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Article

Analysis of the importance of business model and business plan in the process of entrepreneurship: Taking college students entrepreneurship as an example

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Abstract: This article explores in-depth entrepreneurship, focusing on business models and business plans. Taking the difficulties and challenges faced by college students as an example, it analyzes the importance of business model innovation to entrepreneurial enterprises and its key role in market competition. The article first summarizes the concept of entrepreneurship and the problems it faces, and then introduces the business model and its application in entrepreneurship, the definition and components of the business plan, and how to make an effective business plan according to market demand, technology trends, and the competitive environment. This paper points out that a successful business model needs to be closely combined with market positioning, product strategy, marketing means, profit model, and other elements, and the formulation of a business plan requires rigorous steps. The study has concluded that the business model is the core of the business plan, and the plan is the specific implementation of the model. The two need to adjust to each other and jointly determine the success of the enterprise. The future development trend of the business model and business plan is the trend of digitalization and intelligence, personalization and customization, flexibility, and adaptability. This paper puts forward suggestions for entrepreneurs represented by college students: an in-depth understanding of market and customer needs, the need to maintain innovative thinking, the feasibility of a socialist plan, etc., thus improving the success rate of entrepreneurship. This paper enriches the relevant theories of entrepreneurship, lays the foundation for in-depth research, and has certain theoretical significance.

Keywords: entrepreneurship; college students; business model; business plan; innovation management

1. Introduction

In today's highly competitive and rapidly developing business environment, entrepreneurship has become an important force to promote economic growth, create job opportunities, and drive social progress. Entrepreneurship is an important driving force to promote regional economic growth and a key carrier for deepening supply-side structural reform and implementing an innovation-driven development strategy. Entrepreneurship is based on innovation. Innovation is a powerful driving force for economic development and a core driving force for high-quality development. The structural contradictions of the Chinese employment market are relatively prominent, which specifically show that in an environment of rapid upgrading and transformation of industrial structure, the talent supply does not match the talent demand of enterprises [1]. The prominent structural contradictions in the employment market

objectively make more people choose to start their own businesses, thus promoting the development of entrepreneurship.

The 36 Kr Research Institute, a Chinese market venture capital industry research organization, released the "2021 China Core Entrepreneurs Research Report" in 2021 [2]. The report shows that 40% of entrepreneurs are young people under the age of 30, and young people are becoming the main force of entrepreneurship, showing an increasing trend year by year. With the release of a series of policies, such as Guiding Opinions on Further Supporting the Innovation and Entrepreneurship of College Students, Notice on Tax Policies Related to Supporting and Promoting Employment, and Implementation Opinions on Deepening the Reform of Innovation and Entrepreneurship Education in Institutions of Higher Learning [3], the practice of "entrepreneurship and innovation" in China has entered a new stage of development [4]. In 2017, the CPC Central Committee and the State Council issued the "Medium- and Long-term Youth Development Plan (2016–2025)" [5], which listed "youth employment and entrepreneurship" as one of the ten key development goals and put forward the policy system to promote youth employment and entrepreneurship [6]. In addition, with the support of a series of policies, all provinces and universities have launched "Internet +", "Challenge Cup" and "College Students Innovation and Entrepreneurship Training Plan" to promote innovation and entrepreneurship activities for college students. However, although the environment for the number of entrepreneurs is improving and the number of entrepreneurs is increasing, the failure rate is still high, as is the result for college students, too. In addition, according to the "2022 College Student Employment Report", only 1.2% of college graduates choose to start their own businesses [7]. It can be seen that the entrepreneurial situation is grim. Wang analyzed the reasons for the failure of college students' entrepreneurship from the perspectives of culture and education, social resources, information acquisition, and subjective reasons [8]. Liu and Ma pointed out the entrepreneurial difficulties of college students from the four aspects of employment concept, entrepreneurship mechanism, policy system, and platform construction [9]. Ping pointed out the reasons for failure from the aspects of social environment, college students' self-cognition, comprehensive quality, and so on [10]. Other scholars also analyzed the reasons for the high failure rate of entrepreneurship from the perspectives of the external environment, college students' own quality, college entrepreneurship education, and public opinion [11–15]. These scholars also explored the path of innovation and entrepreneurship from the aspects of national policies, setting clear goals, building teams, improving courses, improving their own quality, psychological education [16], fault tolerance mechanisms, and so on. Among them, the establishment of the fault-tolerant mechanism is conducive to eliminating the ideological burden of college students' entrepreneurship and can effectively expand the theoretical system of college students' innovation and entrepreneurship work, which is of great significance to college students' entrepreneurship [17]. In universities, college students can learn the writing of business models and business plans through innovation and entrepreneurship competitions. This study focuses on analyzing the role of business model and business plan in entrepreneurship and exploring the significance of a perfect business model and business plan for entrepreneurship.

Successful entrepreneurial activities are often inseparable from well-designed business models and business plans. The business model determines how the enterprise creates value, transmits value, and obtains value, and the business plan is the blueprint and action plan to realize this process. Therefore, the research on "entrepreneurship focusing on business model and business plan" is of great significance for guiding entrepreneurial practice and improving the success rate of entrepreneurship.

The following two research methods are used in this paper:

(1) Literature research method: through systematic collection and analysis of existing research literature, understand the main theories in the field of human resource performance management, search the literature related to big data and human resource performance management, and collect and sort out the literature as the basis for the research and demonstration of this paper.

(2) Inductions: analyze combined with cases, explore the common problems in specific cases, explore the universality of particularity, summarize, start from specific cases, seek commonality from individuality, summarize ideas with certain generality, and expand the research direction.

The research significance of this paper is shown as follows:

The first is the theoretical value. Enrich entrepreneurial theory: By focusing on the research of business models and business plans, we can further enrich and improve the entrepreneurial theory system and provide theoretical support and reference for subsequent academic research. Disclosure of the mechanism of success: Studying successful entrepreneurial cases and analyzing the business model and business plan behind them can help reveal the internal mechanisms and laws of entrepreneurial success and provide reference and guidance for later entrepreneurs. The logical theory of the entrepreneurial decision-making effect points out that entrepreneurship is an iterative process in which entrepreneurs constantly adjust their understanding and decision-making of entrepreneurial output. Opportunities and environment evolve together in this process and finally gradually form entrepreneurial products and services.

The second is the practical significance. Guiding entrepreneurial practice: For entrepreneurs, a reasonable business model and business plan are the keys to entrepreneurial success. Studying this field can provide specific guidance and suggestions for entrepreneurs and help them better design business models and make business plans, so as to improve the success rate of entrepreneurship. Promoting economic development: Entrepreneurship is an important force for promoting economic development. Through the study of business models and business plans, more entrepreneurial talents can be cultivated to promote more innovative projects and thus promote the sustainable and healthy development of the economy. Optimize resource allocation. Effective business models and business plans can realize optimal allocation and efficient utilization of resources. The research in this field is helpful to guide enterprises to better allocate resources, improve the efficiency of resource utilization, and achieve a win-win situation of economic and social benefits.

In short, the research focusing on the business model and business plan not only has profound theoretical value but also has important practical significance. It can not only promote the development and perfection of entrepreneurial theory but also

provide strong guidance and support for entrepreneurial practice and promote the sustainable and healthy development of the economy.

Figure 1 is the research structure diagram of this paper, showing the process idea of this paper. First of all, the relevant theories of entrepreneurship are introduced; the business model and business plan are introduced, respectively; and finally, the summary and suggestions are given.

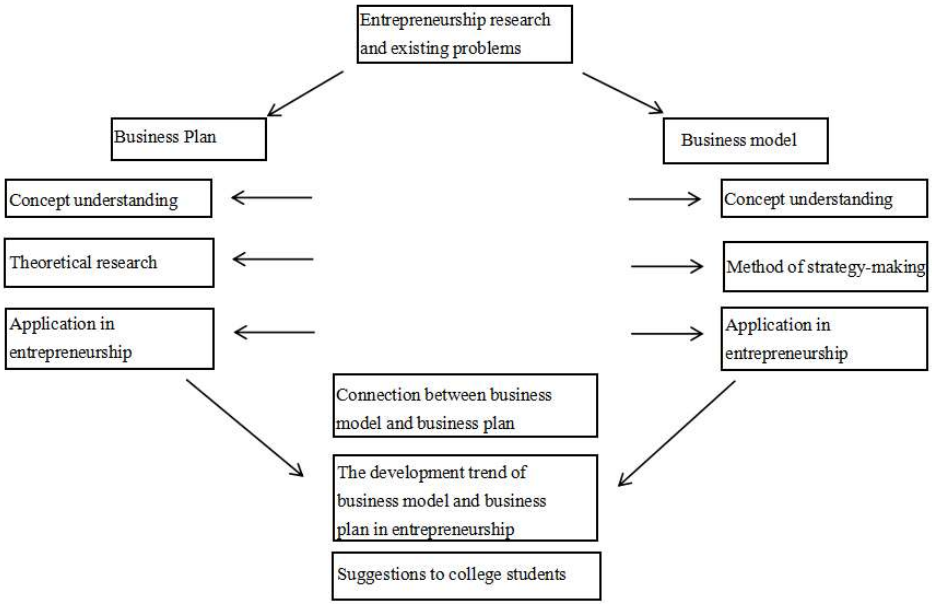

Figure 1. The research structure diagram.

2. Theoretical research on entrepreneurship

2.1. The concept of entrepreneurship

The core spirit of entrepreneurship is innovation. Innovation is a way of thinking that cannot be directly converted into productivity; entrepreneurship is a practical activity that is directly implemented into practical action. Entrepreneurship means that the products or services they provide are widely accepted by the market, which can produce economic returns and gradually generate profits so as to achieve success [18]. The concept of entrepreneurship can be understood from the following four aspects:

(1) Entrepreneurship is a complex creative process. It creates some valuable new things. This new thing must be valuable, not only to the entrepreneurs themselves but also to society. The value attribute is an important social attribute of entrepreneurship, as is the significance and value of entrepreneurial activities.

(2) Entrepreneurship must contribute the necessary time and energy and make a great effort. It takes a lot of time to complete the whole entrepreneurial process and create new and valuable things, but success is impossible without great effort, and many entrepreneurial activities are achieved early on in a very difficult environment.

(3) Entrepreneurship must bear the inevitable risks. Entrepreneurial risk can take various forms, depending on the field of entrepreneurship and the resources of the entrepreneurial team. However, the usual entrepreneurial risk is mainly human resource risk, market risk, financial risk, technical risk, external environment risk, contract risk, spiritual risk, and other aspects. Entrepreneurs should have superhuman

courage, be willing to take risks, and have the courage to bear the risk of most people's careers.

(4) The rewards that entrepreneurship will bring to entrepreneurs. As an entrepreneur, the most important reward may be the independence it gains and the subsequent satisfaction of its personal material wealth. The logical theory of entrepreneurial decision-making effect points out that entrepreneurship is an iterative process in which entrepreneurs constantly adjust their understanding and decision-making of entrepreneurial output, and opportunities and environment evolve together in this process and finally gradually form entrepreneurial products and services [19].

2.2. Problems and risks faced by entrepreneurship

Entrepreneurship is a task full of challenges and risks. Entrepreneurs represented by college students will encounter a variety of problems and challenges. Developing business ideas and visions, raising money for start-ups, and finding the right business location are common internal challenges for new entrepreneurs [20], and external challenges are often unforeseen. Some of the common entrepreneurial issues are discussed in detail below.

(1) Fund-raising and management issues

The first is the initial fundraising, and entrepreneurs usually need a certain amount of start-up capital to support their business. This may include product development, marketing, rent, wages, etc. Raising sufficient initial funding can be a challenge, especially for start-ups without rich financial resources. In the process of starting a business, you will also face the problem of cash flow management. Even after the business starts operating, cash flow management is also an important issue. Ensuring enough capital flows to pay for daily expenses and accounts payable while avoiding overspending is key to success. Entrepreneurs can prove the feasibility of their ideas, but often there is not enough money to commercialize them, thus bringing certain risks to entrepreneurship. Often, only a few funds are willing to encourage entrepreneurs to cross the gap, such as venture investment by wealthy individuals specializing in early-stage projects and government-funded programs.

(2) Market competition problems

In terms of market positioning, it is an important problem to determine the target market and accurately locate it. If the market positioning is not accurate, the product or service may not attract enough customers. In many industries, the competition is very fierce. How to stand out in the competition and attract and retain customers is the challenge that entrepreneurs need to face.

(3) Team building and operation problems

Finding a suitable team is the key to the success of entrepreneurship. By carrying out enterprise practice, cooperating with experienced entrepreneurs, and participating in seminars and practices of high-quality teachers, the Internet entrepreneurship of higher students can be promoted [21]. Therefore, the entrepreneurial spirit of team members can be improved through the above measures. Recruiting people with relevant skills and experience and ensuring that they can integrate into the team culture is an important issue. In terms of team management, it may become more complex as the business grows. How to ensure effective communication, cooperation, and

motivation between team members is a problem that entrepreneurs need to pay attention to.

(4) Technical problems

Technology selection: Choosing an appropriate business development for the technology stack and tools is an important issue. Technology maturity, cost, scalability, and other factors need to be considered. In the process of converting the process of converting the expected products into commercial products (mass production of products), with effective performance, low cost, and high quality products, the process of surviving the market competition requires a lot of complex and costly research work (sometimes a few years) to form the entrepreneurial risk.

(5) Innovation and adaptability

Continuous innovation: In a rapidly changing market environment, continuous innovation is the key to maintaining competitiveness. Entrepreneurs need to pay attention to industry trends and technology development trends and adjust their business strategies over time. Adapt to market changes: the market environment and customer needs may change with time and the external environment. Entrepreneurs need to have keen insight and timely adjust the business direction and strategies to adapt to market changes.

In addition to the above, the lack of management experience for college students makes it difficult to find good entrepreneurial projects, which is also a challenge facing entrepreneurship [22]. In addition, Martijn A. Boermans proposes that the degree of risk perception is positively correlated with the business performance of entrepreneurs [23], that is, the higher the results college students achieve in the process of starting a business, the higher their risk perception, while those with poor entrepreneurs have poor risk perception.

2.3. Theoretical research on entrepreneurship

At present, the theoretical research achievements on “entrepreneurship” are rich, which reveal the essence and success elements of entrepreneurship from different perspectives.

Entrepreneurship emphasizes the importance of innovation, believing that entrepreneurs break the market balance by introducing new products, services, or technologies and creating new business opportunities. This spirit of innovation is at the core of entrepreneurial activities, promoting sustainable economic development and social progress. The national policy to support college students’ entrepreneurship can further relieve the employment pressure of colleges and universities [24], so as to promote the sustainable development and progress of the whole social economy.

At the same time, entrepreneurship also focuses on the personal characteristics and abilities of entrepreneurs. Successful entrepreneurs often have a firm belief, keen market insight, excellent leadership, and strong risk tolerance. These characteristics enable them to make decisions quickly in an uncertain market environment and seize opportunities to achieve rapid growth of enterprises. Because college students lack these abilities, they have certain risks in the process of starting a business. In addition, the entrepreneurial theory also studies the factors affecting the entrepreneurial environment. External conditions such as policy support, social network, market

demand and resource access have an important impact on the success or failure of entrepreneurial activities. Variables such as investment, industry, start-up scale, founder education level, and employee education level can also affect the innovation and success rate of start-ups [25]. In addition, the green economy will affect innovation and entrepreneurship [26,27].

To sum up, the research results of entrepreneurial theory reveal the multidimensional nature and complexity of entrepreneurial activities. To start a successful business, college students need to have an innovative spirit, personal characteristics, and abilities and make full use of external resources to cope with market challenges. These theoretical achievements provide useful guidance for college students to start their own businesses and help them make wiser decisions and actions on the road to entrepreneurship. College students have learned to write business models and business plans through innovation and entrepreneurship competitions and innovation and entrepreneurship courses, which is conducive to integrating resources, building a fault-tolerant mechanism, and perceiving and preventing risks, which is of great help to their future entrepreneurship. Therefore, from the perspective of business model and business plan, this paper explores the help and significance of business model and business plan for entrepreneurship.

3. Business model and its application in entrepreneurship

3.1. Concept and theoretical research of business model

3.1.1. Concept definition and understanding of business model

A business model is the process that describes how an enterprise creates value, transmits value, and obtains value. It involves how companies identify market opportunities, design products or services, build relationships with partners, market and sell products or services, and manage and optimize the entire value creation process. The usefulness and predictability of business models promise to help entrepreneurs make more informed decisions that increase their chances of success [28].

The business model is the embodiment of enterprise strategy, which covers the enterprise's products, services, market positioning, customer relations, revenue sources, and key business activities. These elements are interrelated and together constitute the unique value creation and acquisition system of the enterprise. The key to understanding a business model is to grasp its integrity and dynamics. Integrity means that each component of the business model must be coordinated and supported by each other in order to form an effective value creation and acquisition mechanism. Dynamics emphasizes that business models must be constantly adjusted and innovated to meet the changing market environment and customer needs.

A successful business model should provide clear answers to the following questions: Who do companies create value for? What kind of value is created? How do you create value? How do you convey the value? And how do you benefit from the process of creating value? Answering these questions requires a deep understanding and accurate judgment of the market, customers, competitors, and their own capabilities. In short, the first is the rationality of the business model, that is, the ability

to care about the reasonable demands of all stakeholders, which is the cornerstone of the stability of the business model [29], which determines whether an enterprise can stand out in the fierce market competition. Therefore, enterprises must attach great importance to the construction and innovation of business models and constantly seek new ways of value creation and acquisition to adapt to the changing market environment.

3.1.2. Theoretical research on business model

(1) The components of the business model

The highly inconsistent concept of a business model results in the inconsistency of the constituent elements. Representative ones, Jonas Hedman et al., should include organizational resources, competitors and customers, etc. Gary Hammer believes that there should be four aspects: value network, core strategy, strategic resources, and customer interface. Other representative concepts are the three elements of the business model proposed by Amit and Zott, including content, transaction control, and structure. Afuah and ucci proposed that the business model should include revenue, ability, customer value, and so on, which can be applied in the traditional business model on the network.

(2) Research on the types of business models

The business model originating from EC can be divided into two types: B2C and B2B. Morris According to the growth period of the enterprise, it is divided into three levels, namely the basic layer, unique layer, and rule layer, and each layer includes six elements. The basic layer indicates that during the import period, the unique layer indicates the growth period, and the regular layer indicates the maturity period. Huang and Chen believe that they should be divided into three levels, respectively. In essence, the business model contains the creation of enterprise value.

(3) Market opportunity to pull the momentum

Business models generate momentum in order to seize market opportunities. Lindgardt et al. believe that innovation can bring unique business opportunities to enterprises. Through the conclusion, economic regression contains unlimited business opportunities, which can make enterprises revitalize [30]. As a result, they concluded that companies had highly agreed on innovative business models at the time of the financial crisis. Innovation behavior in specific periods is more important and more explanatory. There are many reasons for innovation and radiating enterprises, but its core is one: to maximize the value of enterprises, and the rest are external forms.

(4) Business models need to be innovated urgently

In order to adapt to the rapidly changing business environment, enterprises must constantly innovate. The pre-driven business model can better adapt to the continuous, dynamic, and radical changes in the business environment. Sosna et al. believe that the sustainability of specific business models should be viewed in the long run, and only continuous innovation can make enterprises invincible [31]. Although many experts and scholars at home and abroad agree with this point, the internal mechanism of the business model has not been well explained, which affects its enterprise innovation.

(5) The core strategy of business model development

Value innovation as the soul, to occupy the customer as the center, the economic alliance as the carrier, strain capacity as the key, the information network as the platform of the soul of the business model breakthrough development is the value innovation, with the help of business model this platform to maximize value, business model innovation is a new enterprise to avoid homogeneity competition, realize the key to survival and rapid development [32]. In consumers, consider immediate interests, from this perspective to observe, only the competition perspective into the user, to enter the competition space: Wang pointed out that the development of the business model core is economic alliance as the carrier, but due to the value of the curve, a third from the enterprise, two-thirds from enterprises, through cooperation between each other, to create greater value and make the make the form more competitive. With the continuous innovation of business models, without the information network, enterprises will eventually be competitive at all.

3.2. Application of business model in entrepreneurship

The realization of entrepreneurial opportunities also needs the support of specific actual behaviors of entrepreneurs. Through comprehensive utilization of various resources, optimization of resource allocation to carry out specific entrepreneurial measures, planning, and coordination to achieve the expected value goals and profit purposes [33], The innovation of business models plays a positive role in improving enterprise performance so as to effectively improve the success rate of entrepreneurship. The implementation of efficient business model innovation by entrepreneurs has a significant role in improving their growth performance [34]. A business model is a potential resource to obtain a competitive advantage. Enterprises can obtain a competitive advantage through their business model. A novel and effective business model can promote the excellent value creation of enterprises. Through empirical analysis, Wu proved that business model innovation plays a positive intermediary role between entrepreneurship and company performance [35]. Cavallo et al. first attempt to establish the theoretical basis and positioning of growth hackers in business model research [36]. The IBM Business Value Institute concluded that outperforming companies innovate their business models more frequently than underperforming companies and that business model innovation can help companies increase gross margin growth by 5% higher than their competitors. 69% of the global CEOs say they are very concerned about business model innovation; almost all CEOs have implemented business model innovation to varying degrees, and the outstanding business model innovation is more thorough. Bachmann et al. proposed a conceptual process model for existing enterprise BMI, which promoted the sustainable development of BMI from a from a process perspective [37].

Future returns on investments in new products and services are always uncertain. The continuous reduction of technical barriers will also encourage industrial homogenization competition [38]. Unwilling to make such big bets, more companies are now turning to business model innovation as an alternative or complement to product or process innovations [39]. Therefore, entrepreneurs represented by college students should turn their focus to the business model when innovating. Enterprises should build a customer-value-oriented business circle [40], and business model

innovation is conducive to promoting this view. New enterprises should actively carry out legalization management strategies while implementing business model innovation. Active legal management, the recognition and support of society, and the improvement of their own legitimacy level are the key links to the impact of business model innovation on the performance of new enterprises and play an important role in the successful implementation of the business model.

4. Business plan and its application in entrepreneurship

4.1. Concept and how to develop the business plan

4.1.1. Concept definition and understanding of the business plan

A business plan is a written document detailing the development plan and strategy of an enterprise. It is mainly used to demonstrate the potential and value of a business to investors, partners, banks, and other stakeholders to attract capital, talent, and other resources, so it is extremely important for a business to develop a business plan. The business plan is not only focused on the current situation of the enterprise but also on its future development. It requires enterprises to have a clear understanding of their own market environment, competitive position, and resource ability and, on this basis, to develop feasible development strategies. A business plan is a dynamic process that needs to be adjusted and optimized according to market changes and enterprise development. It is not only a tool for enterprises to show their own value to the outside world but also an important basis for their internal management, coordination, and decision-making. The complexity of business plans makes them difficult to use in the business field, and this proposed approach can contribute to a business plan or innovation in a practical way [41]. So it's important to start a business and make a business plan.

Understanding a business plan: a business plan is a combination of enterprise strategy and tactics. It should not only have macro-strategic planning, such as market positioning and competitive strategy, but also have a specific tactical implementation plan, such as marketing activities, production arrangements, etc. A business plan is a bridge between enterprises, investors, and partners. Through business plans, enterprises can show their potential and value to the outside world, thus attracting more resources and cooperation opportunities. Business plans develop entrepreneurial skills and increase the necessary capabilities for different entrepreneurial trips [42]. A business plan is a systematic project. It requires enterprises to comprehensively analyze their own advantages and disadvantages, market opportunities, and threats from various perspectives and formulate corresponding development strategies and implementation plans. At the same time, the business plan also needs to be combined with the daily operation and management of the enterprise to ensure the implementation of the plan. Business plans need to be constantly updated and refined. As the market environment changes and the business itself develops, something in the business plan may no longer be applicable. Therefore, companies need to regularly review and adjust their business plans to ensure that they are always consistent with the company's development goals.

