Artificial Intelligence Impact on the Sustainable Entrepreneurial Process

Azra Ahmić[1], Lejla Ahmić Šahović[2]

Abstract

In the face of pressing socio-economic and environmental challenges, such as climate change, resource depletion, and social inequality, entrepreneurs are increasingly compelled to embrace innovative strategies that harmonize profitability with social and environmental stewardship. Artificial Intelligence (AI) holds promise in facilitating such solutions but requires careful examination to ensure its effective and ethical deployment in pursuit of sustainability objectives. The primary goal of this study was to ascertain whether AI significantly influences the sustainable entrepreneurial process. This comprehensive research framework integrates concepts from entrepreneurship, stakeholder theory, and digital technology, offering a multifaceted perspective. We employed the multiple regression analysis to examine data gathered from 40 entrepreneurs operating within the Bosnia and Herzegovina settings. The study's outcomes revealed that AI positively and significantly impacts the sustainable entrepreneurial process and its five sub-dimensions: "idea generation, opportunity recognition, opportunity development, venture launch, and positive impact". This study enriches the literature on AI and sustainable entrepreneurship by offering empirical support for the impact of AI on the sustainable entrepreneurial process while also introducing and validating measurement tools for the sustainable entrepreneurial process. Additionally, entrepreneurs can utilize the findings of this research to strategically incorporate AI into their business processes and product/service innovation, improve operational efficiency, reduce costs, mitigate risks, enhance decision-making, foster collaboration across stakeholders, and capitalize on opportunities effectively.

Keywords: *Entrepreneurship, Sustainability, Artificial Intelligence, Entrepreneurial Process, Idea Generation.*

Introduction

In the contemporary landscape of business and innovation, Artificial Intelligence (AI) has emerged as a transformative force, revolutionizing traditional business models and how entrepreneurial activity is defined and scoped (von Briel et al., 2018). The recent advancements and unfolding developments in digital technology solutions and AI present both unprecedented challenges and remarkable opportunities for those willing to embrace the power of AI. As a result of AI constant development and its associated Information Technologies (IT), it is expected that firms can benefit from a rise in productivity, a decline in operational/capital costs, and a reduction in errors caused by humans (Akerkar, 2019). Besides seeing AI as an amazing opportunity in the long-run cost reduction, managers or businessmen view AI advantages through improved efficiency, spending less time on daily administrative tasks, speedier completion of routine tasks, having more time to focus on strategically relevant activities, boosted profits; and value-added for the firms (Ahmić, 2023).

On the other side, entrepreneurs need to adapt and reposition to broader, potentially adverse impacts of these technological innovations. There is widespread concern that AI will jeopardize both professional positions (such as: financial jobs and judicial jobs…) and less-skilled services-related jobs, which can result in mass unemployment as well as an increase in inequality in accordance with the predictions in the near future (Korinek & Stiglitz, 2017). Moreover, the fear of job loss and uncertainties about the future can have psychological effects (anxiety and stress) on workers (Mansoor et al., 2022). Employees may resist the integration of AI technologies due to a fear of the unknown, lack of understanding, or concerns about job security. Effective change management strategies are crucial to address these issues.

---

[1] Associate Professor, Management and organization, International University Travnik & International University Sarajevo, Bosnia and Herzegovina, Email: azraahmic30@gmail.com, (Corresponding author), https://orcid.org/0000-0002-8042-2195

[2] Head of HR at DDC MLS company, Bosnia and Herzegovina

Although mechanical and cognitive automation is becoming more prevalent, little has been written about the intersection of AI and the entrepreneurship process (Townsend & Hunt, 2019). Simultaneously, there is a lack of empirical evidence on the impact of AI on the sustainable way of doing business (innovating and developing eco-friendly products/services) (Bickley et al., 2021b). The author Schaltegger (2018) emphasized that the intricate, challenging, interconnected, and uncertain nature of sustainability issues leaves no space for corporate complacency and ignorance (p. 22). The aim of this article is to expedite the advancement of theoretical understanding in the intersection of AI and entrepreneurship and to provide empirical evidence on the impact of AI on the sustainable entrepreneurial process.

Literature Review

The literature review serves as the foundational framework for exploring key themes at the intersection of artificial intelligence and sustainable entrepreneurial processes in research.

Adopting a holistic perspective, our framework combines elements from entrepreneurship, stakeholder, and digital technology theories (Hörisch et al., 2020; Obschonka & Audretsch, 2020) to comprehensively elucidate the impacts of AI on the sustainable entrepreneurial process. By suggesting a model that merges stakeholder theory with sustainability accounting, the companies are enabled to integrate various types of information derived from stakeholder engagement initiatives, which prove especially beneficial for the firm (Hörisch et al., 2020). The integrated model proposed considers ethical and business concerns together rather than as separate entities, encompassing value creation beyond financial aspects and incorporating monetary considerations, ultimately producing valuable accounting information for stakeholders. AI and other digital technologies possess the capability to operationalize such a theoretical model, enabling the empirical examination of these distinct value pathways at the system core.

Artificial Intelligence

In essence, AI represents the integration of extensive datasets with computer science focused on creating systems that help automate routine tasks and address diverse challenges in a business context. AI can be characterized as a technological entity capable of emulating human-like tasks by assimilating a measure of human intellect, comprehending, learning from, and incorporating inputs to achieve predetermined results (Ahmić, 2023; Sayed, 2022). Russell and Norvig (2010) categorized the four primary AI approaches as thinking with human-like attributes, thinking based on rationality, acting in a human-like manner, and acting with rationality. Predominantly, AI research has been largely influenced by the "acting rationally" approach, through making decisions and taking actions that are logically sound and aligned with achieving its predefined goals or objectives, employing a deliberate and reasoned approach grounded in the information and knowledge at hand.

