruptive innovation particularly manufacturing, product, process and marketing innovation with regards to the manufacturing sector in the Sub-Saharan region. The fourth industrial revolution and sustainable strategic entrepreneurship are predicted by all the four dimensions of disruptive innovation.

Theoretical implications

While existing literature suggests that innovation leads to industrialisation (Carvalho et al. 2018; Cho et al., 2018; Ellis et al., 2018; Jee, 2017; Naude, 2017; Petrillo et al., 2018; Zach et al., 2020; Zhu et al., 2017), this study found that the link is very dependent on the dimensions of disruptive innovation. This implies that the fourth industrial revolution within the manufacturing sector in Zimbabwe can be improved by paying attention to the dimensions of disruptive innovation that include; product, process, marketing and manufacturing innovation. Moreover, the fourth industrial revolution within the manufacturing sector can influence sustainable strategic entrepreneurship.

Results from the study indicate that all of the selected disruptive innovation dimensions (product, process, marketing and manufacturing innovation) positively affect the fourth industrial revolution. Likewise, all selected dimensions of disruptive innovation were found to have a positive impact on sustainable strategic entrepreneurship. This is confirmed by previous research that found that innovation had a positive impact on industrialisation (Christensen et al., 2018; Cornelius et al., 2021; Karlsson et al., 2019). Moreover, studies by Lounsbury et al. (2019) and Nambisan et al. (2019) support findings from this study that dimensions of innovation like product innovation positively influence entrepreneurship.

The current study further established that the fourth industrialisation positively influences sustainable strategic entrepreneurship. Also, this is consistent with what was established before in other related studies by Carvalho et al. (2018), Naude (2017) and Petrillo et al. (2018) that industrialisation is linked to entrepreneurship. Likewise, the study findings corroborate the disruptive innovation theory which claim that innovation establishes a new market and value network or enters a market from the bottom and eventually supplants long-established market-leading companies, goods, and alliances. Hence the current

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study supports the claim through the finding that disruptive innovation impacts on the 4th industrial revolution and sustainable strategic entrepreneurship.

Practical implications

The goal of the study was to better understand the relationship among disruptive innovation, fourth industrial revolution and sustainable strategic entrepreneurship within the manufacturing sector. It is critical to have a thorough understanding of this relationship for the promotion of industrialisation and entrepreneurship within the manufacturing sector.

In order to promote industrialisation and entrepreneurship, the manufacturing sector should make an effort to foster activities that enhances product, process, marketing and manufacturing innovation. In this scenario, the study suggests that the manufacturing sector should expand the innovation mind-set across entire firms within the manufacturing sector, from the boardroom to the shop floor.

Also, firms within the manufacturing need to implement new and creative ideas in order to create and add value to their processes. To put it another way, businesses within the manufacturing sector should improve processes that involve a combination of company resources such as facilities, skills and technologies as these may impact on industrialisation and sustainable strategic entrepreneurship. The manufacturing sector should also improve marketing innovation by introducing some novel marketing strategies that involve major modifications in product design or packaging, product placement, product promotion, or pricing among others.

Manufacturing firms conduct business in very competitive markets and they are often exposed to severe marketing competition in terms of new commodities, production methods, new materials, as well as regulatory, organisational, and business model developments. They mainly rely on innovation to keep up with the competition or, in rare cases, to gain a competitive advantage through increased productivity and other manufacturing-related metrics like flexibility and agility.

Manufacturing, in particular, demands a firm foundation for innovation ventures, specifically when they encompass significant changes to production processes that will have an impact on future competitiveness. As a result, innovation in the manufacturing sector, in particular, frequently incorporates basic strategic components such as being defensive or even offensive. Methods and metrics must be well-founded in these important and often long-term decision or monitoring procedures.

Furthermore, the study established that the fourth industrial revolution positively influences sustainable strategic entrepreneurship. Because entrepreneurs are typically wealthy business people, those in the manufacturing sector should invest their funds in new technologies. These new inventions lead to breakthroughs in the industrial revolution, allowing entrepreneurs to increase their wealth and invest in future technologies within the manufacturing sector.

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CONCLUSION(S)

Unique results were established in relation to the influence of disruptive innovation on the fourth industrialisation and strategic sustainable entrepreneurship within the manufacturing sector. The conclusions of the current investigation have shown us that the influence of disruptive innovation on the fourth industrialisation and strategic sustainable entrepreneurship depends on innovation dimensions, as well as the sector and location of investigation. Furthermore, there is a link between the fourth industrialisation and strategic sustainable entrepreneurship. However, the research was limited to a single city, Harare in Zimbabwe. When it comes to the generalisability of the findings, this raises a problem. To address generalisation difficulties, upcoming research should be conducted in other towns in Zimbabwe and other third-world states. Furthermore, the research could be more intriguing if it was conducted in other sectors of the economy.

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