4.1.2. How to make a business plan

A great business plan is a plan focused on a range of issues. These questions address four factors that are critical to the success of each new business: personnel, opportunity, background, and the possibility of risk and reward. There are two key components of the business planning process: the expression of a feasible business model and managing the growth and expansion of the business [43]. Making a business plan is a crucial step in the business process, which not only helps entrepreneurs define their goals and strategies but also serves as a tool to attract investors. Here are some suggestions on how to develop a business plan:

A business plan usually includes the following parts: cover and catalog, company overview, market analysis, product or service description, marketing and sales strategies, organizational structure and management teams, financial forecasts and funding requirements, risk assessment and coping strategies, appendix, etc. When developing a business plan, it is necessary to understand the role and content of each part to ensure the integrity and logic of the plan.

Clear goals and strategies: Before making a business plan, entrepreneurs need to define their goals and strategies. This includes identifying the company's mission, vision, and values, as well as setting short- and long-term goals and plans. Objectives and strategies need to be specific, feasible, and measurable to be clearly presented in the plan.

Market research and analysis: The business plan requires in-depth analysis and research of the market. This includes understanding the needs and preferences of target customers, competitors, market size, and growth trends. Through market research and analysis, entrepreneurs can better grasp market opportunities and risks and provide a basis for the development of marketing strategies and financial forecasts.

Highlight the strengths of a product or service: A business plan needs to fully describe the characteristics, strengths, and differentiation of a product or service. This helps to attract investor attention and make them believe that the product or service is market-competitive. When describing products or services, we need to pay attention to objectivity and authenticity and avoid exaggeration or false propaganda.

Develop marketing and sales strategies: The business plan needs to define the marketing and sales strategies, including target customers, market positioning, promotion channels, sales channels, pricing strategies, etc. These strategies need to match the company's goals and market conditions to ensure that products or services can be effectively promoted and sold.

Financial forecast and capital demand analysis: The business plan needs to forecast and analyze the company's financial position, including revenue, cost, profit, cash flow, etc. At the same time, it needs to analyze the capital needs and sources in order to provide sufficient financial support for the development of the company. In the financial forecast and capital demand analysis, market changes, competitive situations, and other factors should be fully considered to ensure the rationality and feasibility of the forecast.

In short, making a business plan requires a comprehensive consideration of all aspects of the company to ensure the integrity and logic of the plan.

4.2. The application of business plans in entrepreneurship

College students have problems with a lack of overall digital literacy and low entrepreneurial alertness [44], and making a sound business plan can make entrepreneurs think deeply about the risks they may encounter and improve their entrepreneurial alertness. Through the above understanding of how to make a business plan and how to make it, the following six points summarize the application of a business plan in entrepreneurship.

1) Clear up the entrepreneurial thinking. Having a good idea is just the beginning of starting a business. Entrepreneurs have too many things to do in order to achieve this idea. And you will inevitably face brutal market competition. There are many obstacles and difficulties that will appear at any time that you have never thought of. War requires strategy, and entrepreneurship, while not that demanding, requires at least a roadmap. A business plan is a roadmap for entrepreneurs. By writing a business plan, founders can comprehensively check their ideas, find problems, and add omissions.
2) Resource integration. Internal entrepreneurship theory refers to the creation of new businesses by utilizing the products, technology, personnel, and capital resources within the existing organization so as to improve the competitiveness and profitability of the organization [45]. Investors should take existing resources into account when making a business plan and plan to allocate existing resources reasonably. College students should learn to use the accumulated contacts and other resources in colleges and universities so as to improve the success rate of entrepreneurship.
3) The carrier should contact the investors. Although the best way to contact investors is still being introduced, most entrepreneurs don't have it. They can't just go to their investors' offices to find them, so many entrepreneurs choose to email their investors. Of course, some entrepreneurs also participate in various activities that can reach investors to seek opportunities to promote projects. But this meeting time is too short; it is difficult to give investors a comprehensive understanding of a project.
4) Planning for companies and projects. A brewing project is often vague, and through the writing of a business plan and venture capital plan, a complete and feasible venture capital plan can be put on paper. To become the action guide for start-ups and the "golden key" to attract investment.
5) Access to venture capital investment. A good business plan is the key to making an investment. How to attract investors, especially venture investors, to participate in entrepreneurs investment projects, then a high-quality and rich content of the business plan to the company and the advantages of the project, potential, operational ideas, and business model such as a perfect show to investors, will make investors faster, better understand the investment projects, have confidence in the project, enthusiasm to get its favor, mobilize investors to participate in the project, and eventually raise funds for the project.

In addition, according to the research, potential college student entrepreneurs pay more attention to business plans than experienced entrepreneurs [46], indicating that

college students have begun to pay attention to the development of business plans in the process of entrepreneurship.

5. Summary analysis

5.1. Summary

5.1.1. Connection between business model and business plan

Business model and business plan are closely linked in entrepreneurship, and they together form the foundation of entrepreneurial success. A business model is at the heart of a business plan. The business model describes how an enterprise creates value, transmits value, and obtains value. It determines the way an enterprise operates, the characteristics of the product or service, the market positioning, and the way it makes profits. It also focuses on the value creation of both the demand side and the supply side [47]. Some scholars use the business model canvas to guide students in making business plans [48]. A business plan is a specific implementation plan formulated based on a business model, including target setting, market strategy, marketing strategy, operation strategy, etc. Therefore, a business model is the core of a business plan, and the business plan needs to be formulated under the guidance of the business model.

A business plan is the execution plan for the business model. Business plan A business plan is the refinement and embodiment of the business model. It describes in detail how an enterprise implements the business model, including the specific action plan, schedule, resource allocation, etc. Business plans need to ensure the effective implementation of business models and provide specific guidance for the development of enterprises.

The business model and the business plan jointly determine the success of the enterprise. The innovation and feasibility of the business model determine the competitiveness and profitability of an enterprise, while the effective implementation of the business plan determines whether the enterprise can realize the potential of the business model. Therefore, the business model and the business plan jointly determine the success of an enterprise. In the process of starting a business, entrepreneurs need to constantly optimize their business models and business plans to adapt to the needs of market changes and enterprise development.

Business models and business plans need to adjust to each other. As the market changes and the enterprises develop, the business models and plans may need to be adjusted accordingly. Business models may need to be optimized to meet changes in market demand, while business plans will need to be tailored to ensure that companies can grow in line with their stated goals. Therefore, in the process of starting a business, entrepreneurs need to continuously pay attention to market changes and enterprise development and timely adjust and optimize their business models and business plans.

In short, business models and business plans are closely linked in entrepreneurship, and they together form the foundation of business success. Entrepreneurs need to fully consider the characteristics and needs of the business model when making a business plan and constantly optimize the business model to meet the needs of market changes and business development.

5.1.2. Summary of the application of business model and business plan in entrepreneurship

The innovation of business models plays a positive role in improving enterprise performance. A positive business model can help enterprises recognize who to create value, what kind of value, how to create value, how to deliver value, and other issues so as to improve the operation efficiency of enterprises. Enterprises can also obtain competitive advantages and competitive resources through business models. According to the literature reviewed, more and more companies are now turning to business model innovation as an alternative or supplement to product or process innovation, so the business model is playing an increasingly important role in the process of entrepreneurial application.

Making a sound business plan can enable entrepreneurs to think deeply about the risks they may encounter and improve their entrepreneurial vigilance. A sound business plan can improve the overall operation efficiency of the enterprise and the enthusiasm of employees. The business plan mainly plays a positive role in the process of entrepreneurial application by clarifying entrepreneurial ideas, integrating resources, connecting investors, planning companies and projects, and obtaining venture capital. In addition, relevant scholars point out that potential college entrepreneurs pay more attention to business plans than other entrepreneurs, so it can be seen that business plans are also valued by young entrepreneurs.

5.2. Analysis

5.2.1. The development trend of business model and business plan in entrepreneurship

The future trends of business models and business plans in the entrepreneurial field may be influenced by a variety of factors, including technological advances, changing consumer demand, market competition, and the global economic environment. Here are some prospects for the future development trend:

(1) Digitization and intelligence trend: With the rapid development of big data, artificial intelligence, the Internet of Things, and other technologies, the future business model will pay more attention to digitalization and intelligence. Companies can make more refined business plans by collecting and analyzing large amounts of data to more accurately understand consumer needs and market trends. At the same time, intelligent technology can also help enterprises optimize their operational processes, improve efficiency, and reduce costs.

(2) The trend of personalization and customization: With the diversification and personalization of consumer needs, the future business model will pay more attention to the personalization and customization of products and services. Enterprises need to provide customized products or services according to consumers' needs and preferences. More market research and consumer insights may be included to determine the needs and preferences of target consumers and to develop appropriate product or service strategies.

(3) Flexibility and adaptability trend: In the face of the rapidly changing market environment, the future business model will pay more attention to flexibility and adaptability. Companies need to be able to quickly adjust their business plans to adapt

to changing markets. Therefore, more flexibility and adaptive strategies such as agile development, rapid iteration, etc. may be included in business plans.

In short, the future trends of business models and business plans are likely to focus more on digitalization, intelligence, sustainability, personalization, customization, platform, ecology, flexibility, and adaptability. Through the above discussion, a good business model and business plan can improve the success rate of entrepreneurship and help enterprises achieve higher performance, as represented by college students. Entrepreneurs need to pay close attention to market changes and technology development trends, pay attention to the changing trends of their business models and business plans, and constantly optimize and adjust their business models and business plans to adapt to future market competition and consumer demand so as to promote the success of entrepreneurship.

5.2.2. Suggestions for college students in the formulation of a business model and business plan

To sum up, on the road to entrepreneurship, the development of a business model and a business plan is crucial.

First, an in-depth understanding of the market and customer needs is the basis for developing a successful business model. The basic dimensions of a business model are resource structure, transaction structure, and value structure. Therefore, a perfect business model can help college students and all entrepreneurs coordinate resources and predict market value in the process of entrepreneurship. Through market research, entrepreneurs can better grasp the market trend and competition situation so as to find an accurate positioning for their products or services.

Secondly, college students need to keep their innovative thinking and constantly explore new business models. In a competitive market, the traditional business model may be difficult to foothold, so it needs to have the courage to try new business models and seek the advantages of differentiated competition.

When making business plans, college students need to pay attention to the feasibility and operability of the plan. A business plan requires not only clear goals and strategies but also specific action plans and schedules. At the same time, it is also necessary to consider the reasonable allocation of resources and risk management to ensure the smooth implementation of the plan.

In addition, college students also need to keep learning and improve their abilities. The development of business models and business plans is a complex process that requires rich knowledge and experience from entrepreneurs. Therefore, college students need to continue to learn new knowledge and new skills to improve their comprehensive quality and ability level.

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Article

Time-varying effects of crude oil price fluctuations on tuna fish prices

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Abstract: This research presents an investigation of the time-varying effects of crude oil on the price of three tuna species, namely skipjack, albacore, and yellow fin. The investigation analyses the impact coefficient of oil price fluctuation on tuna species over time with specific phases related to time points when crude oil prices fall, including December 2008 (due to the impact of the Financial Crisis), February 2016 (due to the impact of the US shale oil and gas revolution), and April 2020 (due to the impact of the global COVID-19). The analysis shows that the price of yellow fin and skipjack shows sensitivity to these phased oil price shocks but stays consistent after recovery. This research finds that the relationship between oil price and tuna price depends on specific phases of oil price fluctuations and that global crude oil price shocks could have immediate and short-term impacts on fish markets, especially during a period of financial crisis.

Keywords: tuna; oil price; commodity; financial crisis; sustainability

1. Introduction

Fish resources are significant to the food security of many nations, and similar to the majority of food systems, fisheries and their supply chains are heavily dependent on fossil fuels [1]. Tuna is one of the oceanic top predators and plays a significant role in marine ecosystems, comprising nearly 20% of the value of capture fisheries. The main commercial species of tuna are the Atlantic bluefin, southern bluefin, albacore, bigeye, yellowfin, and skipjack [2]. These species are the predators of the pelagic ecosystem and are highly migratory, with their distribution covering most of the tropical and temperate areas around the globe. Tuna is one of the most valuable marine resources, and the development of deep freezing storage and enhanced farming techniques has been lucrative for fisheries and resulted in a significant increase in catches [3]. The expenditure on fuel represents a significant component of the operation costs of the fishing fleets, and as a result, the profitability of the fleets is very sensitive to fuel price variations [4]. However, the price of crude oil is subject to constant volatility, and the question of whether the tuna price and the price of crude oil are linked becomes important in the context of fisheries management and planning. Many studies in the literature have investigated the price relationship of crude oil with food commodities, considering linear and non-linear approaches, and reported different findings. This study aims to investigate the time-varying characteristics of

the correlation between crude oil price and tuna price, as well as the time-varying impulse responses of the TVP-VAR model for time points, taking into consideration three main oil price shocks in the period under consideration. These time points include December 2008 (due to the impact of the Financial Crisis), February 2016 (due to the impact of the US shale oil and gas revolution), and April 2020 (due to the impact of the global COVID-19).

In the remainder of this paper, the literature review is presented in Section 2, followed by the methodology and approach in Section 3, the results in Section 4, and the conclusions in Section 5.

2. Literature review

In a study by Chen et al. [5], the relationship between oil prices and global food prices is investigated, and they show that the change in each grain price is significantly influenced by the changes in the crude oil price and other grain prices. Zhang et al. [6] investigate the price relationship of three different fuels with five standard food commodities. They do not find a co-integrating relationship between energy and food commodities. Esmaeili and Shokoohi [7] construct a principal component of the prices of different food commodities and investigate the greater causality between the food component and the oil price, among others. They do not find a direct relationship between the oil price and the food price component. Another study [8] finds that an index composed of prices of different commodities (including foods, metals, and other consumption goods) is cointegrated with the oil price. He also finds Granger causality in the direction from oil to the index. Ciaian and Kancs [9] perform cointegration tests between crude oil prices and prices of various food commodities (including potential biofuel commodities and those that cannot be converted into fuel). They find cointegration relationships with oil prices for typical biofuel crops such as corn and soybeans from 1999 on. Hassouneh et al. [10] find long-run equilibrium relationships between the prices of sunflower, biodiesel, and crude oil based on Spanish data. Moreover, they find that energy prices influence sunflower oil prices through short-run price dynamics. Busse et al. [11] investigate the price relationships of diesel, biodiesel, rapeseed, and soy based on German data. They find that the relationships between the different commodity prices were heavily affected by regime switches of support policies. The TVP-VAR method is applied to study the effects of world stock market and oil price shocks on food prices. Their results show that volatility spillovers increase considerably during crises, and shocks to crude oil and stock markets have immediate and short-term impacts on food markets, especially during the financial crisis period [12]. In a study by Balcilar et al. [13], the relationship between the price of oil and agricultural commodities in South Africa is investigated, and they show that the relationship depends on specific phases of the market and that the oil price shall be considered in strategic economic planning.

Analysis of the literature

Some of the studies summarized indicate cointegration and certain causalities between the oil price and the price of food commodities, while others do not. Following a review of the literature, a gap was found in studies investigating the

relationship between tuna fish prices and crude oil prices. This is particularly important since fuel is one of the most important drivers in fisheries' operations. In this paper, we aim to investigate the relationship between the price of crude oil and three types of tuna species (albacore, yellowfin, and skipjack) and show the time-varying effects using the time-varying parameter structural vector autoregression (TVP-VAR) method.

3. Methodology

Following the data selection and de-trending of the data, the time-varying parameter structural vector autoregression (TVP-VAR) method is applied. The TVP-VAR method enables us to capture the possible time-varying nature of the underlying structure in the economy in a flexible manner. The data used in this study covers the period between 2000 and 2020, and monthly data on crude oil price (WTI crude oil), skipjack price, and yellowfin price from January 2000 to October 2020 are selected.

3.1. Data selection and data pre-processing

The unit root test was carried out for three time series variables, i.e., crude oil price, skipjack price, and yellowfin price, and descriptive statistics were conducted on them. **Table 1** reports the results of descriptive statistics and the unit root test. According to the ADF test results, except for the yellowfin price, which is stable at the 10% significance level, the time series of other variables are non-stationary. After de-trending using the wavelet analysis, the volatility terms of oil price, skipjack, yellowfin, and Albacore prices are significantly stable at the 1% level, which means that the de-trended variables pass the unit root test and can be used in the empirical analysis using the TVPVAR model.

Table 1. Results of descriptive statistics and unit root tests.

	Mean	Std.Dev	Skewness	Kurtosis	JB	ADF
Variable (level)						
Crude oil price	62.002	28.309	0.407	2.115	15.004	−2.485
Skipjack price	1282.0	464.72	0.231	2.125	11.160	−2.414
Yellowfin price	1604.5	464.75	0.129	2.142	8.327	−2.592*
Albacore price	2722.3	571.52	0.279	2.761	3.827	−1.795
Variable (volatility term after de-trending by using the wavelet analysis method)						
Crude oil price	0.000	0.182	−0.754	5.803	105.12	−6.122***
Skipjack price	0.000	0.161	−0.190	2.658	2.708	−6.155***
Yellowfin price	0.000	0.118	−0.167	4.224	16.713	−6.933***
Albacore price	0.000	0.104	−0.457	3.520	11.466	−4.451***

Note: 1) JB refers to the Jarque-Bera statistics for testing normality, which is proposed by Jarque and Bera. 2) Test for unit root in level with intercept in the test equation. 3) *, **, *** represents statistical significance at the 10% level, at the 5% level and at the 1% level, respectively. The wavelet analysis method refers to the filtering method of Hodrick and Prescott.

3.2. Analysis of time-varying characteristics

Parameter estimation

Based on the HP filter processing of the original data, the initial values of the parameters are set according to experience, and the MCMC algorithm is used to simulate 20,000 times to obtain effective samples. The parameter estimation results are shown in **Table 2**.

Table 2. Estimation results of selected parameters in the TVP-VAR model.

Parameter	Mean	Std.Dev	95% L[1]	95% U[2]	Geweke[3]	Inef.[4]
$(\sum_{\beta})_1$	0.0385	0.0099	0.0232	0.0600	0.000	164.67
$(\sum_{\beta})_2$	0.0429	0.0135	0.0251	0.0748	0.023	134.41
$(\sum_{a})_1$	0.0584	0.0276	0.0357	0.0997	0.547	61.60
$(\sum_{a})_2$	0.0611	0.0166	0.0378	0.1026	0.675	81.43
$(\sum_{h})_1$	0.3642	0.0766	0.2463	0.5406	0.640	130.81
$(\sum_{h})_2$	0.3729	0.0847	0.2403	0.5840	0.070	105.91

Notes: 1) 95% lower credible interval limit; 2) 95% upper credible interval limit; 3) Geweke convergence diagnostics statistics; 4) Inefficiency.

Table 2 shows the estimated results of selected parameters in the TVP-VAR model of crude oil price, skipjack price, and yellowfin price calculated by the MCMC algorithm, including the posterior mean, posterior standard deviation, 95% confidence interval, Geweke's CD convergence diagnostic value, and invalid influencing factors. In terms of convergence, the Geweke value of each parameter is less than 1.96, that is, the 5% critical value. There is no evidence to prove that all parameters fail the Geweke convergence test, and the Geweke convergence diagnostic test is posteriori distribution convergence. As can be seen from **Table 2**, the values of parameter Inef. are far less than 20,000 samples. Therefore, the number of samples obtained through the above method is sufficient to carry out a posteriori reasoning on the TVP-VAR model.

4. Results

4.1. The time-varying characteristics of the correlation

With the TVP-VAR model, we can get the time-varying characteristics of the correlation between crude oil price and tuna price (skipjack, albacore, and yellowfin price), as shown in **Figure 1**. The time-varying relationship between oil price and tuna price remains below 0. It can be seen from **Figure 1** that the impact of crude oil price fluctuations on tuna price fluctuations is dynamic (left and right subgraphs in the first row of **Figure 1**; the right subgraph in the second row of **Figure 1**). The left subgraph of the first row shows the dynamic influence of oil price fluctuations on Skipjack price fluctuations. During the period of 2000–2011, the impact coefficient of oil price fluctuation on skipjack price fluctuated around 0, and there was no significant correlation between oil price fluctuation and skipjack price fluctuation during this period. After 2011, the impact coefficient of oil price fluctuation on Skipjack price shows a positive upward trend, and there is a positive correlation between them. The right subgraph of the first row shows the dynamic impact of oil price fluctuations on

yellowfin price fluctuations. Before 2009, the impact of oil price fluctuation on the yellowfin price was positive; after 2009, oil price fluctuation had a negative impact on the yellowfin price. The right subgraph of the second row shows the dynamic impact of oil price fluctuations on albacore price fluctuations. During the sample period, the impact coefficient of the oil price on albacore varies around 0, and there is no significant correlation between the two. In addition, there is a dynamic correlation between the price fluctuations of different kinds of tuna. There is a significant positive correlation between the skipjack price and the yellowfin price (see the left subgraph in the second line), but there is no significant correlation with the albacore price.

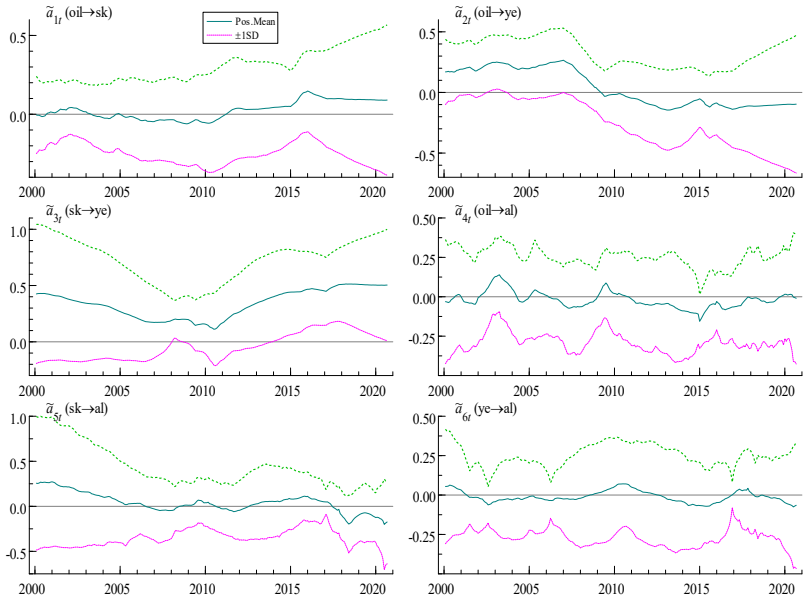

Figure 1. Posterior estimates for simultaneous relations.

4.2. Analysis of time-varying characteristics with time-delay

Figure 2 shows the dynamic characteristics of the changes of oil price and tuna price under different time delay (3, 6 and 12 periods). The four subgraphs in the first row of **Figure 2** show the time-varying response of different time-delay oil price shocks to their own and tuna price changes. It can be seen that the impact of oil price on skipjack price is positive during the sample period (row 1, column 2), indicating that a unit of oil price rise will cause skipjack price to rise, and the impact gradually decreases with the increase of the lag period. The impact degree shows dynamic varying characteristics. Before 2010, the impact of oil price fluctuation on skipjack price remains high. In 2009, oil price rose by one unit, and Skipjack price rose 1.75 units (1.75%) after 3 months (see the red line). After 2010, the impact of oil price fluctuation on skipjack price decreased. After 2018, the impact degree of oil price remains at a low level. The impact of oil price on yellowfin price also changes positively during the sample period (row 1, column 3). Before 2010, the impact of oil price fluctuation on yellowfin price remains high, and reaches its peak in 2008. The oil price rose by one unit after 3 months, and the and the skipjack price rose by 1.25 units. After 2009, the impact of the oil price shock gradually decreased. Since 2018, oil price fluctuation has been in a high position. Since 2018, the dynamic impact effect has been at a lower level. The impact of oil prices on albacore prices shows a random

trend during the sample period, indicating no significant correlation between them.