Given AI's broad applicability, scalability, and solid mathematical underpinnings, it is practical and suitable for addressing real-world problems. Specifically, areas within AI like machine learning (ML) and deep learning (DL), which involve iterative learning methods rooted in probability theory and statistics, have played a crucial role in enabling humans to accomplish remarkable engineering achievements, even when faced with substantial uncertainties in present conditions, observations, and forecasts. Another important AI area refers to Big Data analytics as a powerful approach of tirelessly collecting, capturing, and scrutinizing vast and varied datasets aiming to uncover hidden patterns, insights into market shifts, the evolving tastes of consumers, and unexpected connections that might otherwise go unnoticed which can aid companies in making well-informed and improved business choices (Obschonka & Audretsch, 2020). Similarly, data mining analysts employ a structured process to extract relevant data tailored to specific goals, wherein raw data is collected, scrubbed, and transformed into a standardized format (Amoako et al., 2021). In addition to previously mentioned AI applications, there is also cloud computing as the provision of computing services through the internet, enabling users to remotely access and employ diverse resources and applications without the necessity of physical infrastructure or hardware ownership, as they utilize storage, processing capabilities, and software solutions hosted and maintained by external providers in data centers, typically under a pay-per-use model.

Sustainable Entrepreneurial Process

In order for entrepreneurship to bring sustainable and thriving solutions to the table that accommodate needs innovatively while capturing market prospects, an architected process needs to be applied. Sustainable entrepreneurial process brings resources together and coordinates them to provide customers with distinct services and products utilizing a strategic sustainable approach to break into a desired marketplace. It simultaneously demonstrates to investors the potential for enduring revenue streams and profitability increase. Additional sustainable value can be created by employing diverse sustainability criteria (such as minimizing the footprint of resources, saving energy, reducing negative supply chain effects, using safer/benign materials, and reducing social inequalities) in operations and service/product design.

Regarding the sustainable entrepreneurial process, several studies have dealt with only two sustainability elements (highlighting only the social entrepreneurial process), such as the model proposed by Mets et al. (2013) and Jiménez-Ibáñez et al (2019). From the archived studies that consider the process of sustainable entrepreneurship in terms of three-fold sustainability grounds, there are explorations on how a sustainable enterprise is formed and the steps (process) of creating a new sustainable venture launch. More specifically, academic work by Eckert Matzembacher et al. (2019) embedded "measuring sustainable effect" as part of entrepreneurship's sustainable process with the already existing steps – previously proposed by Mets et al. (2013), which are as follows: "idea generation, opportunity recognition, opportunity development and venture launch (or opportunity exploitation)". In this scientific exploration, the focal point was the study offered by Eckert Matzembacher et al. (2019).

The Generation of Entrepreneurial Ideas

Entrepreneurial success is highly dependent on the quality and well-evolved an idea's authentic construct (an idea in its raw state), which offers sought-after options and alternations of services, products, and resources to replace existing ones. According to Hill and Birkinshaw (2010), an idea can be considered entrepreneurial if a person has an entire package of ideas (beginning at one's "mental sparkle" that can be sporadically accessed until commercializing the idea). Correspondingly, diverse propositions lead to idea generation, which pertains largely to an entrepreneur's precursory knowledge, motivation, abilities, and skills (Matzembacher et al., 2019). Authors Yitshaki and Kropp (2016) unveiled that social entrepreneurs are primarily motivated by factors such as behaving pro-socially, which is influenced by their past life experiences (young adult or childhood awareness of social issues) or current life circumstances. Among other meaningful factors were detecting social concerns as a way of innate professional upgrading (for instance, after being jobless or dissatisfied with seeking a purposeful career) (Yitshaki & Kropp, 2016).

As a cornerstone for a real business, an entrepreneurial idea needs to be sustainable, where sustainability translates into resiliency in the long run (Casali et al., 2018). Sustainable idea generation represents entrepreneurs' inventive and fruitful process to discover sustainable solutions that overcome complex challenges and difficulties the business world, countries, and societies face. Perrini et al. (2010) spotted that the idea generation is nurtured through a sensitive understanding of eco and social issues. Generally, a flourishing entrepreneurial idea is characterized by high profitability prospects, inventiveness, originality, cost-efficiency, the ability to fix the problem (in an intuitive, easy, and likeable manner), and its' ecologically friendly and socially-benevolent focus. Hence, entrepreneurs benefit from developing feasible, innovative, and efficacious ideas in the marketplace that bring an edge over their competitors.

Opportunity Recognition

As a result of generating ideas, the process comes opportunity recognition. Within the area of entrepreneurship, detecting and forming opportunities in a timely manner is an essential part. Authors Lumpkin and Lichtenstein (2005) observed recognizing opportunity as altering an amazing idea into a commercial/investing conception that produces revenues and is value-adding. Thus, for an entrepreneur to be able to recognize opportunity, they need to be alert to investing possibilities for business, vigorously seek, collect information, and discuss it, label the needs of customers, and estimate how viable prospective enterprising undertakings are (Kuckertz et al., 2017).

An alert entrepreneur is one who thinks creatively and strategically, which enables him/her to recognize opportunities (Shane & Nicolaou, 2015) and who is broad-minded regarding new business opportunities (Tang et al., 2012). A large part of entrepreneurial alertness consists of recognizing patterns and putting all the pieces together – which comes from observing social/environmental, market, technological, legislative or economic changes and trends. Regarding seeking and collecting information, an entrepreneur can start with personal troubles (what's bothering them) in everyday activities and then continue with market surveying in order to determine competitive scenery and intended users/customers. Communicating about potential opportunities in business encompasses talking about it to prospective buyers (about their desires, fears, motivations), experts, mentors, colleagues, friends, and other entrepreneurs (Dimov, 2007). Labeling customers' needs pertains to producing opportunities in business on the basis of a perception of real customers issues and their desires. Regarding estimating prospecting opportunities, business ideas are appraised for their feasibility if they suit personal capabilities, knowledge, skills, and improved experience well (McMullen & Shepherd, 2006).

Various factors impact recognizing entrepreneurial opportunity, which involves not only personal attributes, competencies (like senses, cognition, self-belief, persistence, and self-motivation), and experiences but also social capital, viewed primarily through capabilities in networking. Considering socialization, entrepreneurs can enrich their knowledge of eco-social surroundings by including family settings and participating in movements committed to sustainability, which can be accomplished with contributions from the media (Hanohov & Baldacchino, 2018). Moreover, thorough reading can be included, as well as in-depth discussions with others working in the same domain, exploring new places on trips, participating in workshops and meetings organized by professional organizations, and absorbing information in general (Karhunen et al., 2011). Through social networks, as an essential ingredient for entrepreneurship success, entrepreneurs have access to resources they personally lack. An entrepreneur's endeavors will be more successful if they invest more time with their stakeholders (clients, staff, suppliers, competition…) and team members compared to people who do not build and make discussions with networks of this type (Lee & Tsang, 2001).

Opportunity Development

The meaning of "opportunity development" refers to how opportunities turn into ventures both iteratively and dynamically by progressively "polishing" and transforming an idea that was unpolished from the beginning (Dimov, 2007). In other words, the fresh concept of the business appears once an advancement is made with a central idea – that is an answer is proved possible (feasible) for a specific ecological and social issue, and when the market demands for searched value from certain customer clusters get more exact (Belz & Binder, 2017). Through iteration as a turning-point procedure of continuously getting mainly positive suggestions/feedback from relevant interest groups and converting ideas into tangible shapes (models), business concepts (along with services/products) can evolve through gradual modifications. As a result of iterations, the considered problem area becomes less fuzzy, and the overall basic concept gets upgraded and clearer as understanding and learning arise. In order for the nascent concept to be developed and verified, a number of cross-over criteria need to be fulfilled and accordingly provided answers if the concept is feasible, desirable, and viable (Menold et al., 2016). Iteration is one of the probable ways to be employed in all three mentioned criteria to validate the designed concept.

The process of opportunity development involves various operations related to developing a business concept, including resource availability, business model, and marketing mix (Mets et al., 2013). Regarding the business model, as the way how one firm works aiming at generating values, it may encompass several individual components, such as: "core resources/activities/partners; customer segments/relationships; cost structure; propositions of value; channels (networks); and revenue flows" (Osterwalder et al., 2005). Given that transforming eco-social objectives into benefits for buyers is pivotal, a sustainability focus needs to be incorporated into all previously mentioned elements of the business model.

Opportunity Exploitation as Venture Launch

As soon as the entrepreneur determines a suitable fit, they can proceed to prepare to launch the venture. An offensive entrepreneurial strategy needs to be developed as part of this preparation process, and all lacking material resources (such as land funding) and nonphysical resources (like building a management team) must be acquired and expanded. The inclusion of sustainability orientation in this phase is also essential (like: "sustainability strategy and planning; sustainable internal resources management; sustainable partnerships and external resources; for creating triple sustainable outcome") (Ahmić, 2022). Meeting legal formalities also plays a huge role in this stage. The comprehensive preparation process results in the concrete venture launching, simultaneously known as the exploitation of opportunities (Mets et al., 2013). In the market, it occurs when the sustainable product or service commercialization becomes visible by putting the earlier coined business model into action. The pivotal deliberations are regarding finding finances and investing in marketing efforts (Covin et al., 2000). To perform the venture task with better assistance and organization, entrepreneurs often make and pursue comprehensive and mindfully considered business plans in their formal shape. Newly conceived venture must win the market (potential/present customers and users) and investors' hearts, which is possible solely by taking their viewpoints into consideration when making an attractive, precise, finely crafted, and wrapped plan that depicts the designed project's existing situation, actual necessities, and anticipated future in a sustainable way. Therefore, the thriving plan needs to show and vindicate in a compelling and logical way today's and altering required resources, financial forecasts, personnel requirements, marketing resolutions, legal obligations, and demands in the production process.

Finances for starting and continuing an entrepreneurial venture can come internally (for example, entrepreneur's savings/owned capital or cash flow generated from hitherto entrepreneurial operations) and externally. External funding sources can include providing subsidies for start-ups, funding (loans from) the core private business formation structures for supporting businesses (like business associations or incubators), finance institutions/banks in the commercial sector, public funding structures, or crowdfunding). When starting a social enterprise, diverse forms of support can be utilized, such as "funding by the European Union; central/regional government support; charitable trusts" (Shaw & Carter, 2007).

Positive Impact

The concept of sustainable impact measurement is a novel category that arises from the idea that generating a positive social and environmental impact is fundamental for social and sustainable entrepreneurship endeavors (Fors & Lennerfors, 2019). The sustainable entrepreneurial process culminates when it successfully generates tangible positive economic, environmental, and social benefits for society (Matzembacher et al., 2019). The environmental and social positive impact refers to the effects that an action, project, or initiative has on the natural world and on society, encompassing aspects such as resource conservation, pollution, community well-being, and social equity.

AI and Sustainable Entrepreneurial Process

Most previous studies focused on explaining the connection between AI and entrepreneurship through a systematic literature review and by proposing a conceptual framework. Bickley et al. (2021b) stated that an AI-empowered CEO can leverage interests and data to explore new opportunities and risks, enabling them to concentrate on formulating decisions that influence overarching strategies and the general course of the organization. Amoako et al. (2021) proposed a conceptual framework showing that artificial intelligence systems can potentially enhance entrepreneurial decision-making. Moreover, they outlined recommendations for the responsible implementation of AI as an emerging technology to prevent societal harm, while the data regarding entrepreneurial development originated primarily from developed nations (Amoako et al., 2021).

When it comes to empirical research on the influence of AI on the entrepreneurial process (particularly sustainable one), there is an enormous lack of these kinds of studies and evidence, especially with regard to developing economies. One of the recent studies conducted by Chen and Zhang (2023) included the data gathered in China and revealed that there is a strong and positive correlation between AI and entrepreneurial activity, which persists even after subjecting it to manifold examinations such as robustness testing,

exogenous shock analysis and, endogeneity testing. More in detail, this research demonstrated that AI stimulates consumer demand and fosters technological innovation, resulting in a favorable impact on entrepreneurial activity (Chen & Zhang, 2023). Given the enormous gap in investigating the impact of AI on the entrepreneurial process, especially the sustainable one, this study aims to explore if AI positively and substantially influences the sustainable entrepreneurial process in Bosnia and Herzegovina as a country undergoing development.