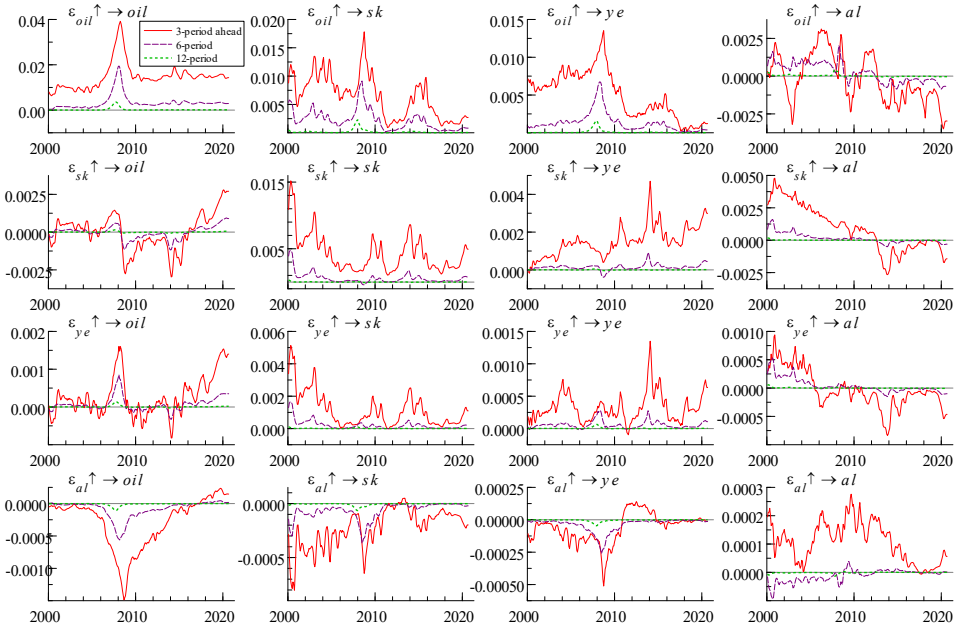

Figure 2. Time-varying impulse responses of the TVP-VAR model.

4.3. Time-varying characteristics based on time points

The above shows that the impact of oil price fluctuations on tuna price fluctuations changes over time. Next, the research focuses on the time points when crude oil prices fall, including December 2008 (due to the impact of the Financial Crisis), February 2016 (due to the impact of the US shale oil and gas revolution), and April 2020 (due to the impact of the global COVID-19). **Figure 3** shows the response of shocks at different time points. Subgraphs 2–4 of the first row, respectively, show the impact of falling oil prices on skipjack prices, yellowfin prices, and albacore prices.

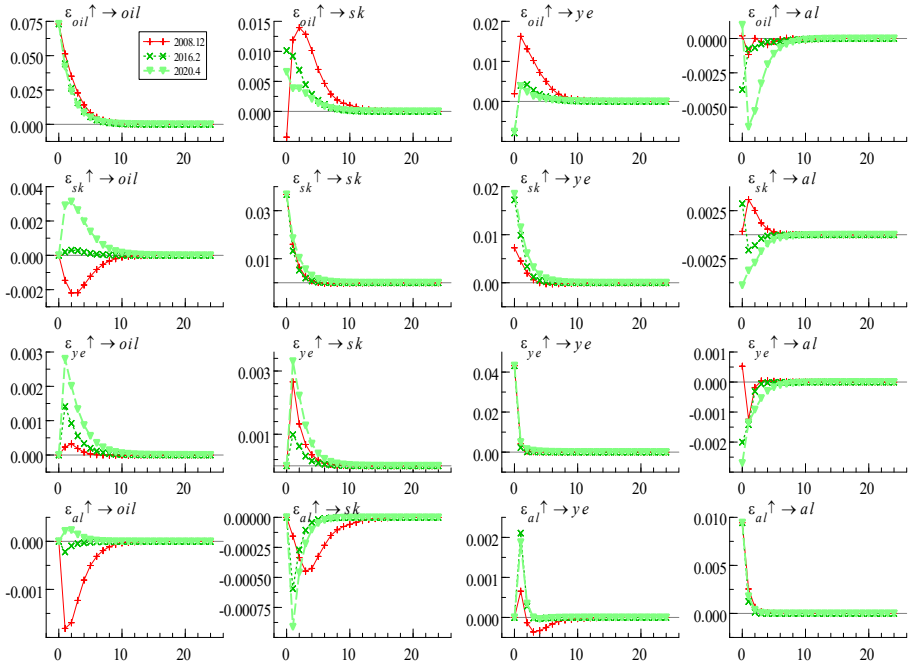

Figure 3. Time-varying impulse responses of the TVP-VAR model for time points.

It can be seen that the impacts of the oil price drop on skipjack price, yellowfin price, and albacore price are different at different time points (event impact). Affected by the Financial Crisis, the oil price dropped sharply in December 2008, causing a negative impact on the price of skipjack in the current period (phase 0), which turned to a positive impact after the first period. In the second period, the impact effect reached its maximum, then gradually declined, and then tended to zero after the 12th period (see the second subgraph in the first row, the red line). Oil price fluctuations have a positive impact on the yellowfin price in the current period, and the impact reached its maximum in the first period, then gradually attenuated and tended to zero after the 10th period (see the third subgraph in the first row, the red line). The impact of oil price fluctuations on the albacore price is negative, but the impact is small (see the fourth subgraph of the first row, red line). Influenced by the shale oil and gas revolution in the United States, oil prices dropped sharply in February 2016, with the largest positive impact on skipjack prices during the period and then gradually declining. At the time point of COVID-19 impact (April 2020), the impact of lower oil prices on the price of Skipjack shows a similar change (row 1, subgraph 2, green dotted and solid lines). At the time points of February 2016 and April 2020, the impact of the fall in crude oil prices on the yellowfin price is consistent; that is, the impact is negative in the current period, reaching its maximum positive impact after the first period, and then the impact effect gradually decreases (the third subgraph in the first row, the green dotted line, and the green solid line). In February 2016, the impact of the oil price decline on the Albacore price reached a negative maximum during the period and gradually approached 0 with the increase in time lag. In April 2020, the impact of the oil price decline on the albacore price was positive in the current period. After the first period, the negative impact of the oil price is the largest and then gradually tends to 0 (the fourth subgraph of the first row, the green dotted line, and the green solid line). In addition, other subgraphs in **Figure 3** show the impact of tuna price fluctuations on oil prices and their own. Finally, the impact effects all tend to 0, indicating that the TVP-VAR model is robust in describing the relationship between oil price and tuna price.

5. Discussion

This research contributes to the existing literature on investigating the price of crude oil on different commodities and presents an investigation of the time-varying effects of crude oil on the price of three tuna species, namely skipjack, albacore, and yellow fin. In this analysis, we show that the impact of crude oil price fluctuations on tuna price fluctuations is dynamic. During the period of 2000–2011, the impact coefficient of oil price fluctuation on skipjack price fluctuated around 0, and there was no significant correlation between oil price fluctuation and skipjack price fluctuation. After 2011, the impact coefficient of oil price fluctuation on Skipjack price shows a positive upward trend, and there is a positive correlation between them. For yellowfin, before 2009, the impact of oil price fluctuation on yellowfin price was positive; after 2009, oil price fluctuation had a negative impact on yellowfin price. During the sample period, the impact coefficient of the oil price on albacore varies around 0, and there is no significant correlation between the two. In addition, there is a dynamic correlation

between the price fluctuations of different kinds of tuna. There is a significant positive correlation between the skipjack price and the yellowfin price, but there is no significant correlation with the albacore price.

In this study, specific phases related to the fluctuations of the oil price and its impact on the tuna price are also analyzed, focusing on the time points when crude oil prices fall, including December 2008 (due to the impact of the Financial Crisis), February 2016 (due to the impact of the US shale oil and gas revolution), and April 2020 (due to the impact of the global COVID-19). **Figure 3** shows the response of shocks at different time points. The analysis shows that the price of yellow fin and skipjack shows sensitivity to these phased oil price shocks but stays consistent after recovery.

6. Conclusions

This analysis shows that the relationship between oil prices and tuna prices depends on specific phases of oil price fluctuations and that global crude oil price shocks could have immediate and short-term impacts on fish markets, especially during a period of financial crisis. Since fuel is one of the most important cost drivers in fisheries, its impact on the price of tuna may be carefully investigated and taken into account for the long-term planning of fisheries management, in particular in areas where there is a heavy reliance on seafood as a source of food and income and limited national adaptive capacity, which may cause vulnerability to the fish. We recommend that tuna fishing organizations, along with the nations and regions where they operate, consider long-term planning scenarios for a range of oil price forecasts. These should include building resiliency into the plans for inevitable future price shocks with mitigation to allow the industry to overcome these short-term fluctuations.

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Article

Innovation and sustainable development among multinational enterprises in Nigeria

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Abstract: This study explores the effect of innovation on sustainable development among multinational enterprises (MNEs) operating in Nigeria. Utilizing a cross-sectional survey design, the research investigates how innovation practices within MNEs influence the economic, environmental, and social dimensions of sustainable development in the Nigerian context. Data were collected from workers of five multinational corporations using a structured questionnaire. The study hypotheses were analysed using partial least squares structural equation modelling (PLS-SEM) via SmartPLS 3.2.9. The findings demonstrate a positive and significant effect of innovation on all three dimensions of sustainable development. This suggests that MNEs fostering innovation contribute meaningfully to achieving broader societal goals beyond economic profit. The study further recommended that MNEs should integrate sustainability metrics into their innovation performance evaluations. Track how their innovations contribute to economic growth, environmental improvements, and social well-being. This will help them identify the most impactful innovations and guide future investments towards projects that generate shared value for their business and society.

Keywords: innovation; sustainable development; multinational enterprises; Nigeria; economic sustainability; environmental sustainability; social sustainability

1. Introduction

In the ever-evolving landscape of global commerce, innovation reigns supreme as the lifeblood of success. For multinational enterprises (MNEs) operating in Nigeria, this principle holds even truer, where navigating complex economic, social, and environmental terrain demands creative solutions. Innovation not only fuels the profitability and competitiveness of MNEs but also unlocks a path towards sustainable development, contributing positively to Nigeria's future. The transformative power of innovation for MNEs is well documented. Studies reveal a clear correlation between innovation and increased firm performance, market share, and profitability [1,2]. Beyond financial gains, innovation fosters job creation, drives technological advancements, and strengthens brand reputation [3]. In the Nigerian context, these benefits are particularly crucial as the country strives towards economic diversification and job creation.

However, the impact of innovation extends far beyond the immediate concerns of MNEs. Embracing sustainable practices has become an imperative, driven by both ethical considerations and the realization that long-term success hinges on environmental and social responsibility. The United Nations Sustainable Development Goals [4] provide a comprehensive framework for achieving this balance, encompassing environmental protection, social equity, and economic prosperity. For

MNEs operating in Nigeria, innovation serves as a powerful tool to contribute to these goals, as highlighted by Okereke [5] and Oni [6]. By developing innovative solutions for resource management, community engagement, and social equity, MNEs can not only mitigate their environmental impact but also contribute positively to the communities they operate in. For instance, innovative agricultural practices can increase food production while conserving resources, while skills development programs can empower local communities and contribute to social inclusion.

As these examples illustrate, innovation holds immense potential for MNEs in Nigeria, enabling them to achieve both economic success and sustainable development. This research delves deeper into this dynamic, exploring the specific drivers and challenges of innovation for MNEs in the Nigerian context. By examining successful case studies, analyzing relevant data, and engaging with stakeholders, this research aims to provide valuable insights and recommendations that empower MNEs to harness the power of innovation for sustainable development in Nigeria.

2. Literature review

2.1. Innovation

Innovation, the lifeblood of progress, has captivated minds for centuries. Its origins trace back to the very dawn of human civilization, where tool development and adaptation marked the first sparks of ingenuity. From the wheel's invention to the printing press's revolutionary impact, innovation has continually reshaped our world. But what exactly is it, and how does it power the success of multinational enterprises (MNEs)?

While a universally accepted definition eludes us, numerous interpretations illuminate the essence of innovation. Some define it as "the successful introduction of new ideas" [7], while others emphasize its transformative nature, "the process by which ideas are translated into new or improved goods or services" [8].

In today's dynamic global market, innovation is not merely optional but essential for MNE survival and growth. It empowers them because, by offering unique and valuable solutions, MNEs can differentiate themselves from competitors and capture market share [9]. It also allows MNEs to adapt to changing customer preferences, technological advancements, and regulatory landscapes [10]. Likewise, innovations can generate new revenue streams, improve efficiency, and reduce costs [8]. Additionally, proactive innovation can help MNEs mitigate potential threats such as resource scarcity or technological disruption [11]. Summarily, innovation serves as the cornerstone of MNE success. By embracing its transformative power, MNEs can navigate complex markets, create value for stakeholders, and contribute to a more sustainable future. As Peter Drucker aptly stated, "Innovation is the only business that exists." For MNEs, this rings truer than ever.

2.2. Sustainable development

The concept of sustainable development emphasizes meeting current needs without compromising the ability of future generations to meet theirs. For multinational enterprises (MNEs) venturing into the vibrant Nigerian landscape, the

pursuit of economic success becomes intricately woven with the responsibility of fostering sustainable development. This delicate balancing act demands MNEs navigate a complex terrain where profit generation intertwines with environmental stewardship and social equity.

At the heart of sustainable development lies a three-pronged approach: economic growth, environmental sustainability, and social equity [4]. While MNEs undoubtedly drive economic progress through investments, job creation, and technology transfer [12], their actions must not come at the expense of local communities or the fragile environment. This necessitates a shift from a singular focus on profit maximization to one that embraces responsible business practices, minimizes environmental impact, and fosters social well-being.

However, the path to achieving this equilibrium in Nigeria presents unique challenges. Weak governance structures, inconsistent regulations, and limited infrastructure create hurdles for responsible business practices and environmental protection efforts [13]. The stark realities of poverty and inequality further complicate the equation, where exploitation and conflict threaten social sustainability [14]. Moreover, environmental degradation looms large, with deforestation, pollution, and climate change demanding immediate attention [15].

Despite these formidable challenges, opportunities for MNEs to contribute to sustainable development in Nigeria abound. Investing in renewable energy sources like solar and wind power can not only promote clean energy access but also mitigate climate change impacts [16]. Partnering with local farmers to adopt sustainable agricultural practices can enhance food security while conserving precious resources [17]. By providing training and educational opportunities, MNEs can empower local communities and contribute to human capital development, fostering a more inclusive and equitable society [18]. Technological innovation also holds immense potential, with MNEs spearheading the development of solutions that address local challenges, such as clean water purification or waste management technologies [19].

Unlocking the true potential for sustainable development requires a collaborative approach. MNEs must forge strong partnerships with government agencies, civil society organizations, and local communities to create a shared vision and implement effective solutions. Transparency and accountability are paramount, ensuring MNEs remain accountable for their social and environmental impacts [20]. Moreover, a long-term commitment is crucial, recognizing that genuine progress necessitates sustained effort and adaptation [21].

Most importantly, the path for MNEs operating in Nigeria is not paved with easy solutions. However, by embracing a holistic approach that prioritizes not just profit but also environmental and social well-being, MNEs can become powerful catalysts for positive change. By collaborating, innovating, and committing to long-term sustainability, they can navigate the tightrope of economic success while ensuring a brighter, more equitable future for Nigeria and its people. Remember, achieving sustainable development is not a destination but a continuous journey, demanding constant evolution and a shared commitment to building a better tomorrow.

2.3. Nexus between innovation and sustainable development

Innovation and sustainable development, two seemingly disparate concepts, are intricately intertwined. While innovation holds immense potential to drive progress towards environmental, social, and economic well-being, its effects are not without their complexities and potential downsides. Numerous studies have documented the positive effects of innovation on sustainable development. For instance, Apostu et al. [22] highlight how eco-innovations, like renewable energy technologies, contribute to climate change mitigation and resource conservation. Also, Nidhi et al. [23] found that social innovations, just like mobile healthcare platforms, can improve access to essential services in developing communities. Innovation can also empower individuals and communities, as Baregheh et al. [24] demonstrate with their study on how digital platforms can facilitate citizen participation in environmental decision-making. The economic benefits of innovation for sustainable development are also undeniable. Calderone et al. [25] argue that green innovations can create new markets and jobs, while Mazzucato [26] emphasizes the role of government-led innovation in fostering sustainable economic growth. By developing cleaner technologies and more efficient processes, innovation can contribute to decoupling economic growth from environmental degradation.

However, it is crucial to acknowledge that innovation is not a guaranteed path to sustainability. Some argue that technological advancements can create unintended consequences, exacerbating existing inequalities or leading to unforeseen environmental damage [27]. For instance, concerns exist that certain innovations, like automation, could lead to job displacement and exacerbate social inequalities [28]. Additionally, the resource-intensive nature of some innovations can have negative environmental impacts, highlighting the need for careful evaluation and responsible development [29].

Innovation, a powerful tool for progress, can be a double-edged sword when it comes to sustainable development. By acknowledging its complexities, fostering responsible development, and prioritizing sustainability goals, we can unlock its true potential to create a more just and equitable future for all. As Albert Einstein aptly stated, “The world needs new ways of thinking.” This study therefore proposes that:

1) Innovation has a positive and significant effect on economic sustainability.
2) Innovation has a positive and significant effect on environmental sustainability.
3) Innovation has a positive and significant effect on social sustainability.

3. Methodology

This study employed a cross-sectional survey design to investigate the relationship between innovation and sustainable development among multinational enterprises (MNEs) operating in Nigeria. This design allowed for the collection of data at a single point in time from a representative sample of MNEs, enabling the examination of associations between variables without the need for longitudinal tracking.

Ten multinational enterprises were approached to be part of the study; however, only five showed interest in the study. Thus, data was collected from these five multinational enterprises. The participants comprised personnel in the managerial

cadre (foremen, supervisors, factory managers, personnel managers, operations managers, general managers, and all other employees in the managerial cadre) due to their experience on the job. A total of 102 copies of the questionnaire were distributed among the five multinational corporations, out of which 67 copies were correctly filled out and returned, which represented a 65.7 percent return rate. Hence, the 67 copies of the questionnaire returned were used for the final analyses. A bootstrap method (with a bootstrap sample of 5000) was used in the final analysis [30,31]. In addition, a proportionate stratified random sampling technique was used to select representatives from each of the MNEs. Also, efforts were made to ensure the sample size was sufficient to provide statistically reliable results, considering factors such as the target population size, desired confidence level, and expected effect size.

Further, the questionnaire was pre-tested with a small sample of MNEs to ensure its clarity, validity, and reliability. Data collection was conducted through email invitations and online surveys, followed up with phone calls where necessary.

Operational measures of variables

Innovation in this study was conceptualized as a unidimensional construct, reflecting the overall level of innovative activity within the MNEs. It was measured using a five-item scale adapted from the Oslo Manual [32], with items such as "our company introduced new or significantly improved products or services in the last two years; our company invested in research and development activities in the last two years".

Sustainable development was decomposed into economic, environmental, and social sustainability. These dimensions were adopted from Ivwurie and Akpan [33] and measured with fourteen (14) statement items. Economic sustainability focused on the MNEs' contribution to economic development in Nigeria. It has five statement items, such as "our company contributes to economic growth and development in Nigeria; our company creates new jobs in Nigeria". Environmental sustainability assessed the MNEs' environmental impact and their efforts to reduce their environmental footprint. It was measured using four items, such as "our company minimizes its use of natural resources in its operations; our company reduces its greenhouse gas emissions and other pollutants". Lastly, social sustainability focused on the MNEs' social impact and their contributions to improving the lives of people in Nigeria. It was measured using items adapted from the UN Sustainable Development Goals [20], including "our company respects human rights and promotes fair labor practices; our company provides safe and healthy working conditions for its employees. All the items were adapted from Ivwurie and Akpan [33] and the UN Sustainable Development Goals [20] and adjusted to suit the Nigerian business environment. They were scaled on a five-point Likert scale with weights assigned as follows: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The full research instrument is shown in Appendix.

4. Results and discussions

This study examined the effect of innovation on sustainable development among Nigerian multinational enterprises (MNEs) using partial least squares structural

equation modelling (PLS-SEM). Several key aspects of the research and its data made PLS-SEM the ideal tool for the job. Firstly, the study aimed to explore and validate a relatively new theoretical model in a context that has not been extensively researched: sustainable development within Nigerian MNEs. PLS-SEM handles exploratory models, where understanding relationships between constructs is more crucial than confirmatory hypothesis testing [34]. Secondly, the sample size was relatively small. Compared to covariance-based structural equation modelling (CB-SEM), PLS-SEM is more robust with smaller samples because it relies on ordinary least squares regression [35]. Thirdly, the study included variables that did not follow a normal distribution, which can be problematic for CB-SEM. PLS-SEM is less sensitive to violations of normality assumptions, making it a suitable choice for this data [36]. Fourthly, PLS-SEM is adept at handling complexities and accommodating formative constructs, where the indicator variables causally influence the latent variable [37]. Fifthly, predicting the impact of innovation on various aspects of sustainable development was the key focus of the study. PLS-SEM is particularly well-suited for prediction-oriented research, aiming to explain the variance in the dependent variables [34].

The following hypotheses were formulated in chapter one of this study:

i. Innovation has a positive and significant effect on economic sustainability.
ii. Innovation has a positive and significant effect on environmental sustainability.
iii. Innovation has a positive and significant effect on social sustainability.

Table 1 revealed significant paths between innovation and economic sustainability ($r = 0.813$; $r^2 = 0.661$, $t = 9.943$; $p < 0.05$), innovation and environmental sustainability ($r = 0.870$; $r^2 = 757$, $t = 9.049$; $p < 0.05$), technology usability and contextual performance ($r = 0.790$; $r^2 = 0.624$; $t = 10.143$; $p < 0.05$), and innovation and social sustainability ($r = 728$; $r^2 = 0.530$; $t = 15.214$; $p < 0.05$). Therefore, the formulated hypotheses were supported. These results imply that higher levels of innovation within MNEs are associated with better performance in achieving sustainable development goals.

Table 1. Predictive accuracy, predictive relevance and effect sizes (f^2).

Hypotheses	Correlation coefficient (r)	Predictive accuracy (r^2)	Adjusted (r^2)	*P*-values	*T*-values	Effect size (f^2)	Predictive relevance (Q^2)
IN -> S	0.813	0.661	0.659	0.001	9.943	0.35	0.215
IN -> EnS	0.790	0.624	0.620	0.000	10.143	0.28	0.183
IN -> SS	0.728	0.530	0.528	0.000	15.214	0.36	0.262

Where: IN = Innovation, ES = Economic Sustainability, EnS = Environmental Sustainability, SS = Social Sustainability. $r^2 = 0.19$ = weak, r^2, 0.33 = moderate, r^2, 0.67 = substantial [38]. Effect size (f^2), 0.02 = small, 0.15 = moderate, while 0.35 = large. Predictive Relevance (Q^2), > 0 = satisfactory [37].
Source: SmartPLS 3.2.9 output on research data, 2024.

Discussions

The positive effects of innovation on various dimensions of sustainable development show the strategic role of innovation in the achievement of sustainable development by multinational corporations in Nigeria. Specifically, the finding that innovation positively influences economic sustainability resonates with previous studies across diverse contexts [37]. Innovation acts as the conductor, leading to new

products, services, and efficiency, ultimately boosting economic growth and job creation [38]. Also, the finding of a positive and significant effect of innovation on environmental sustainability echoes earlier works [39,40]. Innovation enables cleaner technologies, resource efficiency, and minimized environmental impact, aligning with the growing emphasis on sustainability within Nigerian businesses. Lastly, the positive and significant effects of innovation on social sustainability align with studies like Yazdani et al. [41] and Murillo-Luna et al. [42], which highlight how innovation can improve working conditions, community development, and social inclusion. This offers a promising score for Nigerian MNEs to address social challenges and contribute positively to society.

While the findings align with several existing studies, some studies have reported limited or even negative impacts of innovation on certain sustainability dimensions [42,43]. These might be due to factors like the specific type of innovation, inadequate implementation, or unintended consequences, indicating that the innovation-sustainability relationship is not always positive.

5. Conclusion and recommendations

In conclusion, this study has shed light on the effect of innovation on sustainable development within Nigerian MNEs. The significant and positive effects of innovation on economic, environmental, and social dimensions highlight the potential of innovation to drive positive change and contribute to a more sustainable future. These findings resonate with existing research, but also encourage further exploration of the unique context of Nigerian MNEs and the specific types of innovation that drive progress.

While limitations like the sample size and measurement choices should be acknowledged, this study serves as a valuable stepping stone. Future research can build upon these findings by investigating specific types of innovation, exploring mediating mechanisms, conducting longitudinal studies, and examining the nuances of the Nigerian context. Ultimately, understanding and harnessing the power of innovation will be crucial for Nigerian MNEs to achieve sustainable development and contribute positively to their communities and the global landscape.