The Conceptual Framework and the Hypotheses Under Examination

This paper sought to investigate the impact of AI on sustainable entrepreneurial processes across enterprises in Bosnia and Herzegovina. In accordance with the primary goals, the conceptual model was constructed to provide a structural basis for empirical investigation.

Two segments of the suggested conceptual structure involve (Figure 1): AI as an independent variable and its influence on the five dimensions of the sustainable entrepreneurial process, as proposed by Matzembacher et al. (2019), which we named: "idea generation; opportunity recognition; opportunity development; venture launch; and positive impact".

Figure 1. Conceptual Structure
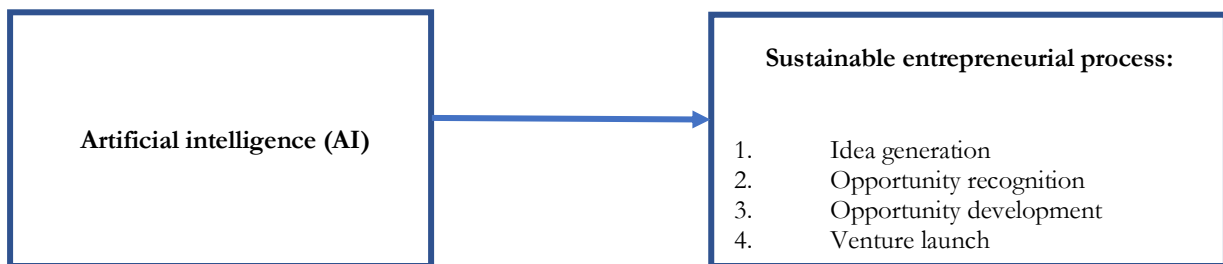
Source: Authors' work

The formulation of research hypotheses stemmed from the depicted conceptual model, which outlined the interrelated variables and their associations. The hypotheses are as follows:

Hypothesis (H1a): Artificial intelligence positively and significantly impacts idea generation.

Hypothesis (H1b): Artificial intelligence positively and significantly impacts opportunity recognition.

Hypothesis (H1c): Artificial intelligence positively and significantly impacts opportunity development.

Hypothesis (H1d): Artificial intelligence positively and significantly impacts the venture launch.

Hypothesis (H1e): There is a positive and significant relationship between artificial intelligence and its positive impact.

Methodology

Sample Depiction

This research was carried out utilizing quantitative methods, focusing on a purposefully chosen group of entrepreneurs for the study. In more detail, purposive sampling was selected for its ability to maximize the collection of pertinent data and facilitate a deeper understanding of the research environment (Esterberg, 2002). The potential participants were pinpointed through referrals from local business networks, chambers of commerce, and professional associations. The criteria for selecting entrepreneurs encompassed the three types of entrepreneurship: corporate, digital, and small business (Ratten, 2023). Corporate entrepreneurship refers to the process in which individuals or a collective group, in collaboration with an established organization, either establishes a new entity (venture) or initiates revitalization and innovative changes within the existing structure (Sharma & Chrisman, 1999). Digital entrepreneurship relates to a subset of entrepreneurship where aspects that were traditionally physical are transformed into digital formats, utilizing various digital tools, platforms, and technological advancements (Elia et al., 2020). Small businesses are characterized as innovative entrepreneurial firms with fewer than 50 employees who engage in various business activities (Ratten, 2023).

Data gathering: A total of 50 questionnaires were sent by e-mail to purposefully chosen entrepreneurs through referrals; certain chosen entrepreneurs were approached in person, and a questionnaire was physically delivered to them. Ultimately, the surveyed sample for this study consisted of 40 entrepreneurs in BiH (response rate of 80%). The profiles of the entrepreneurs involved are detailed in Table 1.

Table 1. Sample Composition

Variables		Frequency
Gender	Female	33%
	Male	67%
Age	20-30	8%
	31-40	34%
	41-50	36%
	51-60	15%
	Over 60	7%
Educational background	PhD	10%
	Degree of master	35%
	Degree of bachelor	39%
	High school	16%
Years of work experience	1-10	21%
	11-20	57%
	Over 21 years	22%

Source: Authors' work

The sample primarily comprised male entrepreneurs, making up 76% of the total, while female entrepreneurs accounted for 33%. Additionally, the respondents were primarily middle-aged adults (34% of entrepreneurs fell within the age bracket of 31 to 40 years, while 36% were aged between 41 and 50 years). Entrepreneurs aged between 51 and 60 (15%) formed the subsequent significant age bracket. Only 8% of the examined sample consisted of young adult entrepreneurs aged between 20 and 30, while individuals over 60 made up just 7% of the group.

In terms of educational attainment, most entrepreneurs hold university degrees. Specifically, 39% had earned a bachelor's degree, 35% had obtained a master's degree, and 10% had completed a PhD. Conversely, a smaller portion of respondents, comprising 16%, had only attained a high school diploma. Concerning years of work experience, the majority of entrepreneurs had accumulated between 11 and 20 years of experience, accounting for 57% of the respondents. Following this, 22% of respondents possessed over 21 years of experience, and 21% of entrepreneurs had between 1 and 10 years of work record.

Research Tool Overview and Reliability Appraisal

The survey utilized a custom-designed questionnaire crafted by the researchers to gather data about artificial intelligence utilization and sustainable entrepreneurial processes for this study from entrepreneurs in Bosnia and Herzegovina. The questionnaire was structured into three distinct sections. The initial section of the questionnaire focused on gathering data related to using artificial intelligence. The second section of the questionnaire addressed aspects related to the sustainable entrepreneurial process: "idea generation, opportunity recognition, opportunity development, venture launch and positive impact". The items for artificial intelligence utilization were created on the basis of the research study by Amoako et al. (2021), while the questions pertaining to sustainable entrepreneurial process were formulated using theories and previous research as reference points by Kuckertz et al. (2017), Ozgen and Baron (2007), Matzembacher et al. (2019) and similar works. All items were assessed using a 5-point Likert scale, with respondents indicating their level of agreement, ranging from 1 ("absolutely disagree") to 5 ("absolutely agree"). The third section of the questionnaire collected fundamental demographic details regarding the entrepreneurs, including the respondent's age, gender, educational history, and years of professional experience. Table 2. presents a comprehensive display of the details regarding the research instruments utilized in the study.

Table 2. The Specifics of the Outlined Research Tool

Structures	Code	Components
Independent variable (Artificial intelligence – AI)		
Artificial intelligence	AI_1	I actively use during work: Machine learning
	AI_2	Data mining
	AI_3	Cloud computing
	AI_4	Big data analysis
Dependent variable – Sustainable entrepreneurial process		
Idea generation	IG_1	I actively seek inspiration from various sources and methods when generating new business ideas
	IG_2	I persistently collect available information and facts through market research about spotted problem or challenge
	IG_3	I combine the existing knowledge and personal experience with the acquired information
	IG_4	I test ideas through market research to refine them based on feedback
	IG_5	Collaboration and networking fuel my idea generation process
	IG_6	I prioritize environmentally and socially conscious ideas with good profitability potential
Opportunity recognition	OR_1	I often notice lots of opportunities to start or expand a business
	OR_2	I find it easy to spot potential business opportunities
	OR_3	There are plenty of chances for creating new products/services in the market
	OR_4	I have a keen sense for coming up with new venture prospects
	OR_5	In the course of my regular daily tasks, I spot potential business opportunities
Opportunity development	OD_1	I continuously seek ongoing feedback from relevant interest groups to develop the spotted opportunity
	OD_2	I excel at transforming promising opportunities into concrete business concepts
	OD_3	I assess and validate concepts based on multiple criteria to ensure they are feasible, profitable, and sustainable
	OD_4	I prioritize developing resources and identifying core partners, activities, and customer segments

	OD_5	I create business goals aligned with my business model to generate positive impacts
Venture launch	VL_1	I excel at identifying the best timing to launch my venture based on market conditions
	VL_2	I proactively develop an offensive entrepreneurial strategy to propel my venture forward
	VL_3	I efficiently secure both material and nonphysical resources needed for business expansion and growth
	VL_4	I regularly seek counsel from legal advisors to ensure compliance with all necessary legal formalities
	VL_5	I successfully commercialize new products or services by meeting market demands and generating value
Positive impact	PI_1	I create new or improved products/services to make a positive impact on society or the environment
	PI_2	I actively seek out ways to measure and track the positive impact of my venture on the community or environment
	PI_3	I prioritize ethical practices and social responsibility in the operation of my venture
	PI_4	I am committed to continuously seeking ways to enhance the positive impact of my venture beyond financial success
Control variables		
Gender		Female, Male
Age		20-30, 31-40, 41-50, 51-60, Over 60
Educational background		PhD, Degree of master, Degree of bachelor, High school
Work experience		1-10, 11-20, Over 21 years

Source: Authors' work

We performed a Cronbach's alpha reliability analysis to evaluate how consistently the identified factors align internally, as shown in Table 3. Each component within the AI and sustainable entrepreneurial process framework exhibited a Cronbach's alpha value exceeding 0.7, signifying a satisfactory degree of internal consistency among the elements and reliably constructed frameworks (Table 3).

Table 3. Reliability of Structures

Variables	Count of items	Cronbach Alpha
Artificial intelligence	4	0.885
Idea generation	6	0.843
Opportunity recognition	5	0.871
Opportunity development	5	0.832
Venture launch	5	0.855
Positive impact	4	0.881

Source: Authors' work

Results

This study utilized the following approaches to analyze the gathered data: exploratory factor analysis and multiple regression analysis.

Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) was employed to delve into the validity of the data structure and tease out the dimensions of the sustainable entrepreneurial process construct. Varimax rotations were applied during the analysis to enhance interpretability and clarity. The Kaiser-Meyer-Olkin (KMO) statistical test, indicating a value above 0.5, alongside the Bartlett test, which demonstrated statistical significance at the 1% level, provided strong evidence that the data was suitable for further factor analysis.

Following Varimax rotation, which converged after five iterations, five factors were identified within the sustainable entrepreneurial process structure. These factors exhibited eigenvalues surpassing one and accounted for an average variance explained of 73.28%. They were labeled as (1) idea generation, (2) opportunity recognition, (3) opportunity development, (4) venture launch, and (5) positive impact, as detailed in Table 4.

Table 4. Factor Analysis of the Sustainable Entrepreneurial Process Structure

Dimensions	Variables	Mean	Components				
			IG	OR	OD	VL	PI
Idea generation (IG)	IG_1	3.91	0.853				
	IG_2	4.76	0.925				
	IG_3	4.60	0.908				
	IG_4	3.33	0.762				
	IG_5	4.20	0.880				
	IG_6	3.00	0.690				
Opportunity recognition (OR)	OR_1	4.14		0.852			
	OR_2	4.40		0.901			
	OR_3	3.72		0.793			
	OR_4	3.61		0.770			
	OR_5	3.35		0.755			
Opportunity development (OD)	OD_1	3.44			0.761		
	OD_2	4.12			0.840		
	OD_3	4.00			0.811		
	OD_4	4.85			0.945		
	OD_5	4.51			0.902		
Venture launch (VL)	VL_1	4.73				0.919	
	VL_2	4.50				0.900	
	VL_3	4.00				0.813	
	VL_4	3.65				0.778	
	VL_5	3.78				0.804	
Positive impact (PI)	PI_1	4.78					0.937
	PI_2	3.00					0.680
	PI_3	3.90					0.815
	PI_4	3.77					0.804

Source: Authors work

Given that all extracted elements composing the sustainable entrepreneurial process construct exhibited values surpassing 0.50 (as indicated in Table 4.), they were deemed suitable for continued investigation.