The following recommendations are made for the MNEs:

i. The MNEs should shift their innovation focus towards developing products, processes, and services that directly address environmental and social challenges in Nigeria. Think beyond incremental improvements and aim for disruptive solutions that tackle issues like water scarcity, waste management, or energy efficiency. Partner with local communities and research institutions to ensure your innovations respond to specific needs and contexts.
ii. They should also integrate sustainability metrics into their innovation performance evaluation. Track how their innovations contribute to economic growth, environmental improvements, and social well-being. This will help them identify the most impactful innovations and guide future investments towards projects that generate shared value for their business and society.
iii. Lastly, the MNEs should collaborate with other MNEs, local startups, and NGOs to create an ecosystem of innovation for sustainable development. Share

knowledge, resources, and best practices to accelerate the adoption of sustainable solutions across different industries. By fostering a collaborative approach, they can amplify their impact and contribute to a systemic shift towards a more sustainable future for Nigeria.

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Appendix: Questionnaire

Section A: Innovation

Indicate your level of agreement with the following sentences from 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree.

S/N	Innovation	1	2	3	4	5
1	Our company introduced new or significantly improved products or services in the last two years.					
2	Our company invested in research and development activities in the last two years.					
3	Our company has a dedicated team or department responsible for innovation activities.					
4	Our company encourages employees to suggest and implement new ideas.					
5	Our company collaborates with external partners (universities, research institutions, etc.) on innovation projects.					

Section B: Sustainable development

Indicate your level of agreement with the following sentences from 1 = Strongly Agree; 2 = Agree; 3 = Neutral; 4 = Disagree; 5 = Strongly Disagree.

	Sustainable development	1	2	3	4	5
S/N	**Economic Sustainability**					
1	Our company contributes to economic growth and development in Nigeria.					
2	Our company creates new jobs in Nigeria.					
3	Our company invests in local communities and suppliers in Nigeria.					
4	Our company pays fair wages and benefits to its employees in Nigeria.					
5	Our company contributes to government tax revenues in Nigeria.					
S/N	**Environmental Sustainability**					
1	Our company minimizes its use of natural resources in its operations.					
2	Our company reduces its greenhouse gas emissions and other pollutants.					
3	Our company promotes sustainable waste management practices.					
4	Our company invests in renewable energy sources.					
S/N	**Social Sustainability**					
1	Our company respects human rights and promotes fair labor practices.					
2	Our company provides safe and healthy working conditions for its employees.					
3	Our company invests in education and training for its employees and communities.					
4	Our company promotes diversity and inclusion in its workforce.					
5	Our company contributes to community development projects in Nigeria.					

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Article

Innovation and engineering education: New challenges for achieving sustainable development goals

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Abstract: This article is an analysis of global trends in the field of socio-economic development, which in modern conditions is determined by innovative technological engineering solutions. Innovation is new knowledge embodied in engineering technologies that can meet the needs of mankind's development. However, changes caused by scientific and technological progress radically change not only human life but also its natural habitat. The effect of the use of a large number of technological solutions for humans is positive (a decrease in the share of heavy manual labor, an increase in life expectancy, etc.), and for the environment, it is negative (depletion of soils, pollution of the atmosphere and water bodies, etc.). The result of technological development, which humanity has today, forces us to revise the fundamental elements of technological development, shifting priorities from increasing the diversity of social consumption to the ecological depletion of the planet, and this, in turn, requires a change in the values of professional engineering thinking, which is formed in the learning process.

Keywords: sovereignty; technological innovations; socio-economic development; knowledge economy; engineering solutions; innovative knowledge

1. Introduction

The development of humanity at the present stage depends more than ever on the ability to produce new knowledge or innovation. The production of new knowledge and its use in socially significant processes helps to survive not only for individual organizations but also for national economies; therefore, for the successful formation of the knowledge economy, specialists are needed who are able to create knowledge and implement it into demanded innovative solutions that ensure competitiveness and development. The economy of knowledge, being the economy of breakthrough technological engineering solutions that change a person's life, also changes the requirements for a person and his capabilities.

Many processes caused by digital innovation solutions are global in nature, causing the transformation of national economies, changes in national development priorities, changing the daily life of a person, and changing the requirements of society for the social realization of a person. Strategically important changes in society's requirements for a person are changes in the professional sphere, which leads to the transformation of the global labor market and, therefore, a change in the requirements and demand for the level and quality of vocational education, a set of demanded skills and competencies in a specific field of professional activity, and opportunities for professional vertical and horizontal growth, which determines the social and economic status of a person in society.

However, dynamic socio-technological development also has a negative socio-economic effect, which manifests itself in the uneven material distribution of benefits, global climate change, depletion of soil, flora, fauna, and other necessary resources for the existence of mankind, which, according to the theory of needs, A. Maslow is basic (physiological needs and security needs) and determine the very fact of human existence, therefore, human civilization [1,2].

2. Theoretical foundations

Rapid innovative development that creates life-saving technologies, as evidenced by an increase in life expectancy (according to statistics in 2023, the average life expectancy on earth was 72 years, while a hundred years ago, even in developed countries, it was 55–60 years [3], caused irreparable damage to the environment, provoking threats of the possibility of not only promising development but also the very fact of the existence of mankind. The problems of significant depletion of vital resources and irreversible changes in natural habitats are a global problem that needs to be resolved as soon as possible. So, for example, according to the statement of climatologists, 2023 was the warmest year in the entire history of climate observations, while 10% of days in terms of temperature exceeded the climatic norm, which is an indicator that climatic changes on Earth are irretrievable and technogenic in nature [4]. In the current conditions, humans are faced with the task of becoming an innovative knowledge economy based on high-tech and high-tech production, preferably a closed cycle (zero-waste production), using renewable energy sources with minimal negative impact on the environment (green technologies), which is evidence of concern for future generations and is also regarded as a factor that can restrain the speed of further climatic changes associated with negative technological impacts.

One of the strategically important requirements for the development and establishment of an innovative knowledge economy is its ability to generate and apply knowledge-intensive innovations for the benefit of humanity, not to create "innovations" for their painful, sometimes useless introduction into the economy. An example demonstrating this statement is the creation, production, and use of plastic, which at one time was considered a breakthrough technology. Its use was promoted in every possible way in all areas of activity. Plastic production has skyrocketed from 2 million tons in 1950 to more than 438 million tons in 2017, and plastic production is expected to reach 1.1 billion tons per year by 2050 [5]. However, the negative consequences of its use overlapped with the entire positive effect of its use.

- impossibility of decomposition in the natural environment (appearance of harmful substances in the decomposition process, long term of the natural decomposition process (from 1000 years to 700 years and more);
- difficulties of complete disposal (high costs, new plastic disposal technology is required);
- plastic recycling is more expensive than its production;
- the ingress of plastic microparticles into a living organism causes oncological diseases (there are cases of plastic microparticles in the respiratory tract of the human embryo, in the cells of tissues and internal organs of humans, and even in fish);

- disruption of the ecosystem in places of accumulation (release) of plastic, associated with the mass death of animals, which leads to violations of the food chain and irreversible changes in regional flora and fauna;
- According to some reports, the world's plastic waste weighs about the same as the world's population, due to the impossibility of its processing and decomposition.

In the age of information technologies, computerization, the development of artificial intelligence technologies, cybernization, etc., it is impossible to build an innovative knowledge economy that contributes to the containment of negative technogenic influence on the environment without engineering solutions with an effective environmental component. The need to create and implement increasingly complex technological innovations determines the high level of engineering thinking and education in demand, as well as the high level of human capital development. Since the transformation of new knowledge into innovation is through technology, engineering solutions become meaningful in any activity, and the requirements for engineering education itself are changing as rapidly as the technologies that humanity develops and masters.

The development of humanity is inextricably linked with the acquisition of new knowledge, which determines the direction of evolution. Throughout the history of human development, knowledge was regarded as a strategic resource, whose accessibility was limited for a certain part of society. In the modern world, thanks to the dissemination and strengthening of humanistic principles of social interaction and the development of information technologies, knowledge has become more accessible, but this does not mean that it has ceased to be regarded as a strategic resource that determines progress and well-being. Countries with high human capital indices tend to have high educational development indices and are characterized as high-tech [6]. The development of the knowledge economy can be seen as a global socio-economic process that gives knowledge the status of a key resource and source of development. However, if we consider knowledge from an economic point of view, then it should be a competitive product that is "bought", therefore it is not knowledge itself that has value, but a new product (technology, products, goods, etc.) in which it was realized through innovative characteristics or properties. New properties should enhance the value of the product, thereby increasing its usefulness and attractiveness to the consumer.

Innovative information technologies, which today determine the socio-economic development of not only individual organizations but also national economies, providing them with security, are a product of engineering knowledge. Scientific and natural knowledge, which is engineering, needs a symbiosis with social (humanitarian) knowledge to be used for the production of new knowledge since social knowledge determines the potential consumer's needs, values, and needs, which together give innovation as new knowledge economic value and social utility. In order for engineering to be able to meet the needs of modern socio-technological development, it is necessary to change not only the quality of engineering education but also the content of the educational process, taking into account the high requirements for specialists in engineering specialties, including in the development of the ecology of consciousness and environmental culture.

World development trends are characterized by dynamic technological processes, the complexity of which is increasing. The struggle for technological leadership in the field of engineering solutions sometimes turns into a global environmental disaster, as is the case with plastic. In such circumstances, it is crucial that the engineering profession have a structured learning approach, not only in university education but throughout the professional activities of practicing engineers. One of the main goals of continuous training for engineers is to master new knowledge, practices, and competencies both in the field of engineering and in related areas of knowledge that can make engineering solutions more efficient and less harmful to the environment. The implementation of such principles in engineering education will require significant efforts on the part of teachers, employers, and professional societies, as well as on the part of the state, since engineering technological innovations form the basis of national competitiveness and technological and intellectual sovereignty.

3. Methods and materials

This study is analytical in nature and therefore used a comparison, comparative, and problem analysis of current global trends in the development of technological innovations, engineering solutions, and engineering education, as well as assessments of these trends by specialists (sociologists, economists, ecologists, engineers, etc.), including the authors of this work.

Humanity realized the importance of harmonious development back in 1972 [7,8]: industry must meet the development needs of society but at the same time not cause irreparable technogenic damage to the environment. During the time that has passed from 1972 to the present day, humanity has changed a lot, and the conditions in which it is necessary to achieve sustainable development have changed (**Figure 1**).

- Socio-economic development is largely determined by the capabilities and properties of the digital environment, which develops dynamically, penetrating into all areas of human activity and creating new areas of activity.
- Socio-economic development has a pronounced non-uniform character, which is largely determined by irreversible environmental changes. As can be seen from **Figure 1**, the more dynamic the development of digital technologies, the more intense the depletion of the environment.
- Between the main components that determine sustainable development, the conflict of interests takes on consequences that threaten the existence of mankind.
- Engineering solutions and technological innovations become a link capable of creating not only innovative, unique products that meet the needs of new ways but also find a compromise between the needs of humanity for continuous development and the need of humans as a biological species for the preservation of a habitat suitable for existence (**Figure 1).**
- Achieving sustainable development in the digital environment is achievable only if engineering solutions and technological innovations are created by specialists who, among other competencies, will have the competencies “ecology of consciousness” and environmental thinking and will have a real opportunity to use these competencies as priorities in professional activities. These competencies will contribute to the ability not only to critically assess

technological innovation, but also to strategically analyze the possible promising consequences of its use, both constructive and destructive.

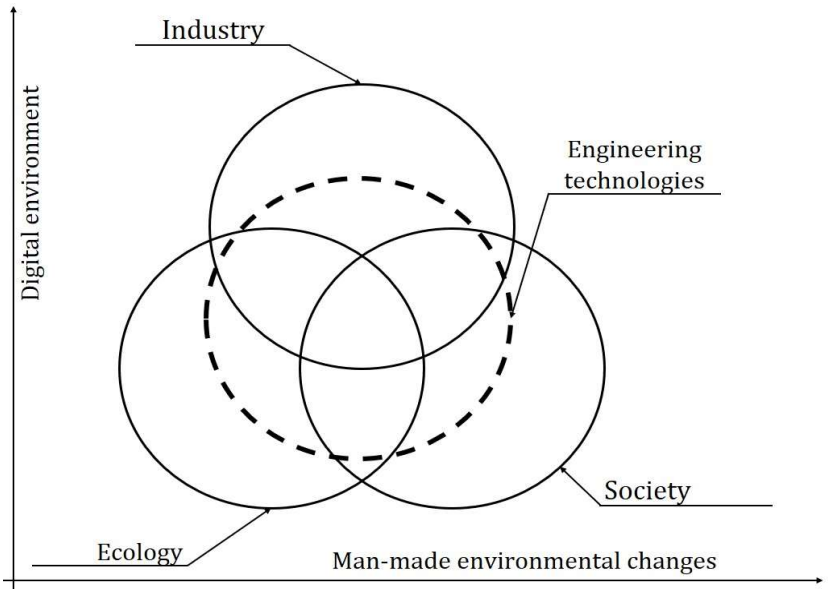

Figure 1. Model of sustainable development in modern conditions (compiled by the authors).

Sustainable development has evolved from a desirable state for the modern human being into a vital necessity, the achievement of which is based on innovative technologies that can solve the conflict of interest between the need for continuous development and the resource capabilities of the environment. Modern development is defined as technological; therefore, engineering solutions, along with information solutions, penetrate all spheres of human life. An example of such technology is the "smart city" technology (Russia, Moscow), which, thanks to innovative engineering solutions, contributes to more harmonious interaction and development of the main life-supporting infrastructures of the city (transport, social, logistics, information, industry, etc.). The interaction of urban services thanks to innovative engineering solutions becomes more structured and, therefore, more accessible and convenient, both for ensuring urban management processes and for living in an urban environment.

The use of engineering technologies also changes the professional language in many areas of activity, but the most noticeable changes can be observed in economics and management, since the effectiveness of these areas of activity largely depends on the effectiveness of innovative engineering solutions: business processes, organization architecture, etc. Innovation as a result of the transformation of new knowledge into a demanded product, as already noted, is the main technological development or technological progress. However, "technological progress is not at all invented by loners who are struggling with the task in isolation from everyone else; almost all innovations are the processing or improvement of existing technologies" [9]. Such an explanation of the nature of the origin of innovation allows us to consider innovation as a constructive result of the interaction of industry, science, and engineering education (**Figure 2**).

- Science is designed to respond to the needs of society by offering new knowledge, the use of which contributes to the partial or complete satisfaction of urgent needs. Science offers solutions that are relevant to its current state and development. Scientific progress expands the resources and capabilities of science over time; socio-economic development provokes the emergence of new needs or the desire to satisfy needs in a new way; and the production of innovative scientific knowledge occurs, which can be considered an improvement of the "old" [9].
- Production for survival, competitiveness, and ensuring the economic development of not only its own but also that of others is obliged to materialize innovative scientific knowledge into a product, taking into account consumer requirements. (monetization). Product quality, the speed with which industry responds to changes in social needs and demands, and the readiness to implement and produce innovative solutions depend on technological engineering capabilities and resources.
- Engineering education, directly or indirectly (through engineering specialists), largely determines the quality of the innovative scientific knowledge obtained (the technical support of scientific research), the possibility of its use in various fields of activity (ensuring effective intersectoral communications), and the and the technological capabilities of the production of an innovative product (production technologies).

According to the model of technological development in the digital environment (knowledge economy) presented in **Figure 2**, innovation can be considered a synergistic effect of the constructive interaction of science, engineering education, and production. Such a demand for high-quality engineering education in a dynamically changing digital environment presupposes a high level of continuous adaptability of engineering education to the needs of production and science. One of the obvious solutions is to maintain the quality of engineering education that meets the pace of modern technological development—this is continuity throughout the professional activity of a specialist engineer.

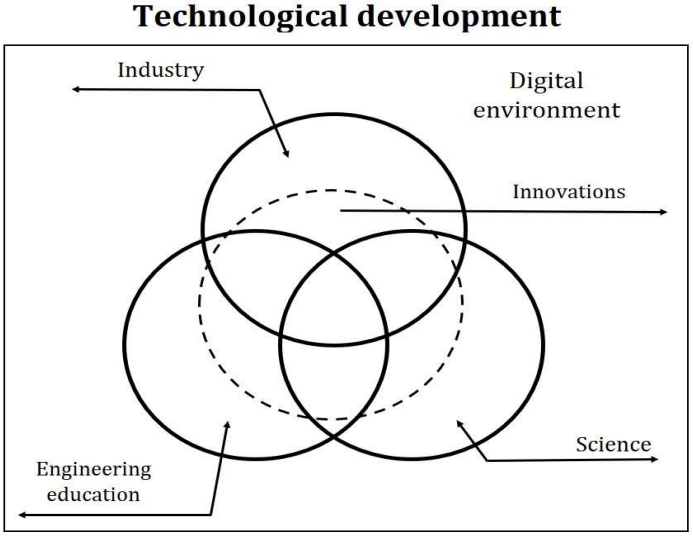

Figure 2. Model of modern technological development (compiled by the authors).

4. Results

Following the development of digital technologies, which have radically changed many areas of human activity, there are global changes in the requirements for the quality and properties of human capital as the main source of all technological innovations. The need for innovation is at the heart of modern socio-economic development, but producing innovation in a tough competitive environment requires:

- greater specialization, which determines changes in the requirements for the training of highly qualified specialists and, first of all, the engineering direction;
- flexibility of innovative technologies that increase the efficiency of their use, which determines the need for related competencies, both among the creators of innovations and those who use them in practical activities;
- allocation of funds (investments) for research and scientific and technical developments, which determines the need for highly qualified scientific and technical specialists with a high level of professional creative and productive thinking (an urgent requirement for human capital).

1) Dynamic changes in needs that occur in the knowledge economy are the root cause of the current challenges of modern engineering practice, assuming a wider range of professional skills and skills in related fields than those provided by Russian academic engineering education at the moment. The ongoing changes in global technological development contribute to the realization of the strategic importance of technological innovations for the economic competitiveness of the Russian economy and the formation of technological sovereignty. There is a worldwide awareness and recognition that technological leadership in innovation is the core of national well-being, competitiveness, and development, ensuring technological sovereignty and national security in a knowledge economy. This fact, which determines the importance of innovation, is the basis for the expediency of the global ranking of countries according to the innovative development index, in which Russia in 2022 ranked 47th among 132 world economies [6]. Since Russian society has to build technological sovereignty in conditions of political instability and another international polarization, such conditions give the goal of "achieving technological sovereignty" a strategic status, the achievement of which largely determines national security. However, an analysis of advanced technological countries, including Switzerland (the country that ranks first in the world ranking for innovative development in 2022), the USA, Canada, and Sweden, shows that the formation of technological sovereignty is a long-term resource-intensive process that requires, first of all, large investments, both from the state and from private investors and businesses. The Russian economy and society, taking into account world experience, create the necessary technological base for the formation of a knowledge economy that ensures national security and development.
2) In the modern world, one of the critical restraining factors of innovative development is the limitations caused by global changes in the ecosystem that ensure the existence of mankind as a whole, which is reflected in such scientific theories as the Concept of Marginal Growth (1972) [7,8], the Concept of Planetary Boundaries (2010) [10], the Concept of Great Acceleration (2015) [11], etc. The

disruption of the ecosystem's ability to heal itself caused by innovative technological solutions and man-made human intervention (it is worth noting again that not all technologies in the long-term perspective turned out to be as effective as they seemed initially) suggests that humanity, which has violated its environment of existence, will create new technologies and rules for interaction (use) with the environment in order to at least slow down the devastating impact.

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Article

Beyond gender: The evolving significance of pink in the contemporary marketing

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Abstract: This study investigates the influence of pink in marketing, focusing on its impact on female consumer behavior, particularly in light of the Barbie movie's recent popularity. It analyzes the psychological and historical significance of pink, and its economic implications in marketing strategies. This study conducts an in-depth literature review and case study analysis to explore the cultural and psychological significance of the color pink in marketing and its influence on consumer behavior beyond different genders. The originality of this study lies in its multifaceted exploration of the interplay between the color pink and female consumer behavior, particularly through the lens of cinematic imagery. By focusing on the cultural and psychological significance of pink in films and its subsequent impact on fashion trends and marketing strategies, this research uniquely bridges the gap between color symbolism and contemporary consumer behavior.

Keywords: pink marketing; femininity; color symbolism; cinematic imagery

1. Introduction

The increasing prominence of the color pink in contemporary markets has solidified its status as a significant symbol within consumer products and popular culture, particularly resonating with female consumers [1]. This trend is evident in the widespread introduction of pink-themed products, especially within categories such as cosmetics and other daily necessities targeted at women. Empirical studies indicate a notable preference among women for these pink-colored items, suggesting that the color not only appeals aesthetically but also influences purchasing behavior [2].

In the film industry, the color pink serves as an equally intriguing and significant classification. Recent trends have seen the emergence of a series of feminist films prominently featuring the color pink, reflected in various elements such as posters and costumes [3]. These films have had a profound impact on female audiences, suggesting that the visual representation of pink may influence their consumption behaviors. This study analyzes the depiction of pink in these films and investigate whether these images stimulate female viewers' propensity to purchase pink-themed products. By focusing on the imagery of pink within these films, this study aims to elucidate how cinematic representations can shape and influence the consumption choices of female audiences.

In this case, the film of Barbie is selected as a focal point for analysis due to its emblematic status within contemporary pink-themed cinema. As a cultural icon, Barbie embodies the color's branding and market influence, offering a pertinent case study for examining the impact of pink on consumer behavior. Therefore, this paper

analyzes the film of Barbie alongside other films and TV series that utilize pink as a thematic color for their main characters, with a particular focus on the effectiveness of pink cinematic imagery in influencing women's shopping behaviors in contemporary society. By examining the symbolic meaning of pink within the framework of feminism, the impact of pink film imagery on social media, and the implementation of pink marketing concepts in the marketplace, this paper aims to demonstrate how women identify with pink images on a societal level. Despite a growing body of literature on color psychology and marketing, there remains a significant gap in understanding how specific colors, such as pink, are leveraged in contemporary media to influence consumer behavior, particularly within the context of evolving gender norms and consumer demographics. Hence, this analysis will further illustrate the role of pink film imagery in promoting women's purchasing behaviors of pink products. Consequently, it suggests that the depiction of pink in films positively influences women's propensity to buy pink-themed products.

2. Social identity and feminine symbol of pink color screen images

Different colors are generally attributed unique gendered characteristics. As Zarei and Kharajo [4] define, "Pink is the color of femininity," suggesting that pink can be considered a symbol of feminine culture. The act of purchasing pink products has become a significant approach for women to express their identity in society. Previous studies have consistently shown that pink is strongly associated with femininity, imbued with extensive feminine symbolism. The color pink is easily linked to traits often stereotypically attributed to girls, such as softness, delicacy, and innocence [5]. For adult women, pink often signifies youthfulness and femininity, which explains its popularity in the cosmetics industry [6].

In the context of female consumer behavior, the color pink plays a multifaceted role. It serves not only as a marker of gender identity but also as a means of emotional and psychological expression. Women's preference for pink products is rooted in deep-seated cultural norms and societal expectations that associate pink with femininity and beauty [7]. This cultural conditioning begins early in life, with pink being a predominant color in children's clothing, toys, and accessories, thereby reinforcing gender norms from a young age [8].

For adult women, the appeal of pink extends beyond mere cultural symbolism. The cosmetics industry, in particular, capitalizes on the association of pink with youthfulness and beauty. Products packaged in pink or featuring pink tones are marketed as enhancing feminine qualities, thus attracting female consumers who wish to embody these traits [9]. This marketing strategy taps into the psychological aspects of color perception, where pink is perceived as nurturing, calming, and aesthetically pleasing.

Moreover, the preference for pink is not just limited to personal use but also extends to lifestyle and luxury products. The fashion industry's embrace of pink as a trendy and stylish color further solidifies its status as a symbol of femininity. High-end brands often use pink in their product lines to appeal to female consumers seeking to make a statement about their identity and social status [10].

The association of colors with gender also includes a common juxtaposition of

men with blue and women with pink. Zotos and Grau [11] discusses that in American culture, pink and purple symbolize tenderness and femininity, whereas blue represents toughness and masculinity. However, some women challenge this binary association and avoid pink due to gender equality concerns, as the color may emphasize gender differences [12]. Despite this perspective, pink remains a significant color in discussions about women's issues and continues to be closely associated with femininity.