Testing the Core Research Hypothesis

Prior to conducting hypothesis testing through multiple regression analysis, correlation analysis was undertaken that unveiled a notable correlation between the five sustainable entrepreneurial process dimensions, with correlation coefficients ranging from 0.503 to 0.736, significant at either the 1% or 5% levels of significance.

Multiple regression analysis was employed to investigate whether there exists a relationship between artificial intelligence (AI) and sustainable entrepreneurial processes. This involved testing hypotheses labeled as "H1a, H1b, H1c, H1d, and H1e". Five separate multiple regression models were developed, with the "idea generation, opportunity recognition, opportunity development, venture launch and positive impact" of sustainable entrepreneurial process serving as the independent variables. Each model's dependent variable was artificial intelligence (AI). As summarized in Table 5., the utilization of AI demonstrates a statistically significant effect on sustainable entrepreneurial processes. The initial multiple regression model illustrates how AI affects idea generation. The R-square value of this regression model stands at 0.616, indicating that the AI can account for 61.6% of the variance in idea generation. Furthermore, this model shows that idea generation is most significantly influenced by AI (at a significance level of 1%), as indicated by a beta coefficient of 0.48. This indicates a strong correlation between AI and idea generation.

Table 5. The Regression Analysis Outcome on the Impact of Ai on the Sustainable Entrepreneurial Process

Sustainable entrepreneurial process					
	Idea generation	Opportunity recognition	Opportunity development	Venture launch	Positive impact
R	0.785	0.641	0.688	0.662	0.549
R2	0.616	0.411	0.473	0.438	0.301
df	40	40	40	40	40
Sig.	0.000	0.000	0.000	0.000	0.001
	Coef.	Coef.	Coef.	Coef.	Coef.
Constant	1.263	0.852	1.130	0.902	0.580
AI	0.488**	0.322*	0.407**	0.330*	0.224*

Note: ** Statistically significant at 1%; * Statistically significant at 5%.

Source: Authors work

The second multiple regression model examines if AI impacts opportunity recognition, revealing an R-squared value of 0.411, indicating that AI can explain 41% of the variation in opportunity recognition. Additionally, AI notably influences opportunity recognition, as evidenced by a beta coefficient of 0.32, achieving statistical significance at a 5% level.

The third multiple regression model investigates the influence of AI on opportunity development, unveiling an R-squared value of 0.473, implying that AI can account for 47% of the variability in opportunity development. Furthermore, AI significantly impacts opportunity development, supported by a beta coefficient of 0.40, which reaches statistical significance at the 1% level.

The fourth multiple regression model explores how AI affects venture launch, revealing an R-squared value of 0.438, suggesting that 43% of the variation in venture launch can be attributed to AI. Moreover, AI considerably influences venture launches, backed by a beta coefficient of 0.33, attaining statistical significance at the 5% level.

The fifth multiple regression model delves into the impact of AI on the positive impact, unveiling an R-squared value of 0.301, indicating that 30% of the variability in positive impact can be ascribed to AI. In addition to the previously mentioned, AI showcases a substantial impact on positive impact, supported by a beta coefficient of 0.22, achieving statistical significance at the 5% level.

In summary, AI has a statistically significant positive impact on the sustainable entrepreneurial process. At a confidence level of 1%, AI demonstrates a significant influence on idea generation and opportunity development, while AI exhibits a significant impact at a confidence level of 5% on opportunity recognition,

venture launch, and positive impact. Thus, hypotheses "H1a, H1b, H1c, H1d, and H1e" are fully validated, demonstrating a positive and statistically significant relationship between AI and "the idea generation, opportunity recognition, opportunity development, venture launch, and positive impact".

Discussion

The initial phase of this research study centered on investigating whether AI has a statistically significant positive impact on the sustainable entrepreneurial process. Regression analysis determined that AI exerts a significant and beneficial influence on the sustainable entrepreneurial process and its five sub-dimensions: "idea generation, opportunity recognition, opportunity development, venture launch, and positive impact". This impact implies that integrating AI into entrepreneurial practices can lead to more effective and sustainable business operations. By leveraging AI technologies, entrepreneurs can harness advanced analytics, predictive modeling, and automation to optimize resource utilization, identify market opportunities, and mitigate risks, thereby fostering resilient and environmentally conscious business practices. This transformative role of AI underscores its potential to revolutionize the landscape of sustainable entrepreneurship, empowering ventures to navigate complexities and drive positive socio-environmental impact while achieving long-term viability and competitiveness in today's dynamic market ecosystem. Even though no previous empirical research study has been conducted on the impact of AI on the sustainable entrepreneurial process, some authors empirically proved that there is a strong and positive correlation between AI and entrepreneurial activity (Chen & Zhang, 2023). Other authors tried to explain this relationship by proposing a conceptual framework demonstrating that AI systems have the potential to enhance decision-making from an entrepreneurial standpoint (Amoako et al., 2021).

This research study showed that AI has a stronger impact on entrepreneurial idea generation and opportunity development than opportunity recognition, venture launches, and positive societal and environmental impact. This can be attributed firstly to data-driven insights because AI excels in processing and analyzing vast amounts of data from various sources to identify patterns, trends, and potential opportunities. In the context of idea generation and opportunity development, where creativity and innovation are paramount, AI can leverage data-driven insights to generate novel ideas, explore market trends, and uncover untapped opportunities. However, in the earlier stage of opportunity recognition, where the focus is on identifying nascent market needs or gaps, the available data may be less structured or scarce, making it challenging for AI to provide meaningful insights. A similar explanation of AI's limited impact can be provided for the later stages (venture launch and positive impact) since the data in these cases might become more specialized and context-dependent. The process of launching a venture and achieving positive societal and environmental impact involves multifaceted challenges, including regulatory hurdles, market dynamics, greater human creativity, and stakeholder engagement. These complexities introduce higher levels of uncertainty and ambiguity, which may pose challenges for AI algorithms that rely on historical data patterns to make predictions. In contrast, idea generation and opportunity development stages are relatively more structured and conducive to data-driven approaches.