Building on the theories regarding the association of pink with feminism, numerous studies have demonstrated that pink can be represented as a symbol of feminism in pink-colored cinematographic images. Zotos and Grau [11] argues that stereotypes of gender roles can be effectively visualized. Similarly, Khan [3] observes that the notion of gendered colors can subtly influence viewers' perceptions through the visual presentation of film posters (refer to **Figure 1**). Classic Hollywood posters serve as illustrative examples of this phenomenon. Such as the Legally Blonde in the early 2000s, and the more recent blockbuster Barbie. These film posters have subconsciously reinforced the audience's perception and recognition of the feminine attributes associated with the color pink through their visual presentation.

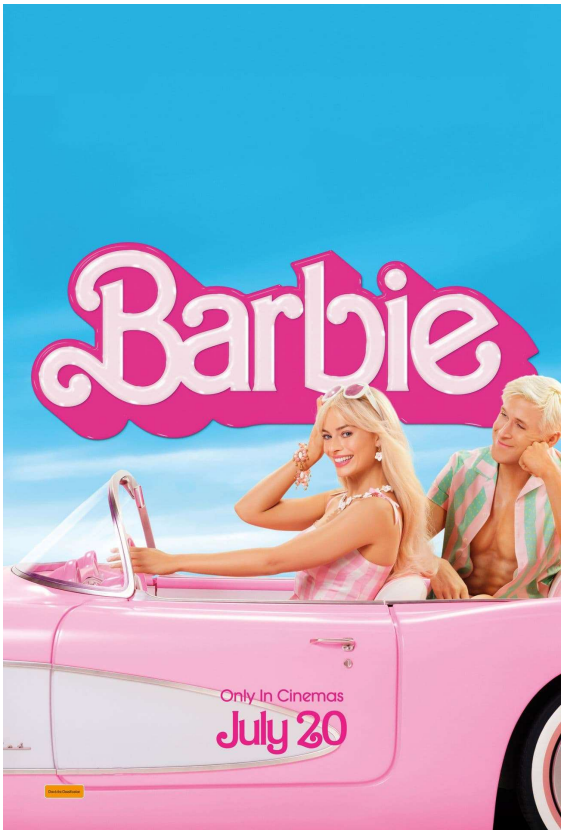

Figure 1. Pink film posters [13].

Furthermore, the portrayal of pink female images in film can serve as reflections of societal expectations and ideals regarding women. Barbie stands out as an example of this phenomenon, showcasing the diversity of female professional identities in cinema. Barbie, portrayed by Margot Robbie assuming various roles and presenting a wide spectrum of images. Havrylenko [14] indicates Barbie's remarkable ability to

reinvent herself, embodying a diverse representation of women. Similarly, Verde and Maizonniaux [15] analyze Barbie's past portrayals in DVDs, noting her depiction as capable, self-confident, innovative, and intelligent, thereby highlighting the independence of women. Consequently, Barbie's imagery conveys significantly positive values to female audiences.

This sentiment is further exemplified in the narrative of Legally Blonde, where the protagonist Elle Woods (portrayed by Reese Witherspoon) boldly wears conspicuous pink attire at Harvard Law School. Elle's journey involves diligent study, striving for excellence, and ultimately overcoming adversity, including retaliation against her ex-boyfriend who once dismissed her. In this context, Dole [12] observes that Legally Blonde effectively navigates the intersection of femininity and power anxieties. Thus, it becomes evident that the portrayal of pink women on screen generally embodies modern femininity and contributes to the portrayal of diverse and positive characterizations of women.

In light of the social images portrayed by the pink characters discussed above, female consumers demonstrate a willingness to engage with this social identity by selecting pink products associated with these pink images. As Fluckiger [16] discusses, one of the most crucial functions of cinematic color is its capacity to establish a connection between a character's emotions and the audience's own perceptions. Additionally, Liebes and Katz [17] explicitly highlight that audience identification with a media character often leads to the emulation of the character's role. Consequently, the identification with film characters can enable audiences to broaden their emotional horizons and social perspectives [18], fostering resonance with the characters.

Thus, the color pink serves not only as a symbol of women's culture but also as an essential element in effectively expressing the identity of the female group in society. Through their choices to purchase products associated with these pink images, female customers can unmistakably convey their participation in this social identity and find a unique expression of their self-identity.

3. PINK characters reputation influences and fashion trend on social media

Based on the pink film images mentioned above, these films play an essential role in entertainment culture. Because of the tremendous popularity they generate in today's social media platforms, they lead modern society's fashion and cultural trends, which leads to the purchase intention of related pink products as a way for the female audience groups to follow the cultural and fashionable trends.

Pink occupies a vital place in fashion and trends, as Dole [12] defines pink as part of the fashion trends of the new century nowadays, representing a brighter and more sensual style, implying a powerful femininity as well. Thus, the identity symbol of pink has prompted customers to connect fashion with these pink film images. Again, using the classic Barbie as an example, the image of Barbie has always been associated with fashion style in popular perception [13], and with the visual representation of the film, the main character's backgrounds and outfits are always made up of pink colors, which further contributes to the audience's linkage of fashion and pink and adopting

these pink images as a fashion trendsetter.

The influence of pink film images extends beyond the realm of fashion to encompass today's social networks. Miyatake et al. [19] conducted a study on the correlation between pink preference and fashion tastes, revealing that the application of pink in fashion and cosmetics products undergoes new changes under the influence of trends. This finding is exemplified by the phenomenon observed in 2023, where the trending pink color dubbed Barbie Pink emerged. The release of the Barbie film in the same year saw the film team leveraging TikTok as part of their promotional strategy. Twigg [20] indicates that the Barbie film team orchestrated various exciting and designed challenges, dances, and other engaging content on TikTok, leading to the rapid proliferation of Barbie's pink image across social media platforms. This highlights the vital role of pink film images in shaping contemporary social media trends and influencing consumer preferences in fashion and cosmetics.

Similarly, Burgos [21] also claims that Barbie's advertisements on social media platforms attract thousands of people to enter the Barbie world. This impact can even extend to the popularity and reputation of the actors. Havrylenko [13] points out that Margot Robbie, the performer of Barbie, is an iconic figure in real-life fashion. Due to her striking resemblance to the Barbie character, she is widely recognized as the real-life embodiment of the Barbie image. Hence, this adds an extra layer of authenticity and appeal to the film's promotion, further reinforcing the association between pink and fashion.

The interpretation of the fashionable aspect of pink imagery and its significant influence on social media indicates the preference of female audiences for purchasing pink products to align with current trends and fashion. As mentioned by Nannini [22], women are often more active on social media platforms and tend to avidly follow fashion trends depicted in the media. Nurhandayani et al. [23] further emphasize the role of social media influencers in disseminating information to consumers and fostering interest in purchases, exemplified by the creation of the "

Barbie Pink trend by Margot Robbie in 2023. Consequently, the popularity of pink film imagery on social media serves as a guiding force for women in their fashion pursuits, thereby stimulating their inclination to purchase pink products.

The fashionable nature of the color pink, coupled with the prevalence of pink film imagery, establishes a strong connection with the concept of fashion. This connection extends to the social impact of pink film imagery, ultimately leading to its widespread recognition as a fashion trend on social media platforms. This recognition serves as one of the driving factors motivating female audiences to choose pink products.

4. Stimulation of PINK advertisement and color marketing

Understanding the psychology behind women's pursuit of fashion, as elucidated earlier, businesses recognize the importance of the female demographic in consumer purchasing behavior. Consequently, they have endeavored to capitalize on the intersection of pink film imagery and the symbolic significance of pink. Companies have developed numerous pink marketing strategies aimed at strengthening the brand image of pink products, thereby garnering increased attention and purchases from the female audience. This strategic alignment between film imagery, color symbolism, and

marketing initiatives reflect the effectiveness of leveraging pink as a means to appeal to female consumers and enhance brand recognition and loyalty.

Many previous cases have also reflected the influence from different colors to the product design and marketing strategy. In the conceptual collaboration between Nike and Marvel's Avengers, the Spider-Man themed Air Max 270 sneakers exemplify the pivotal role of color red and blue in brand product marketing [24]. Adorned with Spider-Man's iconic red and blue color scheme, the design not only reflects the character's visual identity but also establishes an emotional connection with consumers through the symbolic meaning of color, stimulating fans' sense of identification and desire to purchase. The spiderweb pattern on the upper, side panel design, and the Spider-Man logo on the tongue enhance the product's association with the superhero's image, enriching the design's depth and increasing its appeal. Hence, this design strategy demonstrates the impact of color in shaping brand image, conveying cultural values, and evoking consumer emotions, proving the importance of color consistency in brand products and marketing strategies [24].

Also, another effective case is based on Disney's film Aladdin in the year of 2019. The strategic partnership between MAC Cosmetics and Disney to launch a special-edition collection inspired by the live-action adaptation of Aladdin exemplifies the convergence of cinema, color, and marketing [25]. This collaboration capitalizes on the film's vibrant visual aesthetics, particularly the color purple, which rich hues and metallics that mirror the story's magical and exotic setting. This collection features a spectrum of playful bright colors and neutral tones, aligns with the character of Jasmine and her embodiment of self-assurance and authenticity. The packaging design, itself a visual treat, further enhances the allure of the collection, inviting consumers to engage with the brand and the film on a deeper level. MAC Cosmetics' integration of social media tagging encourages user-generated content, fostering a community around the collection and amplifying its market reach [25]. Therefore, it illustrates the power of color in cinematic storytelling and its translation into product design and marketing strategies, creating a synergistic brand experience that resonates with consumers' emotional connection.

However, as to the pink color marketing, the influence of the female demographic in driving purchasing decisions has led to the emergence of pink marketing, as highlighted in previous studies. The increasing engagement of women across various spheres of daily life indicates the importance of tailoring marketing strategies to cater to this demographic, given their significant societal roles [26]. Moreover, Fayyad and Shehata [27] reveal a striking statistic indicating that up to 85 percent of purchasing decisions are either directly made by women or strongly influenced by them, underscoring their substantial impact in the marketing realm.

In product marketing, color is recognized as a crucial element in evoking pleasurable responses through product appearance [28]. This recognition, coupled with the established connection between women and the color pink, as elaborated earlier, has paved the way for one of the most effective marketing concepts of the twenty-first century: pink marketing [26]. This targeted marketing strategy tailored specifically for women leverages the inherent appeal of the color pink to resonate with female consumers, effectively influencing their purchasing decisions and driving brand engagement and loyalty.

The concept of pink marketing has permeated various sectors of today's market, appealing to women across different age groups, from young girls to adults. Mileti et al. [2] observe that pink is a prevalent color used extensively in advertising and promoting children's clothing, accessories, toys, and other products. Previous studies suggest that the roots of pink marketing can be traced back to children's demographics. Even before a child is born, the traditional practice of associating girls with pink gradually becomes entrenched as a predominant gender marker [3]. Moreover, Fine and Rush [29] indicate a significant gendered aspect in the marketing of children's toys, with a widespread design of girls' toys and products as pink items. This phenomenon may be attributed to the influence of the Disney film industry, as detailed analysis of various Disney princesses' on-screen portrayals reveals a prevalence of pink or purple clothing and accessories. These depictions significantly contribute to reinforcing the association of pink with femininity among teenage girls [3]. Given that children are recognized as active consumers in the contemporary film industry, the inclusion of pink imagery in these films further bolsters the efficacy of the pink marketing strategy.

For adult women, the scope of products under pink marketing is notably extensive, encompassing cosmetics, luxury goods, and various lifestyle products. As highlighted by Khan [3], a multitude of products targeted towards women, from Unilever's Fair & Lovely fairness product to Axe's body spray, are predominantly pink in color. Unlike children, the purchasing behavior of mature female consumers is linked to their willingness to purchase pink products and the associated brand concepts. Massoudi [9] explicitly delineates significant motivational and psychological distinctions between men and women in purchasing behavior, resulting in distinct shopping behaviors among women.

For example, Burgos [21], in an analysis of Barbie marketing, suggests that female customers exhibit a preference for pink products and associate them with the Barbie image, a phenomenon possibly rooted in color psychology and brand memorability. This observation is corroborated by Havrylenko [13], indicating that the Barbie marketing team's recognition of the mature and loyal fan base, particularly among female audiences. These consumers often develop emotional attachments to products associated with the pink Barbie image. Building upon this foundation, the Barbie team has forged partnerships with well-known brands, ranging from small items like pink cotton candy ice cream to larger products like Chevrolet cars with pink exteriors [21]. Numerous other brands have followed suit, adopting this approach and reinforcing the influence of pink marketing and Barbie films throughout society.

Despite the considerable success achieved by the pink marketing strategy, some scholars have voiced criticism against this phenomenon. Uncu and Calisir [1] argue that pink bombing represents a consumerist approach, with all pink products potentially fostering unrealistic desires and exerting a detrimental impact on women's lives. Moreover, this phenomenon may exacerbate conflicts pertaining to gender equality, as male consumers might avoid pink products due to the consumer environment shaped by pink marketing and associated gender stereotypes, leading to a phenomenon termed pink bias [2]. Consequently, it is evident that this marketing approach and the prevalence of pink products encounter skepticism within society.

Given the fundamental role of female groups in contemporary social activities

and women's unique affinity for pink, pink has effectively emerged as a hallmark color in brand marketing. Moreover, the portrayal of pink in films has contributed to the distinctiveness and recognition of these pink products. The pink marketing strategy seamlessly integrates film narratives with brand promotion, thereby stimulating the purchase intentions of female audiences.

Although the color pink has traditionally been associated with femininity, its influence is no longer confined to female consumers. The modern design of fashion and consumer culture has witnessed a shift where men are increasingly embracing pink as a color of choice [30]. This trend is exemplified by brands like Pink in London, which caters to a masculine demographic, and Ralph Lauren's popular pink polo shirts, which have become a staple in men's fashion. The growing acceptance of pink among men challenges the historical gender binary associated with colors and reflects a broader societal move towards gender inclusivity. The color's versatility and its adoption by male consumers signify a cultural evolution where color choices are becoming less gendered and more personalized [31]. This shift in perception suggests that marketing strategies should adapt to recognize and appeal to the diverse preferences of consumers, regardless of gender. Thus, the color pink serves as a vibrant example of how societal norms are evolving and how the marketing industry can leverage this change to engage with a more inclusive consumer base.

5. Conclusion

This study explores the social phenomenon of female consumers' preference for purchasing pink products. By analyzing the portrayal of pink women in films, it elucidates how these cinematic depictions influence the purchasing intentions of female groups. Through an examination of three key aspects—the cultural identity of pink and feminism, the influence of pink film imagery in fashion and social media, and the effectiveness of pink marketing strategies in today's commercial landscape—the study elucidates why "women use pink to attract women" [3]. It posits that the imagery of pink films positively influences the purchase intentions and shopping behavior of female audiences.

It also has some limitations, particularly regarding the analysis of pink images primarily centered around Barbie. It suggests that a more comprehensive examination covering diverse characteristics of pink movie imagery would enhance the generalizability of the arguments presented. However, despite these limitations, the study holds significance in the realms of film color and marketing.

In essence, the study of pink imagery illuminates the dynamic relationship between film, fashion, and consumer behavior, offering valuable insights for film industry professionals and product designers alike. Directors can leverage the evolving symbolic meaning of pink to craft diverse characters that resonate with audience perceptions, reflecting societal changes. Similarly, merchants can harness the profound impact of color on cultural dynamics and consumer choices by integrating pink into marketing strategies.

In conclusion, pink emerges as both a symbol and a cultural trend-setting force, acting an important role in shaping women's shopping behavior. Despite its limitations, the study underscores the enduring significance of pink imagery in influencing

consumer preferences and behaviors.

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Article

Analysis of business valuation models with AI emphasis

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Abstract: The main purpose of the paper is to evaluate and compare different business valuation models that incorporate artificial intelligence (AI) technologies. The paper seeks to understand the capabilities, advantages, disadvantages, and limitations of these AI-based models in valuing businesses accurately. Additionally, the paper aims to provide insights into how AI can be utilized effectively in the field of business valuation to enhance accuracy and efficiency. We used qualitative research methods which involve reviewing and analyzing existing literature, case studies, and expert opinions on business valuation models and artificial intelligence. The main contribution of the paper is the integration of artificial intelligence (AI) techniques into traditional business valuation models. The authors propose using AI algorithms such as machine learning and natural language processing to improve the accuracy and efficiency of valuing businesses. By leveraging AI technology, the paper aims to provide more reliable and data-driven valuations, ultimately enhancing decision-making processes for investors, managers, and other stakeholders. The initial segment of the analysis outlines conventional business valuation approaches, such as discounted cash flow (DCF), comparable company analysis (CCA), and asset-based valuation. These methods utilize historical financial data, market comparisons, and asset valuations to estimate a company's value. Although they are effective, these traditional models have limitations in terms of capturing intricate market dynamics and accurately forecasting future performance. The following section of the analysis delves into specific AI-driven valuation strategies, such as sentiment analysis, predictive analytics, and algorithmic trading techniques. It also explores how AI technologies, like machine learning algorithms, natural language processing (NLP), and deep learning, are revolutionizing business valuation practices. AI enables the analysis of vast datasets, including unstructured data from platforms like social media, news articles, and industry reports, to extract valuable insights. Machine learning models can detect patterns, correlations, and predictive indicators that traditional models may miss, leading to more accurate and agile valuations. The analysis then addresses the benefits, obstacles, and considerations associated with integrating AI into business valuation. This includes data quality and accessibility, model interpretability and transparency, regulatory compliance, and ethical concerns related to AI bias and fairness. In addition, a comparative evaluation of AI-based models is presented. In conclusion, integrating AI into business valuation models presents significant potential to enhance the accuracy, efficiency, and dependability of valuation assessments. Using AI-driven methodologies, investors and analysts can gain deeper insights into the intrinsic value of businesses, enabling them to make more informed investment decisions in dynamic and competitive markets. However, it is crucial to pay careful attention to data integrity, model transparency, and ethical implications to ensure the responsible and effective use of AI in business valuation. Finally, future directions and recommendations are provided.

Keywords: business analysis; business valuations; startups; Artificial Intelligence; traditional models

Jel Classification: C45; G12; M21

1. Introduction

Business valuation is the process of determining the economic value of a business or company [1,2]. This involves assessing various factors, such as financial performance, assets, liabilities, market trends, industry conditions, and growth prospects, to obtain an estimate of the business' worth. Business valuation models are methods used to determine the economic value of a business or company [3]. These tools are crucial for investors, analysts, and business owners to assess the worth of a business, whether for buying or selling purposes, financial reporting, or strategic decision-making. These models use various financial and non-financial factors to estimate business value. Business valuation is crucial for various purposes, as presented in **Table 1** [4].

Table1. Business valuation purposes.

Row	Purpose	Explanations
1	Mergers and Acquisitions (M&A)	Valuation helps buyers and sellers negotiate the purchase or sale of businesses
2	Investment Analysis	Investors use valuation to assess the potential return on investment (ROI) and make informed decisions about allocating capital.
3	Equity Financing	Valuation is essential for determining the value of equity shares issued to investors during fundraising rounds.
4	Financial Reporting	Companies may require valuations for financial reporting purposes, such as fair value measurements, goodwill impairment testing, and stock-based compensation
5	Litigation and Dispute Resolution	Valuation experts provide opinions on the value of businesses in legal proceedings, such as shareholder disputes, divorce settlements, and estate planning.
6	Taxation	Valuation is used to determine the tax implications of transactions, including estate taxes, gift taxes, and corporate taxes.

There are several approaches to business valuation, each with its own set of assumptions, methodologies, and applications. Some of the most common valuation models include: 1) Income approach 2) Market approach 3) Asset approach 4) Hybrid approach [5].

Although common business valuation models provide useful frameworks for estimating the value of a business, they also have limitations [6].

- Sensitivity to Assumptions: Valuation models often rely on various assumptions about future growth rates, discount rates, and cash flow projections. Small changes in these assumptions can lead to significant differences in the estimated value of a business, making valuations sensitive to subjective inputs.
- Historical Data Bias: Many valuation models use historical financial data to forecast future performance. However, historical data cannot always accurately reflect future trends, especially rapidly changing industries or economic downturns. This can result in inaccurate valuations.
- Lack of Precision: Valuation models provide estimates of values within a range rather than precise values. The inherent uncertainty in predicting future cash flows, discount rates, and other factors means that valuations are inherently imprecise and subject to interpretation.

- Limited Scope: Some valuation models focus solely on financial metrics, such as earnings or cash flow, without considering other factors that can affect the value of a business, such as market trends, competitive positioning, management quality, and intangible assets.
- Assumption of Market Efficiency: Valuation models often assume that markets are efficient and that asset prices reflect all available information. However, in practice, markets may be inefficient, leading to mispricing and discrepancies between intrinsic and market values.
- Complexity: Certain valuation models, such as discounted cash flow (DCF) analysis and option pricing models, can be intricate and require significant expertise. This complexity can make it challenging for nonexperts to understand and interpret the results accurately.
- Subjectivity: Valuation models involve subjective judgments and assumptions, especially when estimating future growth rates, discount rates, and terminal values. Different analysts use different methodologies and assumptions, resulting in different valuation results.
- Limited Applicability: Some valuation models may be more suitable for certain types of businesses or industries than others. For example, discounted cash flow (DCF) analysis may be less effective for early-stage startups with limited operating history or companies in highly volatile industries.

The purpose of the paper is to evaluate and compare various business valuation models that incorporate artificial intelligence (AI) technology to determine their effectiveness and accuracy in predicting the value of a business.

The objectives of the research paper are:

- To examine different AI-based business valuation models currently used in the market.
- To assess the strengths and weaknesses of these AI-based business valuation models.
- To compare the accuracy and reliability of AI-based business valuation models with traditional valuation methods.
- To identify the key factors that influence the valuation of a business and determine how AI technology can improve the accuracy of these factors.
- To provide recommendations for businesses on selecting the most appropriate AI-based business valuation model for their specific needs.

The hypothesis of the research paper is that AI technology can significantly enhance the accuracy and efficiency of business valuation models, leading to more reliable and informed decision-making for business owners, investors, and other stakeholders.

2. Literature review

Business valuation is a critical aspect of corporate finance, as it involves determining the worth of a company or its assets. Various methods and models have been developed over the years to help investors, managers, and other stakeholders make informed decisions about the value of a business [7]. With the advent of artificial intelligence (AI) technology, these valuation models are now being enhanced and

improved to provide more accurate and reliable estimates.

One of the most commonly used business valuation models is the discounted cash flow (DCF) method [8]. This model estimates the present value of a company's future cash flows by discounting them back to their current value using a discount rate. While the DCF method is widely accepted and used in practice, it has its limitations, such as the need for accurate revenue and cost projections, and the choice of an appropriate discount rate. AI technologies can help overcome these limitations by automating the process of data collection and analysis, and by providing more accurate and timely projections.

Another popular valuation model is the comparable company analysis (CCA) method, which involves comparing the financial metrics of a target company to those of similar public companies in the same industry [9]. While the CCA method is relatively simple and straightforward, it can be time-consuming and subjective, as it relies on the judgment of analysts to select an appropriate set of comparable companies. AI technologies can help streamline this process by analyzing large datasets of financial information and identifying the most relevant comparable based on predefined criteria.

In recent years, machine learning algorithms have been applied to business valuation models to improve their accuracy and reliability [10]. Machine learning algorithms can analyze large amounts of data and identify complex patterns and relationships that may not be immediately apparent to human analysts. These algorithms can be trained on historical valuation data to make predictions about the value of a company based on its financial and non-financial attributes. By incorporating machine learning into business valuation models, analysts can provide more objective and data-driven estimates of a company's worth.

One key advantage of using AI technology in business valuation is the ability to automate repetitive tasks and reduce human error [11]. AI algorithms can process vast amounts of data in a fraction of the time it would take a human analyst, freeing up valuable time for more strategic analysis and decision-making. Additionally, AI technologies can help analysts identify potential biases and inconsistencies in their valuation models, leading to more accurate and robust estimates.

Despite the potential benefits of AI in business valuation, there are also challenges and limitations to consider. One of the main challenges is the need for high-quality data to train AI algorithms and ensure accurate predictions [12]. Inaccurate or incomplete data can lead to erroneous valuation estimates, undermining the credibility of the model. Additionally, the complexity and interpretability of AI algorithms can pose challenges for analysts and stakeholders who may not fully understand how the model arrives at its conclusions.