Conclusions

This study investigated the influence of AI on the sustainable entrepreneurial process by including 40 entrepreneurs in the Bosnia and Herzegovina context. The hypotheses were tested using multiple regression techniques, revealing that AI (observed through the active utilization of machine learning, data mining, cloud computing, and big data analysis) significantly and positively impacts the sustainable entrepreneurial process and its five sub-components: "idea generation, opportunity recognition, opportunity development, venture launce, and positive impact".

Beyond enhancing existing literature on AI and sustainable entrepreneurship, this research introduces and verifies instruments designed to assess the sustainable entrepreneurial process. Moreover, this study offers empirical evidence concerning the relationship between AI and sustainable entrepreneurial processes,

especially from the viewpoint of developing economies. Entrepreneurs can practically use this research outcomes in order to strategically integrate AI into their business processes and product/service innovation to advance sustainability efforts, leveraging AI's capabilities in optimizing resources, creating new sustainable ventures, managing supply chains, and assessing environmental impacts. Additionally, by harnessing AI for automation, data analysis, and predictive modeling, entrepreneurs can improve operational efficiency, reduce costs, mitigate risks, enhance decision-making, foster collaboration across stakeholders, and capitalize on opportunities effectively.

The limitation of this study stems from the relatively small sample size and lacked analysis across various industry and business segments. Potential future direction may involve conducting longitudinal studies to track the adoption and impact of AI technologies on entrepreneurial ventures over time. Longitudinal research can provide insights into the dynamic nature of AI adoption, its effects on business performance, and the evolution of entrepreneurial strategies in response to technological advancements. Further, researchers can carry out cross-cultural comparisons by comparing the adoption and impact of AI on the sustainable entrepreneurial process across different cultural, institutional, and economic contexts. Another future research proposal is to provide sector-specific analyses by examining how AI technologies are transforming entrepreneurship in different industries, such as healthcare, finance, agriculture, manufacturing, and tourism. Sector-specific research can pinpoint industry-specific challenges, opportunities, and effective strategies for AI integration, guiding tailored interventions and policy suggestions.

References

Ahmić, A. (2022). Business model for continuous enterprise sustainability. Management and Business Research Quarterly, 22, 33-50. https://doi.org/10.32038/mbrq.2022.22.04

Ahmić, A. (2023). Artificial intelligence practices, opportunities and barriers in human resource management. Nauka I tehnologija, 11(2), 98-107. http://dx.doi.org/10.58952/nit20231102098

Akerkar, R. (2019). Artificial intelligence for business. Springerbriefs in business. https://doi.org/10.1007/978-3-319-97436-1

Amoako, G., Omari, P. Kumi, D. K., Agbemabiase, G. C., & Asamoah, G. (2021). Conceptual framework—artificial intelligence and better entrepreneurial decision-making: the influence of customer preference, industry benchmark, and employee involvement in an emerging market. Journal of risk and financial management, 14(12), 1-20. http://dx.doi.org/10.3390/jrfm14120604

Belz, F. M., & Binder, J. K. (2017). Sustainable entrepreneurship: a convergent process model. Business strategy and the environment, 26(1), 1-17. http://dx.doi.org/10.1002/bse.1887

Bickley, S. J., Macintyre, A., & Torgler, B. (2021b). Artificial intelligence and big data in sustainable entrepreneurship. Crema working paper, (2021 September). Center for Research in Economics, Management and the Arts (CREMA), Zürich. Https://doi.org/10.2139/ssrn.4686881

Casali, G. L., Perano, M., Moretta Tartaglione, A., & Zolin, R. (2018). How business idea fit affects sustainability and creates opportunities for value co-creation in nascent firms. Sustainability, 10(1), 1-15. Http://doi.org/10.3390/su10010189

Chen, K., & Zhang, S. (2023). Impact of artificial intelligence on entrepreneurial activity-empirical evidence from Chinese cities. Technology analysis & strategic management, 1-14. Https://doi.org/10.1080/09537325.2023.2268210

Covin, J. G., Slevin, D. P., & Heeley, M. B. (2000). Pioneers and followers: competitive tactics, environment, and firm growth. Journal of Business Venturing, 15(2), 175-210. Http://www.sciencedirect.com/science/article/pii/s0883-9026(98)00015-9

Dimov, D. (2007). From opportunity insight to opportunity intention: the importance of person-situation learning match. Entrepreneurship theory and practice, 31(4), 561-583. Https://doi.org/10.1111/j.1540-6520.2007.00188.x

Elia, G., Margherita, A., & Passiante, G. (2020). Digital entrepreneurship ecosystem: how digital technologies and collective intelligence are reshaping the entrepreneurial process. Technological forecasting and social change, 150. Https://doi.org/10.1016/j.techfore.2019.119791

Esterberg, K. G. (2002). Qualitative methods in social research. Boston: McGraw-Hill.

Fors, P., & Lennerfors, T. T. (2019). The individual-care nexus: a theory of entrepreneurial care for sustainable entrepreneurship. Sustainability, 11(18), 1-18. Https://doi.org/10.3390/su11184904

Hanohov, R., & Baldacchino, L. (2018). Opportunity recognition in sustainable entrepreneurship: an exploratory study. International journal of entrepreneurial behavior & research, 24(2), 333-358. Https://doi.org/10.1108/ijebr-12-2015-0275

Hill, S. A., & Birkinshaw, J. M. (2010). Idea sets: conceptualizing and measuring a new unit of analysis in entrepreneurship research. Organizational research methods, 13(1), 85-113. Https://doi.org/10.1177/1094428109337542

Hörisch, J., Schaltegger, S., & Freeman, R. E. (2020). Integrating stakeholder theory and sustainability accounting: a conceptual synthesis. Journal of Cleaner Production, 275(1), 1-12. Https://doi.org/10.1016/j.jclepro.2020.124097

Jiménez-Ibáñez. E., Magal-Royo, T., Jordá-Albiñana, B., Montesinos-Sanchís, P., & González-del-Río, J. (2019). Design thinking for innovation in Colombian SMEs. Studies in Educational Management, 2, 20-26. https://doi.org/10.32038/SEM.2019.02.02

Karhunen, P., Arvola, K., Küttim, M., Venesaar, U., Mets, T., Raudsaar, M., & Uba, L. (2011). Creative entrepreneurs' perceptions about entrepreneurial education. Paper report, university of Tartu: Tartu, Estonia.