In conclusion, the integration of AI technology into business valuation models has the potential to revolutionize the way companies are valued and assessed. By automating repetitive tasks, improving data quality, and enhancing the accuracy of predictions, AI can help analysts make more informed decisions about the value of a business. While there are challenges and limitations to consider, the benefits of using AI in business valuation are clear, and the field is likely to continue evolving as new technologies and techniques are developed.

3. Current business valuation methods

We will delve into various current business valuation methods [13]:

1) Asset-Based Approach
   - Book Value Method: This method calculates the value of a business based on its net assets' book value (assets minus liabilities), as reported on the balance sheet.
   - Adjusted Net Asset Method: This method adjusts the book value of assets and liabilities to reflect fair market values rather than historical costs.
2) Income Approach:
   - Discounted Cash Flow (DCF) Analysis estimates the present value of a business' future cash flows considering factors such as revenue growth, operating expenses, capital expenditures, and discount rates.
   - Capitalization of Earnings Method: This method determines the value of a business by capitalizing expected future earnings at an appropriate rate.
   - The capital asset pricing model (CAPM) utilizes the risk-free rate, market risk premium, and beta coefficient to calculate equity costs. This equity cost is then used to discount future cash flows in a Discounted Cash Flow (DCF) analysis.
3) Market Approach:
   - Comparable Company Analysis (CCA) compares the target company with similar publicly traded companies in terms of size, industry, growth prospects, and financial performance.
   - Comparable Transaction Analysis (CTA): This analysis reviews recent transactions of similar businesses to determine valuation multiples (e.g., price-to-earnings ratio, enterprise value-to-revenue ratio) that can be applied to the target company.
   - Guideline Public Companies: This method utilizes valuation multiples obtained from publicly traded companies with similar characteristics to determine the value of the target company.
4) Hybrid Approach:
   - Weighted Average Method: Combines multiple valuation methods, assigning weights based on relevance and reliability to obtain the final valuation estimate.
   - Adjusted Present Value (APV): Includes elements of both the income approach (DCF analysis) and the market approach (valuation multiples) to account for factors such as debt financing and tax shields.
5) Industry-Specific Methods:
   - Real Estate Valuation: Utilizes methods such as the cost approach (replacement cost, reproduction cost), income approach (capitalization rate, gross rent multiplier), and market approach (comparable sales analysis) to value real estate properties.
   - Technology Valuation: This model employs specialized techniques, such as the option pricing model, the Black-Scholes model, and risk-adjusted return on capital (RAROC) model, to assess the value of technology companies and intellectual property assets.

6) Intangible Asset Valuation:
   - Income: This method estimates the value of future economic benefits derived from intangible assets, such as patents, trademarks, copyrights, and customer relationships.
   - Market Method: Determines the value of intangible assets by comparing similar prices in a marketplace.
   - Cost Method: Calculates the cost of replacing or reproducing intangible assets.

Each of these methods has its advantages, limitations, and applicability, depending on the nature of the business, industry dynamics, market conditions, and purpose of the valuation. It is common for business appraisers to use multiple methods and approaches to triangulate a reliable valuation estimate.

In summary, **Figure 1** presents the following:

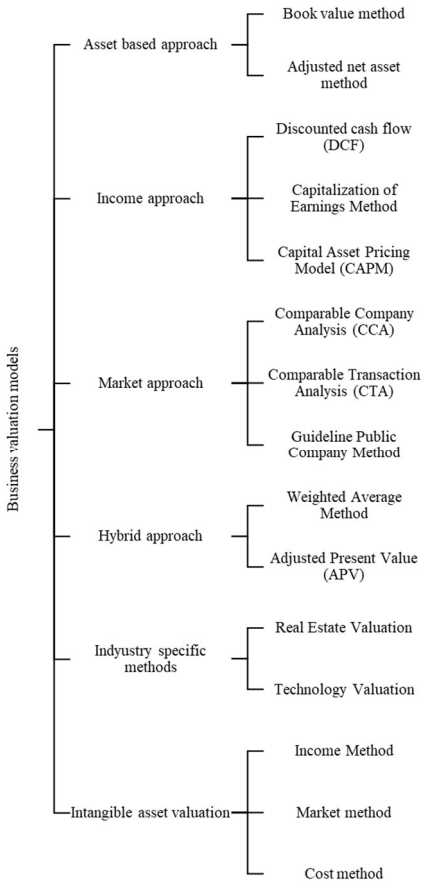

Figure 1. Business valuation methods.

4. AI techniques in business valuation

Artificial Intelligence (AI) techniques are becoming increasingly relevant in business valuation, offering innovative ways to assess company performance, identify key valuation drivers, and make more informed investment decisions. In **Table 2**, there are some AI techniques commonly used in business valuation [14]:

By using artificial intelligence (AI) techniques, businesses and valuation professionals can improve the accuracy, efficiency, and reliability of their valuation

analyses. This can lead to more informed investment decisions and strategic planning.

Table 2. AI techniques in business valuation.

Row	Techniques	Explanations
1	Machine Learning (ML)	• Machine learning algorithms analyze large datasets to identify key trends and correlations affecting business valuation. Supervised learning techniques, such as regression analysis and decision trees, can predict business valuations from historical financial data and market comparisons. Unsupervised learning techniques, such as clustering and dimensionality reduction, can uncover hidden insights and relationships in complex datasets. • Regression Analysis: Machine learning algorithms can be used to analyze historical financial data and identify relationships between various financial metrics and company valuations. • Random forest: This random forest model uses multiple decision trees to provide robust and accurate valuations. • Gradient Boosting Machines: Used for predicting company valuations by iteratively building weak predictive models and combining them to create a strong overall prediction.
2	Natural Language Processing (NLP)	• NLP techniques enable the analysis of unstructured text data, such as financial reports, industry reports, news articles, and social media posts, to extract relevant information for business valuation. Sentiment analysis can assess market sentiment and investor perceptions, and topic modeling can identify key topics and themes relevant to valuation. • Topic Modeling: NLP techniques help identify topics and themes in textual data and provide valuable insights into market trends, competitive landscapes, and industry dynamics that impact valuation.
3	Deep Learning (DL)	• DL algorithms, such as neural networks, can process vast amounts of structured and unstructured data to derive insights for business valuation. Deep learning models can learn complex relationships and nonlinear patterns in data, making them suitable for tasks such as forecasting financial performance, assessing market dynamics, and identifying valuation drivers. • Neural Networks: Deep learning models can be applied to complex valuation scenarios in which nonlinear relationships exist between input variables and company valuations. • Convolutional Neural Networks (CNN): A CNN can process and analyze large sets of financial data, images, or time-series data to extract meaningful features that impact business valuation.
4	Predictive Analytics	• Predictive analytics techniques leverage historical data to forecast future business performance and estimate valuation metrics. Predictive analytics uses time series analysis, regression modeling, and ensemble methods to forecast key financial indicators like revenue growth, profitability, and cash flow projections. • Time-series forecasting: Predictive models can use historical financial data to forecast future performance indicators, such as revenue growth, profitability, and market share, which are crucial in determining company valuation. • Customer Churn Prediction: By predicting customer churn rates, businesses can assess the impact on future cash flows and company valuation.
5	Sentiment Analysis	Sentiment analysis algorithms analyze textual data to gauge market sentiment, customer opinions, and stakeholder perceptions related to a business. Sentiment analysis analyzes news articles, social media posts, customer reviews, and analyst reports to assess the impact of external factors on business valuation.
6	Image Recognition	Image recognition technologies can analyze visual data, such as satellite imagery, aerial photographs, and property images, to identify physical assets, infrastructure, and real estate properties relevant to business valuation. Computer vision algorithms analyze visual features and characteristics to assess property conditions, identify market trends, and estimate asset values.
7	Robotic Process Automation (RPA)	RPA technologies automate repetitive and rule-based tasks involved in business valuation processes, such as data collection, data entry, and report generation. By automating manual processes, RPA improves efficiency, reduces errors, and allows valuation professionals to focus on higher-value activities, such as analysis and decision-making.
8	Knowledge Graphs	Knowledge graphs represent structured information about business entities, relationships, and attributes in a graph-based format. By integrating data from various sources, such as financial databases, market reports, and regulatory filings, knowledge graphs provide a comprehensive view of the business ecosystem, allowing for more informed valuation decisions.
9	Data Mining and Pattern Recognition	• Anomaly Detection: AI algorithms can detect irregular patterns in financial data that may indicate fraudulent activities or errors, thereby impacting company valuation. • Cluster Analysis: Identifying clusters of companies with similar valuation drivers through cluster analysis can provide insights into industry benchmarks and competitive positioning.
10	AI-Powered Valuation Tools:	• Automated Valuation Models (AVMs): AI-driven tools can automate the valuation process by efficiently analyzing vast data and generating accurate valuation estimates. • AI tools can simulate various scenarios and evaluate their impact on company valuation, thereby improving risk management and strategic decision-making.

5. Advantages and disadvantages of AI-based valuation models

AI-based valuation models offer several advantages and disadvantages in the context of business valuation. In **Table 3**, we have explored some key points for each Advantages and disadvantage of AI-based valuation models [15–17]:

Table 3. Advantages and disadvantages of AI-based valuation models.

Advantages	Disadvantages
• Increased accuracy: AI algorithms can analyze vast amounts of data and identify complex patterns and relationships that may not be apparent to human analysts. This can lead to more accurate valuation estimates by incorporating a wider range of factors into the analysis. • Improved efficiency: AI-based valuation models automate many aspects of the valuation process, such as data collection, analysis, and reporting, reducing the time and effort required to perform valuations. This allows valuation professionals to focus on higher-level tasks and strategic decision-making. • Enhanced predictive power: AI techniques, such as machine learning, can forecast future business performance based on historical data and market trends. By incorporating predictive analytics into the valuation process, AI-based models can provide insights into the potential future value of a business. • Adaptability: AI algorithms can adapt and learn from new data, allowing valuation models to evolve and improve over time. This flexibility enables AI-based models to adjust to changing market conditions and incorporate new information into the valuation analysis. • Scalability: AI-based valuation models can handle large and complex datasets, making them suitable for valuing businesses of all sizes and across various industries. This scalability allows valuation professionals to analyze multiple companies simultaneously and assess their relative value more efficiently. • Improved speed: AI-based models can automate the valuation process, reducing the time required to generate valuation reports and allowing for quicker decision-making. • Reduced bias: AI models can help minimize human bias in the valuation process by relying on data-driven analysis rather than subjective judgment. • Continuous learning: AI algorithms can continuously learn from new data and adapt to changing market conditions, improving the model's accuracy and relevance over time.	• Data Dependence: AI-based valuation models rely heavily on data inputs for training and analysis. Incomplete, inaccurate, or biased data used to train the models can result in flawed valuation estimates and unreliable results. • Lack of Transparency: Some AI algorithms, particularly deep learning models, operate as "black boxes," making it challenging to interpret their decision-making process. The lack of transparency can raise concerns about the reliability and trustworthiness of AI-based valuation models. • Overfitting: AI algorithms may overfit the training data, resulting in the capture of irrelevant patterns or noise that do not generalize well to new data. This can result in overly optimistic or pessimistic valuation estimates that do not accurately represent the true value of the business. • Complexity: AI-based valuation models can be complex and may require specialized knowledge and expertise to develop and interpret. This complexity may limit the accessibility of AI-based valuation techniques to non-experts and smaller firms with limited resources. • Ethical and Regulatory Concerns: AI-based valuation models raise ethical and regulatory concerns related to data privacy, bias, and accountability. Valuation professionals must ensure that AI algorithms are used responsibly, in compliance with relevant regulations and industry standards. • Initial Investment: Implementing AI-based valuation models may require a significant upfront investment in technology, infrastructure, and expertise, which can be a barrier for smaller businesses.

Overall, AI-based valuation models offer significant advantages in terms of accuracy, efficiency, and adaptability; however, they also pose challenges related to data quality, transparency, and interpretability. Valuation professionals should carefully consider these factors when incorporating AI techniques into their valuation processes and ensure that AI-based models are used responsibly and ethically.

6. A comparative study of AI-based models

Comparing AI-based valuation models can provide insights into their strengths, weaknesses, and suitability for different business valuation scenarios. **Table 4** presents a comparative study focusing on three popular AI-based valuation techniques: Machine Learning, Deep Learning Models, and Natural Language Processing (NLP) Models.

Table 4. Strengths and weaknesses of AI-based models.

	Machine learning (ML)	Deep learning (DL)	Natural language processing (NLP)
Strengths	(1) Interpretable Results: Machine learning models like regression analysis, provide interpretable results, allowing users to understand the factors driving valuation. (2) Robustness: Models like Random Forest and Gradient Boosting are robust against noise and outliers in data, resulting in stable valuation predictions. (3) Feature Importance: These models help identify key valuation drivers via feature importance analysis.	Complex Patterns: Deep learning models like Neural Networks can capture complex patterns in data, which makes them suitable for intricate valuation scenarios. Automated Feature Learning: These models automatically learn relevant features from the data, which reduces the need for manual feature engineering. High Accuracy: Deep learning models can achieve high accuracy when trained on large datasets with diverse variables.	(1) Sentiment Analysis: NLP analyzes textual data to gauge market sentiment and incorporate qualitative factors into valuation models. (2) Information extraction: This technique extracts valuable insights from unstructured text data, such as news articles, reports, and social media, and enhances valuation analysis. (3) Topic Modeling: Helps in identifying key themes and topics that influence company valuations and provides a holistic view of valuation drivers.
Weaknesses	(1) Linear Relationships: The ability to capture nonlinear relationships between input variables and valuation, which limits the accuracy of complex scenarios. (2) Manual feature engineering: Manual feature engineering is often required to optimize model performance; this can be time-consuming and may introduce bias.	(1) Black box nature: Deep learning models are often considered black boxes; thus, it is challenging to interpret how they arrive at their valuation predictions. (2) Data Requirements: Large amounts of high-quality data are required for training, which may be a limitation for some businesses with limited data availability.	(1) Subjectivity: Textual data analysis is prone to subjectivity and interpretation bias, which impacts the accuracy of sentiment analysis. (2) Data preprocessing: This task requires the preprocessing of unstructured text data, including cleaning, tolerization, and normalization, and can be labor intensive.

In the following, more comparative information is presented:

- Model Interpretability

Machine learning models generally offer more interpretability than deep learning models. This interpretability allows users to understand how the model arrives at its predictions, which makes it easier for stakeholders to explain the valuation outcomes. NLP models, particularly sentiment analysis and topic modeling, may offer less interpretability than traditional machine learning models like regression analysis. The outputs of NLP models are often based on the analysis of textual data, which can be a challenge to interpret directly.

- Data Requirements

Deep learning models often require large amounts of data for training to achieve optimal performance. In contrast, machine learning models can sometimes work well with smaller datasets, making them more accessible for businesses with limited data availability. NLP models typically require unstructured text data, such as news articles, reports, and social media content, which may present different data challenges than the structured financial data used in traditional machine learning models. Ensuring high-quality relevant text data is crucial for the effectiveness of NLP models in business valuation.

- Computational Complexity

Deep learning models, especially complex neural networks, are computationally intensive and require significant computational resources for training and inference. Machine learning models, particularly simpler ones like linear regression, are less computationally expensive. NLP models can vary in complexity depending on the techniques used, such as sentiment analysis, topic modeling, and word embeddings.

Although they may require processing power for text preprocessing and feature extraction, the computational requirements of NLP models can differ from those of deep learning models that work with numerical data.

- Generalization Ability

Deep learning models can generalize well to unseen data, especially in complex valuation scenarios with high-dimensional data. However, machine learning models may struggle with generalization in such scenarios. NLP models, particularly sentiment analysis models, are designed to extract sentiment and textual relationships that may not always be generalizable to all valuation scenarios. Deep learning and traditional machine learning models may offer more versatility relative to handling diverse data types and capturing complex patterns that enhance generalizability.

- Domain Adaptability

Natural Language Processing models, due to their ability to analyze textual data, are particularly suitable for industries in which qualitative information plays a significant role in valuation, such as the financial sector. Machine learning and deep learning models, while versatile, may not capture qualitative factors as effectively. NLP models excel at extracting insights from qualitative data sources, making them well-suited for industries where textual information plays a significant role in valuation decisions. In contrast, machine learning and deep learning models are more versatile in handling varied data types and can be adapted to different domains with proper feature engineering.

- Cost and Implementation

Deep learning models often require specialized expertise in neural networks and substantial computational resources, potentially increasing implementation costs. Machine learning models are more straightforward to implement and maintain in comparison. Implementing NLP models requires expertise in natural language processing and text data preprocessing. Depending on the complexity of the NLP model and the volume of text data, the implementation and maintenance costs may differ compared to traditional machine learning models.

- Scalability and Flexibility

Machine learning models offer higher flexibility and scalability compared to deep learning models, allowing for easier adaptation to changing valuation requirements and datasets. NLP models offer flexibility in terms of analyzing text data and extracting valuable insights about market sentiment, competitive landscape, and industry trends. They can complement traditional machine learning models by incorporating qualitative factors into the valuation process, thereby enhancing the overall analysis.

In summary, the selection of an AI-based valuation model should consider factors such as interpretability, data requirements, computational complexity, generalization ability, domain adaptability, cost, scalability, and flexibility. Each model has strengths and weaknesses, and the selection should be based on the specific needs and characteristics of the given valuation task. It may also be beneficial to combine multiple AI techniques to exploit their advantages and enhance the overall valuation process.

7. Conclusions and remarks

In conclusion, the paper reveals the transformative potential of AI in revolutionizing traditional valuation methods. Through this study, we explored various AI-based approaches to business valuation, including machine learning algorithms, neural networks, and natural language processing techniques.

Overall, AI-based valuation models offer several advantages over traditional methods, including improved accuracy, scalability, and efficiency. By leveraging large datasets and sophisticated algorithms, AI models can uncover hidden patterns and insights in financial data, leading to more accurate and reliable valuations. In addition, AI-driven automation streamlines the valuation process, thereby reducing the time and resources required for analysis.

However, it is essential to acknowledge the limitations and challenges associated with AI-based valuation models. These concerns include data quality, model interpretability, and regulatory compliance. Furthermore, the success of AI-based valuation depends heavily on the availability of high-quality data and the expertise of data scientists and financial analysts in developing and deploying these models effectively.

Looking ahead, there is immense potential for further research and innovation in AI-based valuation techniques. Future advancements in AI technology, such as explainable AI and reinforcement learning, hold promise in terms of addressing current limitations and enhancing the capabilities of valuation models. Moreover, interdisciplinary collaboration between finance experts, data scientists, and AI researchers will drive progress in this field.

In conclusion, AI-based valuation models represent a significant advancement in business valuation practices; their successful implementation requires careful consideration of both opportunities and challenges. By harnessing the power of AI responsibly and ethically, businesses can leverage these innovative techniques to make informed decisions and drive sustainable growth in today's dynamic business environment.

8. Policy implications

1) Regulation and Oversight: Policymakers may need to consider implementing regulations and oversight mechanisms to ensure that AI-powered business valuation models are accurate, reliable, and transparent. This could involve setting standards for AI algorithms and requiring validation and auditing of these models.
2) Education and Training: Policymakers could also focus on promoting education and training programs to help business owners and investors understand how AI-powered valuation models work and how to interpret their results. This could help prevent misunderstandings or misuse of these models.
3) Data Privacy and Security: Given the reliance on large amounts of data for AI-powered business valuation models, policymakers may need to address concerns around data privacy and security. This could involve implementing strict data protection measures and ensuring that data used for valuation purposes is handled securely and ethically.

4) Bias and Fairness: Policymakers may also need to address concerns around bias and fairness in AI-powered business valuation models. This could involve developing guidelines for mitigating bias in algorithms, ensuring diversity in data sources, and promoting the use of ethical AI practices.
5) Accessibility and Inclusivity: Policymakers could work to ensure that AI-powered business valuation models are accessible and inclusive for all stakeholders, including small businesses, startups, and marginalized communities. This could involve providing resources and support for those who may not have access to sophisticated AI technologies.

Overall, the policy implications of the paper suggest a need for careful consideration of how AI-powered business valuation models are developed, implemented, and regulated to ensure that they provide accurate and fair valuations for businesses of all sizes and types.

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Article

Nexus between foreign assistance and economic growth in Tanzania

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Abstract: The ability of a country to grow economically sustainably depends on its ability to borrow since borrowing is an essential component of resource creation and the foundation of resource generation strategy, particularly in emerging nations. Evaluating the relationship between Tanzania's economic progress on foreign aid, it was the main goal of the study. Secondary data and a quantitative time series data regression research methodology were used in the study. The fiscal years 1970–2020 were covered by the 51 data observations. The findings indicated that while there is a statistically significant positive relationship between foreign aid and economic growth.

Keywords: foreign assistance; foreign direct investment; trade openness; economic growth; Tanzania

1. Introduction

Borrowing is essential to a country's ability to achieve sustainable economic growth since it is one of the key elements influencing resource generation and the foundation for directing resource generation, especially in developing nations [1]. Since economic growth is the primary objective of the majority of developing nations, funds are raised from various sources, including the national debt, and allocated to workable projects to accelerate development [2,3]. Every country has benefited from the global wealth boom by increasing reserves and fostering economic growth [3]. found that these are unique countries with high loan servicing levels that contribute to low levels of domestic savings and investment and growing fiscal deficits. This finding is supported by the data.

The African Development Bank provides advice on how nations should use the available cash to strengthen their economies. The African Development Bank observed in its 2018 report that public borrowing and national debt are widespread global practices, particularly for emerging countries. The nation's debt has historically come from the inability to pay for actual development initiatives, such as those pertaining to infrastructure, water, energy, education, and so forth. But according to an assessment conducted later by the Africa Development Bank, the country's debt has significantly increased [3]. Further evidence supporting this assertion came from Azam and Feng [3], who noted that during the past 50 years, economic development in less developed countries has occurred at a glacial pace in every sector.

To pay for their budget deficits, many developing countries rely on loans, whether from domestic or international sources. Despite the government's best efforts to ensure that the financial system makes money by ensuring that it is regularly exploited, manufacturing speculation resulted in the construction of transportation infrastructure, hydroelectric plants, responsible public services, and management of

all unethical activities. Still, it appears that the state's responsibilities are expanding every year [4]. The study attempted to solve Tanzania's most significant issue by examining the relationship between economic conditions and public loans. However, Tanzania's GDP remains unstable, and the government of the nation continues to borrow money from foreign organizations and nations.

A consensus regarding the relationship between national debt and economic growth cannot be reached due to limited evidence from previous studies. While this has historically been the case in academic journals and scientific publications, new research indicates that the emphasis on economic expansion and budget deficits may be progressively contributing to a large level of debt. The general consensus that late payments are advantageous to the lending industry motivates this kind of research. Further research is necessary to fully comprehend the impact of growing debt on the economy because countries such as Tanzania keep borrowing money even after gaining independence. The foundation for future research on possible connections between foreign aid and economic development will be laid by this study. This organization is required to carry out any upcoming initiatives.

This research aimed to examine whether economic growth, that is GDP can be explained foreign assistance, foreign direct investment and trade openness.

2. Literature reviews

The dual-gap idea was initially presented by Chenery and Strout in 1966 [4]. contend that saving should come before investing. According to this idea, there aren't enough domestic savings to cover the costs of the investments needed for economic growth. Foreign investment capital is required to close the gap [4]. The main query is whether and to what degree foreign public debt and other external funding sources contribute to the economic development of developing countries. Since the components of spending and revenue are equal, dual-gap analysis is predicated on the identities of national income accounting, as demonstrated below:

$$Yi = C + I + S \tag{1}$$

whereby *Yi* and *Yo* represent income and output respectively, *C* represent Consumption, *E* represent export, *I* represent imports and *S* the savings, *INV* is the investments.

$$Y0 = C + E + INV \tag{2}$$

As income = output from Equations (1) and (2) it implies that

$$INV - S = I - E \tag{3}$$

In theory for uniqueness Equation (3) to grasp truth it needs that

$$INV = S + I - E \tag{4}$$

There is an export-of-origin exchange gap when imports exceed required exports; on the other hand, there is a saving-investment gap when domestic saving falls short of anticipated economic growth [4].

When it comes to international help, objectives, resource types and sources, and recipient performance expectations differ [5]. The four types of subsidies that are offered are capital project loans, general assistance loans, grants, and surplus agricultural commodities against loans repayable in local currency [5]. From an economic standpoint, encouraging economic growth is the main goal of public capital

inflows as, among other things, foreign aid generates export revenues, which spare developing nations from having to bridge the funding gap on their own.

Foreign aid can impact a recipient's GDP at macro- and micro-level, according to Kirikkaleli et al. [6], albeit other external factors need to be taken into account when estimating economic growth.

The text does not, however, make clear how public debt impacts economic advancement. The argument on the relationship between the national debt and economic progress has endured despite contradictory results. Previous research has shown that in order to fully comprehend the several factors influencing economic growth, a thorough analysis of the conditions in each nation is required. Numerous writers focused on developed economies, analyzing debt from both domestic and international sources while leaving out the impact of public debt on economic expansion [7]. Others have conducted research on Tanzania's external loans and their servicing, as well as the importance of foreign direct investment and external debts to the nation's economic growth. The majority of them have underestimated Tanzania's economic development due to the country's total external and domestic debt.

Similar research was done on 85 developing nations in Latin America, Africa, Asia, and the Caribbean by Kyara et al. [8], who found that different foreign aid programs had different effects on economic growth [8,9].

Research hypothesis

H0: There is no relationship between foreign assistance and economic growth in Tanzania?

H0: There is no relationship between Trade openness influence economic growth in Tanzania?

3. Research methodology

Secondary data was used as source of the data and a time series used as research design because the study intends to test causal relationship between variables. Quantitative method used as research approach. The financial data from 1970–2020 were included to this study whereby 51 observations were used. Diagnostic tests of econometric methods were used for both descriptive and inferential data analysis was used, the Autoregressive Distributed Lag Model (ARDL) was employed.

Model specification

Using the Autoregressive Distributed Lag Model (ARDL), Tanzania's economic progress, trade openness, foreign aid, and foreign direct investment were assessed. It is important to keep in mind that the dependent variable being examined is "continuous data in nature" or GDP fluctuations expressed as percentages. The ARDL are therefore pertinent to our research. Using the model, the researcher investigated the long-term relationship between the variables.

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \epsilon \quad (5)$$

whereby, Y = Economic Growth; $X1$ = Foreign Assistance, $X2$ = FDI and $X3$ = Trade openness; whereby $\beta 0$ = Co-efficient of the model; $\beta 1$–$\beta 5$ = Coefficients; ϵ = Stochastic Error Term.

4. Results and discussion

4.1. Basic descriptive statistics

In the study, descriptive statistics are employed to emphasize the salient features of the data. Big data sets can also be presented in a comprehensible way with descriptive statistics. Since a descriptive statistic distills a large amount of data into a concise description of the sample, it is the initial stage in any quantitative data study. Descriptive or summary statistics, which use skewness and kurtosis to infer features of the data distribution, play a major role in determining whether or not the data may be processed using natural logarithms. The annual time series data used in this study comprised 51 observations from 1970 to 2020. The two primary components of the study are the GDP and foreign aid. **Table 1** displays the findings of the created, assembled, and presented descriptive statistics.

Table 1. Descriptive statistics.

Variables	Observation	Mean	Std. Dev.	Min	Max	Skew.	Kurt.
GDP	51	3,652,526	5,923,000	9173	1.4908e	1.718	4.731
DD	51	743.1181	768.9742	6.9	2294.1461	0.712	2.246
ED	51	5,440,000	8,760,000	2219.6	29,900,000	1.582	4.123
ln (GDP)	51	14.3750	3.2501	9.124	18.8155	–0.223	1.585
TO	51	15.6010	11.0551	2.4	36.1001	0.504	1.693
FA	51	16.5540	7.5792	7.5	35.9499	0.874	3.15

Source: Research findings, 2024.

The results of the logarithmically converted data for the level and mean, standard deviation, maximum, minimum, and skewness are shown in **Table 1**. The data in the accompanying table shows that the mean values of all the variables that were analyzed were positive. Furthermore, in the event of exceptional trade openness and foreign help, a negative skewness is observed for the natural logarithms of GDP and foreign aid. The kurtosis values of all the variables are quite close to normalcy and fall below the 3-point threshold for a normal distribution. The GDP and foreign aid show the biggest disparities.

4.2. Diagnostics test

Before making any conclusions from the estimation data, a number of diagnostic tests were run to make sure the models were statistically sound and appropriate for forecasting [9]. The following diagnostic tests were performed to make sure the empirical models were statistically sound and that the fundamental presumptions of the classical linear regression model (CLRM) were maintained: To ascertain whether the residuals were regularly distributed, a number of tests were conducted. These included tests for heteroscedasticity, Jarque-Berra (J-B) tests, Breusch-Godfrey LM tests to find the Lagrange multiplier (LM) to assess for serial autocorrelation, and CUSUM and CUSUM of squares tests to confirm model stability. It is crucial to remember that estimating statistical models under circumstances when the traditional linear regression model's assumptions are broken may result in skewed and

inconsistent parameter estimates.

4.2.1. Breusch-Godfrey LM test for autocorrelation

The Breusch-Godfrey Serial Correlation Test was used to determine whether the investigation's mistake phrases were serially connected. The alternative hypothesis to the null hypothesis that there is no serial correlation in the serial correlation test is that the error terms are auto-correlated. At a 5% significance level, the Breusch-Godfrey (B-G) critical value (CV) is normally 3.84. The estimated Breusch-Godfrey *F*-statistic (B-G statistic 3.84), at the 5% significant level, should typically be less than the critical value of 3.84 in order to avoid rejecting the null hypothesis that there is no serial link. Additionally, at the 5% significant level, the matching *p*-value that was produced ought to have been greater than 0.05. **Table 2** shows the findings of the Breusch-Godfrey Serial Correlation tests, which were prepared, summarized, and presented as shown below.

Table 2. Breusch-Godfrey LM test for autocorrelation.

lags(p)	chi2	df	Prob > chi2
1	20.369	1	0.630

Source: Research findings, 2024.

The *p*-value exceeds the test's necessary significance level of 5%, as **Table 2** demonstrates. Therefore, we are unable to reject the null hypothesis at the 5% significance level. Consequently, it was demonstrated that serial autocorrelation is absent from the regression residuals. The data series does not violate the autocorrelation assumption, as shown by the Breusch-Godfrey Serial Autocorrelation results.

4.2.2. Test of the normality assumption

As seen in **Table 3**, the computed Jarque-Berra p-value was 0.3443, which is greater than 0.05 at the 5% significant level. Because of this, if the computed p-value is higher than the 5% level of significance, the null hypothesis can usually not be rejected. Consequently, the normal distribution of the regression residuals was ascertained. The data series does not defy the presumption of a normal distribution, according to the findings of the Jarque-Berra normality test. According to Mushi [10], if the residuals show a pattern of normal distribution, then the estimates' coefficients also do.

Table 3. Jarque-Berra statistic.

Model	Chi2	Prob > Chi2	Model
Residuals	3.222	0.4322	Residuals

Source: Research findings, 2024.

4.2.3. Test of heteroscedasticity assumption

Table 4 displays the computed *p*-value of 0.1129 for the Breusch Pagan test of heteroscedasticity. This finding is significant above 0.05 at the 5% level. Therefore, in general, at the 5% level of significance, the null hypothesis could not be rejected. This suggests that there is continuous variance as the residual show homoscedasticity.

Table 4. Test for heteroscedasticity.

Source	chi2	df	P
Heteroscedasticity	30.00	3	0.001
Skewness	8.22	3	0.003
Kurtosis	2.33	3	0.03
Total	2.88	9	0.04

Source: Research findings, 2024.

4.2.4. Model stability tests

Ultimately, a stability test of the recursive estimations in the model was performed on the resulting equations. Consequently, in order to ascertain whether the regression model is stable, the CUSUM chart tests were employed in this investigation. In contrast to the alternative hypothesis, which contends that the model is not stable, the null hypothesis for the CUSUM chart tests suggests that the model is stable. If the cumulative sum (CUSUM) of the residual curves is beyond the dual standard of errors range, the null hypothesis that the model is stable at the 5% significance level is typically not able to be rejected. **Figures 1** and **2** show the output results from the CUSUM tests that are performed in this regard.

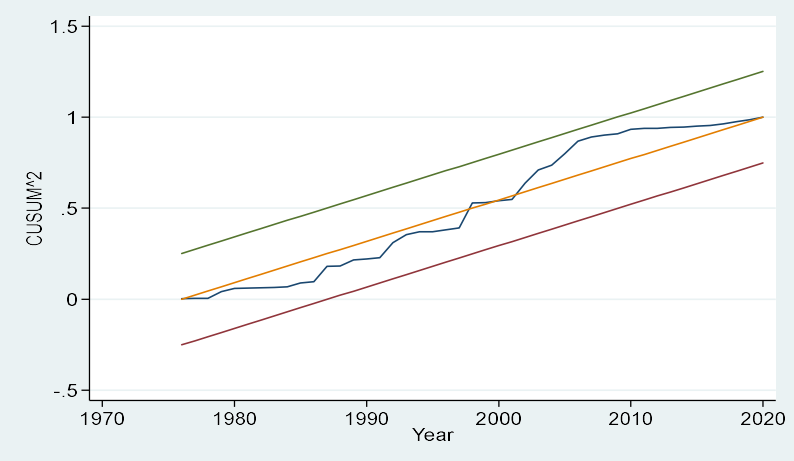

Figure 1. CUSUM square chart.

Source: Research findings, 2024.

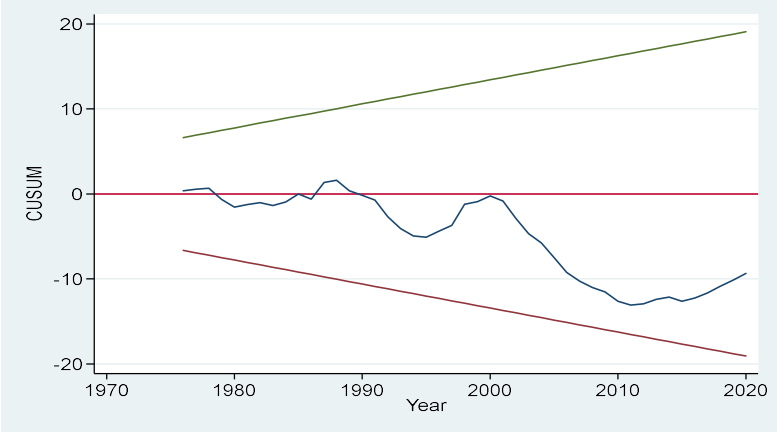

Figure 2. CUSUM chart.

Source: Research findings, 2024.

The results displayed in **Figure 1** demonstrate that the residual curves fall inside or between the upper and lower bounds of the dual standard of errors range at a five percent significant level. These results provided significant evidence for the null hypothesis, which holds that the model is stable, at the five percent significance level. The findings suggest that the regression model hypothesis is robust because the residuals curve falls within the dual standard error range.

The CUSUM chart, which is used to track residual and assess model stability, is shown in **Figure 2**. The results, which are shown in **Figure 2**, show that residual curves exist over the dual standard of error range at the 5% significant level. These results provide sufficient evidence in favor of the null hypothesis. Because the residuals curve and the CUSUM square chart are both within the dual standard error range, the results support the assertion that the regression model is stable.

4.3. Correlation matrix

The correlation matrix shows the initial pattern of the relationship between the dependent and explanatory variables. This matrix shows the orientations of the two random variables. The multicollinearity of the explanatory components may also be shown by the correlation matrix if the correlation coefficient is 0.9 or above. If the correlation coefficient is one, then there is a complete linear relationship between the variables. There is always a range of values for the correlation coefficient, ranging from negative to positive. These two additional important correlational characteristics. Moreover, multicollinearity is evident at all correlation locations, which span from 0.9 to 1 or from –0.9 to negative 1. **Table 5** displays the outcomes of the matrix test.

Table 5. Show the correlation matrix table for foreign assistance, FDI and Trade Openness.

	TO	**FA**	**FDI**
TO	1		
FA	–0.4303	1	
	(0.0016)		
FDI	0.4127	0.2573	1
	(0.0026)	(0.0683)	

Source: Research findings, 2024.

Due to the fact that the absolute coefficient of correlation, $r = 0.7697$, is found to be greater than 0.5 and the *p*-value in the brackets was 0.000, which is below the 0.05 level of significance, **Table 5** only shows a strong positive linear link between trade openness, foreign aid, and FDI. This suggests that there is no connection between aid, foreign direct investment, and trade openness. Furthermore, a less-than-0.5 correlation of 0.4127 was found between trade openness, FDI, and aid. Furthermore, the *p*-value was found to be less than 0.05, indicating that aid, FDI, and trade openness were only marginally positively correlated.

However, the results show a strong positive linear correlation between foreign aid, FDI, and trade openness rate, with the p-value in the brackets being less than the 0.05 level of significance and the absolute coefficient of correlation ($r = 0.5653$) being

less than 0.5. Finally, **Table 5**'s results demonstrated that there was no correlation between the independent variables examined in this study, with each pair's coefficient being less than 0.9. This suggests that the multicollinearity of the model was not problematic.

The findings presented here corroborate those of Mushi [10], who discovered evidence of a significant positive and negative relationship between GDP and foreign assistance.

4.4. Results for unit root test

The unit root or stationarity test was applied to the time series data. This test aims to identify the order in which the variables are integrated as well as if the time series consists of stationary or non-stationary data. A time series is considered stationary when its mean and variance do not change during the course of the series. On the other hand, time series data are regarded as non-stationary if the variance and/or the mean vary over time. The trend in the data series makes non-stationary variables liable to yield weak or misleading results, which is why the unit root test is required.

Mushi [10], states that the first stage in creating a time series model is to test the unit root. One popular technique for figuring out if a series has a root unit is the Augmented Dickey-Fuller (ADF) test. But as Mushi [10] points out, the ADF criteria is notorious for having a low test power. The ADF test has been criticized on occasion for having insufficient power, hence the unit root test was broadened to incorporate Phillips' Peron (PP) test techniques. PP is a better criterion since it can differentiate between series that seem to have unit roots, series that are stationary, and series for which tests are unable to identify whether the series is stationary or integrated. The results were created, summarized, and submitted in **Table 6** for the Augmented Dickey-Fuller (ADF) tests and Phillips's Peron (PP) test.

Table 6. Show test for stationarity in both the Augmented Dickey fuller test and Phillips's Peron.

ADF Test					
Variable	**Level**		**First difference**		**Order of integration**
	Test statistics	**Critical value**	**Test statistics**	**Critical value**	
GDP	–3.255	–2.588	–3.551 **	–5.555	I (1)
TO	–3.222	–1.258	–4.555 **	–3.555	I (1)
FA	–2.058	–3.580	–9.007 **	–3.587	I (1)
FDI	–1.428	–3.580	–5.263 **	–3.587	I (1)
The PP Test					
Variable	**Level**		**First difference**		**Order of integration**
	Test statistics	**Critical value**	**Test statistics**	**Critical value**	
GDP	2.50	–2.3633	–4.187 **	–3.587	I (1)
TO	–3.252	–7.333	–4.336 **	–3.587	I (1)
FA	–1.931	–3.580	–9.167 **	–3.587	I (1)
FDI	–1.606	–3.580	–5.233 **	–3.587	I (1)

Note: That the star (**) therefore accounts for the *P* values that are less than a 5% level of significance.
Source: Research findings, 2024.

The alternative hypothesis, which contends that the series lacks a root unit, and the null hypothesis, which contends that the series does have a root unit, serve as the foundation for the Dickey-Fuller (ADF) test. It is assumed that the series has no unit root if the ADF statistics exceed the absolute asymptotic critical values. It is necessary to show the stability of the null hypothesis, which states that the unit root of the series is rejected [11]. To further evaluate the provided data, the superior Phillips's Peron (PP) criteria were applied because some of the variables had root unit ADF data. According to Mwananziche [11], when tests fail to identify whether a series is integrated or stationary, Phillips's Peron (PP), which makes the distinction between stationary series, unit root series, and non-unit root series, is a more appropriate criterion. The results that were gathered, combined, and presented are shown in **Table 6**.

4.5. Johansen co-integration test

The task of figuring out whether there is a long-term link between the variables is made easier by Johansen co-integration. The Johansen co-integration test is applied once the variables' ideal lag time has been determined and a stationary check has been completed. When variables show a long-term link or association, the Vector Error Correction Model (VECM), also known as the VEC model, is appropriate. When there are both non-stationary I (1) and Stationary I (0) variables present, Mwananziche et al. [11] advise using the ARDL.

Among the many advantages of the ARDL model is its ability to avoid the pre-test difficulty that the typical co-integration technique provides, which requires a comparable integration [12]. It also applies to small samples. This study employed the homogeneous integration order-based Johansen co-integration test to determine whether or not the time series data are co-integrated. Other co-integration tests, such as the Gregory-Hansen test and co-integration border tests, have historically been employed in addition to the Johansen co-integration test when the order integration is not uniform to all variables.

Table 7. Johnsen co-integration test.

Null hypotheses	Trace statistics	Critical value	Max-eigen statistics	Critical value
$r = 0$	77.5522**	87.88	66.888	88.663
$r \leq 1$	57.1572**	63.55	36.666	63.88
$r \leq 2$	63.555**	33.88	99.888	87.22
$r \leq 3$	33.333**	18.88	33.885	19.88
$r \leq 4$	3.8522**	6.33	3.999**	88.99

Note: r: represents co-integrating vectors or relationships; when $\lambda trace$ and λmax tests are in conflict decision is made based on $\lambda trace$ statistics; ** indicates rejection of the null hypotheses at 5% levels of significance.
Source: Research findings, 2024.

Because the trace statics were greater than the absolute asymptotic critical values, the tests in **Table 7** reject the null hypothesis of co-integration (r = 0) against the alternative, indicating a long-term relationship between GDP, foreign aid, FDI, and trade openness. In contrast to Max-Eigen statistics, which fell below the absolute

asymptotic critical values, this showed that trade openness, GDP, FDI, and foreign assistance did not have a long-term relationship. When two statistics produce inconsistent results, the most reasonable course of action is to use trace statistics [12]. Because of this, there is a need to find trace statistics, which ultimately results in the realization that trade openness, FDI, GDP, and foreign assistance all have a consistent relationship.

4.6. Autoregressive distributed lag model for determining the nexus between foreign assistance, foreign direct investment, trade openness and economic growth in Tanzania

In this section, the result of regression analysis is presented then after that the diagnostic test is followed for the sake of testing the validity of the findings.

4.7. Determination of the relationship between foreign assistance, FDI and trade openness and economic growth in Tanzania

The ARDL statistics used to ascertain the correlation between foreign aid and Tanzania's economic development are presented in **Table 8**. Given that the *p*-value above the significance level of 0.05, it seems likely that there was no long-term effect on economic growth and foreign aid. However, the *p*-value is below the 5% significance level, indicating that there isn't a direct association between foreign aid and economic growth. The regression coefficient of –0.00410 indicates that the initial difference in foreign aid had a substantial negative impact on GDP (economic growth) in the short run; the *p*-value was also found to be below the 5% level of significance. This means that economic growth fell on average by 0.00410 percent for every percentage increase in the first difference in foreign aid. These results are not supported by the findings of Rojík et al. [13]. Studies have demonstrated a strong positive correlation between foreign aid and economic expansion. In this particular study, however, foreign aid had a negative short-term impact on growth. The fact that our study focused on middle-income nations, although the developed countries in these two studies had diverse economies, may help to explain this discrepancy [14].

According to the study's findings on foreign aid, more funding might promote economic growth by providing social amenities like power, water, and medical facilities in addition to education.

Table 8. Show the effects of public debt on economic growth in Tanzania.

	(1)	(2)	(3)
Variables	**ADJ**	**LR**	**SR**
			(0.0019)
D. Foreign assistance			0.0005
			(0.0043)
LD. Trade openness			–0.0182***
			(0.0043)
ln (Trade openness)		0.560***	
		(0.171)	

Table 8. (*Continued*).

	(1)	(2)	(3)
Variables	**ADJ**	**LR**	**SR**
Ln Foreign assistance		0.645***	
		(0.1072)	
FDI		0.0075	
		(0.0107)	
GDP		–0.0150	
		(0.0149)	
L. ln GDP	–0.240***		
	(0.0818)		
Constant			0.891***
			(0.277)
Observations	51	51	51
R-squared	0.78	0.66	0.77

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Source: Research findings, 2024.

4.8. Research hypothesis

H0: There is no relationship between foreign assistance and economic growth in Tanzania?

Findings indicated that there is relationship between foreign assistance and economic growth. These results are not supported by the findings of Younsi et al. [15]. Studies have demonstrated a strong positive correlation between foreign aid and economic expansion. In this particular study, however, foreign aid had a negative short-term impact on growth. The fact that our study focused on middle-income nations, although the developed countries in these two studies had diverse economies, may help to explain this discrepancy [15].

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5. Conclusion and recommendation

There's a risk that receiving aid from abroad may prevent rapid economic expansion. Therefore, in order to decrease the detrimental consequences that these factors impose, the Bank of Tanzania should regulate the variables that affect debt. According to the study, larger loan amounts can promote economic expansion by making it possible to meet necessities like power, water, and medical care.

The analysis's findings show that there isn't a clear relationship between Tanzania's GDP and foreign aid. The analysis came to the conclusion that the

Tanzanian government shouldn't pursue any additional short- or long-term changes to contract terms and conditions in order to achieve economic development and sustainability. The study's findings should increase our understanding of the relationship between Tanzania's national debt and economic growth.

Conflict of interest: The author declares no conflict of interest.

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Article

Developing new boutique winery businesses—Lessons from the Australian experience

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Abstract: The global wine industry has been growing strongly for many years with entrepreneurs often seeking to establish boutique wineries in new or established wine-producing regions, partly to indulge their passion for wine but also to develop successful, long-term business ventures. Within this context, Australia has successfully grown its wine industry over several decades and is now one of the world's largest wine exporters. The country is known for its robust mix of large and small wine producers and wine tourism. This paper explores key issues that should be considered by entrepreneurs contemplating new boutique winery ventures to increase their chances of business success. This is done by reviewing the general wine industry in Australia and comparing the situations of five successful smaller wine producers scattered around the country. To carry out the comparisons, the authors reviewed public promotions, customer reviews, and other materials about the case businesses and industry and interviewed proprietors as needed. A representative convenience sample of successful boutique wineries from several major Australian wine regions was chosen for review so that the whole Australian industry was covered. Based on their analysis, the authors firmly believe that boutique winery entrepreneurs must examine all aspects of the business model for their proposed venture and especially their interface with wine tourism to improve their chances for long-term growth and business success. Like most real estate investments, the location of the vineyard is critically important. Then, as well as producing high-quality grapes and wines and developing strong cellar door sales, they should also incorporate food offerings that emphasize pairing their wines with local produce. In addition, they should establish onsite "experience" focused lodging options that showcase local arts and crafts, with "glamping" style accommodations providing a particularly suitable option. These are all matters which should be considered from the very outset when the venture is initially being conceptualized and plans are being formulated for the development of the chosen property. For the sake of clarity, within this study, the term "boutique winery" refers to a wine-making facility with an adjoining vineyard.

Keywords: new winery development process; beverage management; glamping; business case analysis; wine tourism

1. Introduction

Much of the available vineyard and winery research focuses on viticulture-specific issues such as matching grape varieties to terroir and vineyard micro-climates, the infrastructure and work needed to grow high-quality grapes, how to process these grapes to make good wines, and the characteristics of good wines and how to store and transport them. All of this is core to any successful boutique winery, but this paper would look more broadly, taking the viticulture aspects of the business as a given, and

instead focus on what else is needed to make it successful. As explained in this paper, there is much to be learned about building successful boutique winery businesses from the growth and development of the Australian wine industry and successful boutique wineries already operating within it.

Therefore, this paper begins by briefly introducing Australia and its wine industry. The paper then compares five smaller wine producers located in different wine regions throughout Australia to identify common threads that underpin their success, besides the quality of the wines that they make. It concludes by recommending key issues that entrepreneurs should consider to systematically develop a new wine venture with a strong wine tourism focus to increase its chances of business success.