Korinek, A., & Stiglitz, J. E. (2017). Artificial intelligence and its implications for income distribution and unemployment. National bureau of economic research, 349-390.

Kuckertz, A., Kollmann, T., Krell, P., & Stöckmann, C. (2017). Understanding, differentiating, and measuring opportunity recognition and opportunity exploitation. International journal of entrepreneurial behavior & research, 23(1), 78-97. Https://doi.org/10.1108/ijebr-12-2015-0290

Lee, D., & Tsang, E. W. K. (2001). The effects of entrepreneurial personality, background and network activity on venture growth. Journal of Management Studies, 38(4), 583-602. Https://doi.org/10.1111/1467-6486.00250

Lumpkin, G. T., & Lichtenstein, B. B. (2005). The role of organizational learning in the opportunity recognition process. Entrepreneurship: theory and practice, 29(4), 451-472. Https://doi.org/10.1111/j.1540-6520.2005.00093.x

Matzembacher, D. E., Raudsaar, M., De Barcellos, M. D., & Mets, T. (2019). Sustainable entrepreneurial process: from idea generation to impact measurement. Sustainability, 11(21), 1-26. Https://doi.org/10.3390/su11215892

Mcmullen, J. S., & Shepherd, D. A. (2006). Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. Academy of Management Review, 31(1), 132-152. Https://doi.org/10.5465/amr.2006.19379628

Menold, J., Simpson, T. W., & Jablokow, K. W. (2016). The prototype for x (PFX) framework: assessing the impact of pfx on desirability, feasibility, and viability of end designs. Asme 2016 international design engineering technical conferences. Https://doi.org/10.1115/detc2016-60225

Mansoor, M., Awan, T. M., & Paracha, O. S. (2022). Sustainable buying behaviour: An interplay of consumers' engagement in sustainable consumption and social norms. International Social Science Journal, 72(246), 1053-1070.

Mets, T., Raudsaar, M., & Summatavet, K. (2013). Experimenting social constructivist approach in entrepreneurial process-based training: cases in social, creative and technology entrepreneurship. In the experimental nature of new venture creation; Springer: cham, Switzerland (pp. 107-125). Https://doi.org/10.1007/978-3-319-00179-1_11

Obschonka, M., & Audretsch, D. B. (2020). Artificial intelligence and big data in entrepreneurship: a new era has begun. Small business economics, 55(3), 529-539. Https://doi.org/10.1007/s11187-019-00202-4

Osterwalder, A., Pigneur, Y., & Tucci, C. L. (2005). Clarifying business models: origins, present, and future of the concept. Communications of the association for information systems, 16(1), 1-25. Https://doi.org/10.17705/1cais.01601

Ozgen, E., & Baron, R. A. (2007). Social sources of information in opportunity recognition: effects of mentors, industry networks, and professional forums. Journal of Business Venturing, 22(2), 174-192. Https://doi.org/10.1016/j.jbusvent.2005.12.001

Perrini, F., Vurro, C., & Costanzo, L. A. (2010). A process-based view of social entrepreneurship: from opportunity identification to scaling-up social change in the case of San Patrignano. Entrepreneurship & regional development, 22(6), 515-534. Https://doi.org/10.1080/08985626.2010.488402

Ratten, V. (2023). Entrepreneurship: definitions, opportunities, challenges, and future directions. Global business and organizational excellence, 42(5), 79-90. Https://doi.org/10.1002/joe.22217

Russell, S., & Norvig, P. (2010). Artificial intelligence: a modern approach (3rd ed.). Prentice-hall, upper saddle river.

Sayed, R. (2022). The Impact of Digital Transformation on Project Management and Business Development: Case Studies in Diverse Industries. Marketing and Branding Research, 9(1), 53-64, https://doi.org/10.32038/mbr.2022.09.01.05

Schaltegger, S. (2018). Linking environmental management accounting: a reflection on (missing) links to sustainability and planetary boundaries. Social and environmental accountability journal, 38(1), 19-29. Https://doi.org/10.1080/0969160x.2017.1395351

Shane, S., & Nicolaou, N. (2015). Creative personality, opportunity recognition and the tendency to start businesses: a study of their genetic predispositions. Journal of Business Venturing, 30(3), 407-419. Https://doi.org/10.1016/j.jbusvent.2014.04.001

Sharma, P., & Chrisman, J. J. (1999). Toward a reconciliation of the definitional issues in the field of corporate entrepreneurship. Entrepreneurship theory and practice, 23(3), 11-28. Https://doi.org/10.1007/978-3-540-48543-8_4

Shaw, E., & Carter, S. (2007). Social entrepreneurship: theoretical antecedents and empirical analysis of entrepreneurial processes and outcomes. Journal of small business and enterprise development, 14(3), 418-434. Https://doi.org/10.1108/14626000710773529

Tang, J., Kacmar, K. M., & Busenitz, L. (2012). Entrepreneurial alertness in the pursuit of new opportunities. Journal of Business Venturing, 27(1), 77-94. Https://doi.org/10.1016/j.jbusvent.2010.07.001

Townsend, D. M., & Hunt, R. A. (2019). Entrepreneurial action, creativity and judgment in the age of artificial intelligence. Journal of business venturing insights, 11. Https://doi.org/10.1016/j.jbvi.2019.e00126

Yitshaki, R., & Kropp, F. (2016). Motivations and opportunity recognition of social entrepreneurs. Journal of small business management, 54(2), 546-565. Https://doi.org/10.1111/jsbm.12157

Von briel, F., Davidsson, P., & Recker, J. (2018). Digital technologies as external enablers of new venture creation in the it hardware sector. Entrepreneurship theory and practice, 42(1), 47-69. Https://doi.org/10.1177/1042258717732779.