2. Australia and its wine industry

"Australia" [1] is an ancient, dry island continent in the Southern Hemisphere between the Pacific and Indian oceans. It is about the same size as the contiguous 48 states of the USA, has been geologically isolated for millennia, and has evolved strikingly different fauna and flora to the rest of the world. The Tropic of Capricorn cuts across the middle of the continent so that the lower half has a mostly temperate climate with moderating sea breezes around the coasts and hotter desert areas inland. The top half is more tropical. It is all relatively flat, with the highest point (Mount Kosciuszko) having an elevation of just 2228 m.

Australia was home to many smaller tribes of mostly hunter-gatherer peoples for 50,000+ years, until the British established penal colonies beginning in the 1770s (after losing their American colonies in the US War of Independence). The separate colony states within Australia became a self-governing federation of democracies at the beginning of the 20th century but it still maintains constitutional and other links to the UK. Nonetheless, since the federation of Australia has had relatively welcoming immigration policies, it now has a very cosmopolitan population of around 26 million, with citizens that have originated from almost all world countries, and 30% of its population having been born overseas [2].

Australia now has an advanced mid-sized economy (US$1.33 trillion GDP in 2020), and its major exports are minerals, oil & gas, agricultural products, education, and other services, mostly to Asia [3]. The country is heavily urbanized, with the population mostly concentrated in several cities down the eastern seaboard, but still has a reputation for open, nature-loving lifestyles and sports. Accordingly [4], Australia has the third highest average wealth/adult globally, after Switzerland and the USA. Full-time employees also normally enjoy a 38-hour working week and are entitled to 4 weeks of paid annual leave for every 12 months worked [5]. Melbourne and other major Australian cities regularly feature highly in global rankings of the world's most livable cities [6].

2.1. Wine in Australia

Early European immigrants in the 1800s established vineyards in several parts of Australia, notably the Barossa and Clare Valleys north of Adelaide in South Australia, several places around Victoria including Bendigo, and in the Hunter Valley and other areas in New South Wales. The different colonies generally encouraged wine

production to offer a supposedly less socially damaging alternative to the consumption of distilled spirits. Building on increased immigration from Southern Europe, beginning in the 1960's there were concerted government and industry efforts to increase wine production, including expanding into new production regions like Margaret River, south of Perth in Western Australia. The country is now among the world's top 10 wine-producing regions and exports large quantities all around the world [7]. For clarity, the authors have produced a map of major Australian wine regions, as shown in **Figure 1**.

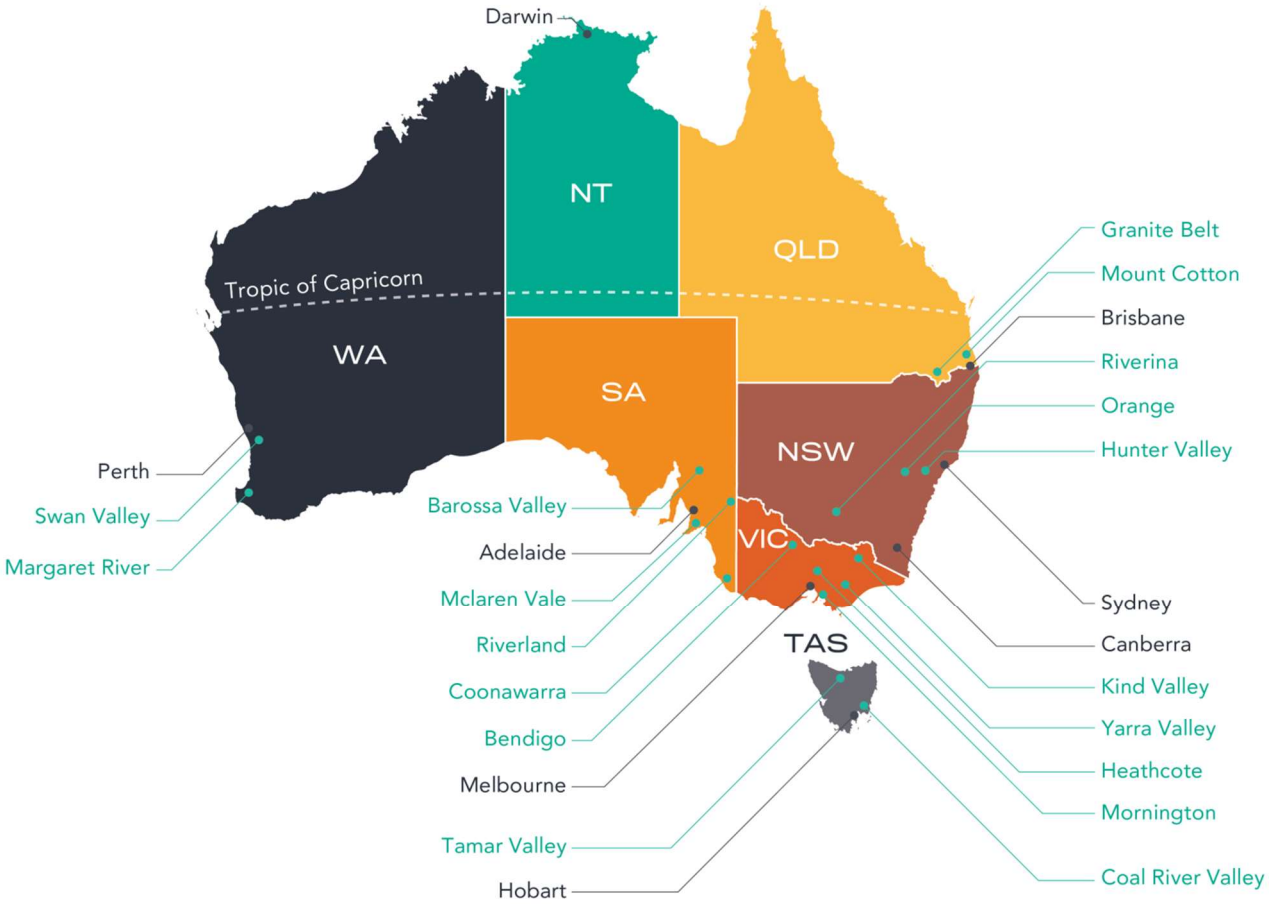

Figure 1. Major Australian wine regions.

Today, the Australian wine industry [8] is dominated by a small number of major producers, e.g., in 2021 just 46 wine grape levy payers crushed over 3000 tonnes each (and overall, about 83% of the total national wine crush), while 1247 levy payers crushed 10–3000t and 592 crushed less than 10t. The larger winery groups generally make standard "mass market" products that are widely distributed for sale both locally and internationally. These are complemented by many much smaller "boutique" producers who make distinctive products and sell through limited (and often domestic) distribution channels.

The large producers primarily make wines for export or distribution through large retail chains while the small producers rely on cellar door and domestic online sales and niche distributors. For ongoing sales, small boutique winemakers must develop

personalized customer connections, whereas large producers rely on mass marketing, branding, and widespread availability to generate sales.

In 2021 [9], there was an estimated total of 146,244 ha of vineyards in Australia operated by about 2156 wineries, along with another 6000 grape growers which mostly sell their harvested grapes to the wineries. Around 52% of these are based in South Australia, 24% in New South Wales, and 15% in Victoria. Also in 2021, around 203 million tonnes of grapes were crushed, with 27% being Shiraz, 19% Chardonnay, and 15% Cabernet Sauvignon. Overall, around 57% of the crush was red wine grapes, continuing the gradual trend towards red wines in recent years. Finally, in 2020–21, a total of about 1.5 GL of wine was made in Australia, of which about 0.4 GL was added to the total countrywide wine inventory, and about 60% of the remainder was exported. This equates to, a total of about AU$5.89 billion in sales. By volume sold, Australia's main export markets were Europe (55%), North America (26%), and Asia (14%). Australia also imported substantial quantities of wine, equivalent to 18% of local consumption.

As already noted, sales of Australian wines have grown strongly since the 1960s, both domestically and internationally. Australian wines now dominate the domestic market and are well-known and well-regarded in most major international wine markets. The Australian industry was among the first to focus on varietal wines so that customers could initially identify the grape variety taste profiles that they enjoyed and then the individual wine producers that they favored. In more recent times, as the local and major international markets have matured, the growth has slowed somewhat but growth in sales to Asia has accelerated, albeit from a relatively low base [9]. Until recent political friction led to a major drop in sales, China was a key growth market for Australian wines. Nonetheless, recent sales growth to other parts of Asia, notably Japan, Korea, Taiwan, and Singapore, have partly compensated for the drop in China sales.

A recent Australian consumer survey [10] found that the direct-to-consumer (DTC) sales volume increased by 14% in 2020–21, while value increased by 17%. During 2020–21, Victoria was in Covid Pandemic lockdown for over 4 months (July–October) and all states were affected by continuing international border closures, cross-border restrictions, and limitations on retail and hospitality activities [11]. These factors contributed to a further shift towards online purchasing, which increased by 44% in volume (on top of an increase of 50% in 2019–20); however, cellar door sales also increased: up 22% in value and 5% in volume, indicating a shift to higher value experiences and strong support from local visitors.

2.2. Wine tourism

Many holidaymakers cite experiencing food or wine as a reason for their trip, and wine tourism is growing strongly in popularity and value in Australia. During the years 2000–2006, the average number of winery visitors grew by 6% per year for domestic tourists and 8% per year for international tourists [12]. This trend has continued more recently with around 3% growth/year over the last decade.

Food and wine are becoming an increasingly important part of promoting international tourism to Australia, where market research indicates that only 26% of

prospective international visitors associate the country with good food and wine, whereas past international visitors rank Australia 2nd across 15 major markets for its food and wine experiences [13].

Generally, food and wine tourists are looking for authentic and memorable experiences in attractive natural settings, involving unique local products and services which offer good value for money. They also want to interact with knowledgeable winemakers, chefs, and service staff to enhance their knowledge of food and wine and build memories to enrich their subsequent lives [14]. They also often prefer casual in/outdoor dining and picnic areas that pair local wines with local produce. The top reasons they give for visiting a wine region are:

- scenery/natural beauty (45%).
- good/great wines/wineries (31%).
- easy access from home (30%).
- knowledgeable/ friendly people and services (16%).
- food, including local produce and restaurants (15%).
- lots of wineries/wines nearby (14%).
- and other activities/things to do (10%).

Most wine tourism studies (e.g., [13,15–18]) primarily focus on food and wine pairings and encourage restaurant developments, but rarely consider the addition of lodging and how it adds another dimension to the mix. This has supported the growth of independent restaurants in many Australian wine-producing regions, along with onsite dining where development entitlements have been available and vineyard owners have made the necessary investments. However, relatively little has been said in past research regarding wine region accommodation, especially the introduction of accommodation options within boutique wineries. Nonetheless, boutique wineries that combine cellar door activities with restaurants or cafes, plus onsite accommodation and sales of other local produce and crafts are viewed as being more successful, especially if they also include tours and open viewing of wine-making processes [16].

Wine tourism is the most established channel through which small wine producers can promote their products and develop stronger customer connections [17]. In this regard, boutique wineries should aim to build relationships with visitors who are discerning and interested in both enology and gastronomy and who want to enhance their knowledge of wine production and enjoyment. As with most marketing, retaining existing customers over time is much more cost-effective than continually acquiring new customers. For long-term customers, an immersive experience is important, including dining with local wine and food pairings, enjoying local accommodations, history and culture, and special events. Subsequent ongoing communications with winery visitors are crucial for maintaining these customer relationships and building ongoing product sales [10,19,20], along with easy product delivery.

2.3. Lodging in wine regions

Within Australia, concern for preserving the natural environment, especially in rural areas, has driven the formulation of tight development controls and carefully crafted land use plans. Development entitlements for tourism accommodations are not

easy to secure in rural areas and the regulatory approval processes can take significant time. Notably, the regulatory approvals for campsites are often much simpler. By contrast, securing entitlements for the development of standalone cafes and restaurants is often easier. The potential for indigenous land claims and objections from residents and other action groups can add further obstacles. A recent example of these challenges can be seen at the proposed AU$50 million Oscar Seppeltsfield winery hotel in the Barossa Valley which has only recently gained approval after facing extensive opposition from local residents [21].

Generally, there are many accommodation options on offer in most wine-producing regions, ranging from simple, un-serviced campsites and fully serviced caravan and motor-home sites to "glamping" tents and cabins plus motel rooms, right up to 5-star hotels. Interestingly, "grey nomads" (retired couples on extended self-driving travel holidays) are an important and relatively fast-growing part of the overall accommodation market [22]. Many grey nomads are relatively wealthy and are a good fit with the preferred wine tourist profile.

Logically, traditional hotel development is well suited to very large, well-established wineries that offer a wide range of onsite facilities, amenities, and experiences. Better still, they should be established within townships in well-known wine regions, so that the hotel can have the scale needed to attract a major brand and serve as a base for exploring the whole region. This is a very different situation to viable accommodation options within individual boutique wineries.

The business case for greatly favoring tented cabins or some other form of environmentally friendly "glamping" accommodations within boutique wineries, as against traditional hotel development is driven by several factors, e.g. [23,24]. These include the challenges associated with securing development approvals for larger scale, more permanent accommodations; the short construction timelines and relatively low costs of developing glamping accommodations; their low environmental impact and smaller carbon footprint; the ease of incrementally expanding capacity to match actual demand growth; and their portability and non-permanent nature.

Glamping accommodations offer a solution that fits in with a boutique winery environment in terms of closeness to nature and an emphasis on sustainability which will often characterize a small winery. They also cater to visitors seeking unique or immersive experiences and will, depending upon quality, generate a significant rate premium as compared to a more stereotypical hotel room. Even so, for small families, a glamping unit that comfortably accommodates 4 people will often still be a cheaper and more suitable option than two standard hotel rooms.

Because of Australia's climate, its unique landscapes and wide-open spaces, its internationally recognized outdoor lifestyles, its vibrant culinary scene, and growing wine tourism, the glamping concept has gained strong traction. It was inevitable that luxury tented cabins and similar style accommodations, with their low environmental impacts, would become a type of accommodation that resonates favorably with both Australian and international wine tourists. A search of the Internet for "glamping sites in Australia" delivers a multiplicity of websites that identify glamping projects across every state, with more and more of these sites being located within wineries.

Above all else, the cost factor is especially significant. According to recent hotel construction costs data for Australia, single or two-story motel and hotel build costs

sit at around \$3000/m^2 [24,25]. While industry data is not readily available, based on private information, the authors' ballpark estimate that the cost for comparable glamping construction is under \$1500/m^2. Moreover, because glamping structures are much lighter and do not necessitate extensive site preparation works, they can be built much faster, often in less than 40% of the time needed for a comparable traditional hotel build. Thus, the payback periods and return on investment can be much better for glamping projects, compared to traditional hotels, for similar occupancy and room rental rates.

The minimal site preparation works needed also mean that glamping units can be easily added incrementally. As well as spreading capital investments over time as funds become available, this enables available capacity to be closely matched to actual demand growth so that capital is used more efficiently. The authors believe that the incremental investment, lower construction costs, and the room rate premium that can be achieved by the experiential elements on offer, can deliver glamping accommodation payback in approximately 4 years, compared to the 10+ years usually needed for traditional hotel construction.

As an even lower-cost alternative, boutique wineries can consider serviced or unserviced campsites as onsite accommodation. These enjoy many of the advantages of glamping with even lower costs, but campsite rental rates are much lower so that the potential income stream and synergies are correspondingly lower. It may be a cost-effective strategy to initially set up campsites and then later upgrade them to glamping sites or cabins once demand has proven itself.

2.4. Establishing a boutique winery venture

While it is beyond the scope of this study to examine the financial feasibility of small winery ventures, such work carried out in the USA indicates that a winery that produces 10,000 cases was best placed to achieve economies of scale and deliver the optimal IRR (Internal Rate of Return) and the shortest payback period [24,26]. Generally, mature vineyards produce about 5t/ha/year of grapes which can be crushed to produce about 1000 cases of wine [27]. Thus, new boutique wineries should aim to have about 10 ha of vineyard.

Successfully growing grapes requires suitable land and water access. Before grape trellises can be installed and suitable grape vines planted, extensive land formation works are often necessary to set up water storage dams and access roads and sculpt the land to ensure proper drainage and good machinery access for the grapes. After planting, grapes typically take 3+ years to grow to maturity and give a harvestable yield.

A winery then also requires land formation works for foundations, etc., and building construction, along with the installation and commissioning of grape processing and wine production equipment. A major item here can be cooperage costs for wood wine storage casks [26]. Wine production also consumes a lot of water and electrical power. Wineries also generally need to incorporate significant climate-controlled wine warehousing because wine maturation is a slow chemical process and the wine from each annual crush will not be ready for sale until 1–2 years later. Note that premium wines must often be stored for longer before they can be sold. Most

vineyards/wineries also incorporate cellar door sales which require visitor parking and tasting room spaces. Virtually all boutique wineries complement their cellar door with online sales via a website.

The reality is that entrepreneurs might experience 4+ years of negative income for a new vineyard/winery, especially if they are only marketing the wine produced from their grapes. This is not a venture for the faintheartedand there is a strong business case for examining other revenue-generating opportunities while getting the new venture established, especially where the location is pristine, easily accessible, and, ideally, close to other established wineries.

Therefore, many successful boutique wineries also combine their cellar door with an onsite restaurant and some visitor lodging options, often including campsites and glamping units. Moreover, glamping style accommodations linked to some authentic local food and wine experiences (possibly with a cellar door offering other local producers' wines) can effectively "kick-start" efforts to build a customer base, well before the new vineyard/winery has its own products ready for sale. Setting up a cellar door and website, restaurants and glamping lodgings can often be done in less than 1 year, depending on the complexity and scale of the facilities.

Location remains a very important factor when establishing a small winery. Efforts should be made to strongly encourage wine sales at the winery since onsite sales are the most profitable. The site selected for the winery also needs room for the buildings required for the startup operations along with room to grow. Adequate parking space for both employees and customers must also be a consideration.

3. Comparing wine regions and smaller boutique wineries

Here we compare publicly available information regarding five smaller wine businesses and one accommodation business located in different wine-growing regions around Australia. The six businesses compared are Balgownie Estate Bendigo-www.balgownie.com/bendigo (Victoria), Bellwether Wines-www.bellwetherwines.com.au (Coonawarra, South Australia), Boydell's-www.boydells.com.au (Hunter Valley, New South Wales), Mile End Glamping-www.mileendglamping.com.au (Margaret River, Western Australia), Nashdale Lane Wines-www.nashdalelane.com (Orange, New South Wales) and Sirromet-www.sirromet.com (Mount Cotton, Queensland).

These properties were all selected because they are reasonably successful, well-known, and respected, and information about them is readily available. They are also spread among several well- and lesser-known wine-growing regions all around Australia. Most are smaller wine producers, but one operates two wineries (Balgownie) and one (Mile End Glamping) only provides lodging. Most offer food as well as wine and most provide some small-scale lodging options, but two (Balgownie and Sirromet) have larger food and lodging operations. Thus, they are representative of better Australian boutique winery businesses, cover many of the country's wine-growing regions, and have some food and lodging operations, as well as being wine producers.

For this analysis, the authors have deliberately chosen to compare properties that incorporate food and lodging options because the preceding industry analysis indicates that smaller producers should blend wine production with wine tourism to develop a

loyal customer base as well as a more sustainable business model with several complimentary revenue streams.

Collectively, this study first considers the regions and properties and their market positioning to understand what kind of guests visit them and why they want to stay. Then their scale and the facilities and the amenities that guests can expect to use during their visits are examined. After this, the study identifies the common features and unique attractions of the different properties that underpin their success. To be clear, this analysis is largely derived from reviewing publicly available information about the different case businesses.

3.1. Regional locations and market positioning

Wine growing began in the 1800s in four of the six case study wine regions (Hunter Valley, Bendigo, Coonawarra, and Orange), while one started in the 1960s (Margaret River). The last case property (Mount Cotton) is not located in a recognized wine region and is more of an entertainment destination that was established in the year 2000. Most of the regions started with livestock grazing, but three were (and still are) associated with gold and other mining (Bendigo, Orange, and Hunter Valley). Interestingly, the original wine industry in Bendigo died out in the early 1900s but was then resurrected in the 1960s as part of Australia's deliberate wine-growing expansion [28].

Overall, wine tourism is an important part of Australia's regional economies. Accordingly [12], in the year ending September 2020, 5.5 million people visited Australian wineries and overall, they spent AU$5.9 billion during their trips. This is about the same scale as Australia's core wine industry. Some 40% of these visitors were domestic day-trippers, and 51% were domestic visitors who stayed at least one night. 9% of these visitors were international tourists, which represents 12.5% of all the international tourists who visited the country. The top three wine regions visited by domestic tourists were Margaret River, Hunter Valley, and the Mornington Peninsula (on the outskirts of Melbourne). For international visitors, the top three destinations were the Yarra Valley (also outside Melbourne), Margaret River, and the Hunter Valley.

Generally, regional tourism is strongly supported by the government and businesses for all except one of the case study properties (Mount Cotton). They provide considerable information online and at local township tourist information centers and support and encourage visitors to enjoy various regional activities and experiences. They focus mostly on local food produce and dining, wine, and other drinks, lodging options, history and culture, outdoor nature and sports activities, spa & wellness, local arts and crafts, shopping, and events (especially those related to music, art, sport, culture, and food). Water-related activities are also emphasized for coastal regions (Margaret River, Coonawarra, and Mount Cotton), including coastal walks, marine animal observations, fishing, and water sports.

Regional support organizations also generally encourage children and "pet-friendly" attractions, as well as those for adult singles, couples, and larger groups of different ages and with different interests. In all cases, food and wine tourism is an important part of the offering and the different regional organizations identify many

cellar doors that people can visit, around 100 for each of Margaret River and Hunter Valley, to around 30 for each of Coonawarra and Orange, to about 10 for Bendigo, with only 1 at Mount Cotton.

Mount Cotton is a picturesque less developed area on the outer edge of Brisbane (population 2.28 million) on the way to Queensland's Gold Coast (population 650,000), a nearby well-known beach resort area. Sirromet is the only winery in the area, which was not previously known for wine tourism, but since 2000 has established itself as a cellar door with winery tours, meals (picnic areas and restaurants), and overnight stopover accommodation (campsites, tents, and cabins), plus being a wedding, corporate and cultural event destination. By 2015 it was attracting more than 300,000 visitors per year [29]. Its expansion has continued, including recently expanding its glamping offering.

The Margaret River region is around a 3-hour drive south of Perth (population 2 million) and has been developed as an urban getaway location since the 1960s. Along with whale watching, surfing, other ocean activities, nature trails, and other cultural and sporting activities, it incorporates extensive wine tourism so that there are things to do for people with all interests. Its primary focus is day-trippers and shorter-stay tourists. It received about 1.59 million visitors who stayed an aggregate of 5.67 million nights in 2021, and these were virtually all local travelers because of the COVID restrictions on inter-state and international travel. Visitation was uneven, with many more visitors during school holidays and weekends and over the summer [30].

Bendigo is a 2–3-hour drive from Melbourne (population 5.15 million) and the Hunter Valley is a comparable distance from Sydney (population 5.35 million). Both are picturesque and have longer colonial histories and early agriculture, wine-making, and mining activities. Both have rich architectural and other infrastructure dating from their earlier agricultural and mining boom periods. Both are positioned as important regional centers with many cultural, sporting, and other activities. Both are known for wineries and local produce and crafts, as well as their range of restaurants and other food outlets. Both also extensively promote regional events and festivals, and they also have extensive inventories of accommodation options. Thus, they are both well able to interest and satisfy all kinds of tourists for day trips, weekend getaways, and somewhat longer stays.

Accordingly to Destination NSW [31], the Hunter Valley region received about 8.4 million visitors who stayed for 9.4 million visitor nights and spent AU$2.3 billion in the year ended December 2021. Because of COVID, virtually all these visitors were domestic tourists, 89% came from within New South Wales, and 48% came from Sydney. While only 36% of visitors stayed overnight, they accounted for over 70% of the total tourism spending in the region demonstrating the high value of increasing visitor length of stay. Finally, 70% of the visitors came during the summer/autumn seasons. Similarly, according to a City of Greater Bendigo media release (23 January 2020), in the year ended September 2019, the region received 2.3 million day-trippers and 1.3 million overnight visitors who stayed a total of 2.6 million visitor-nights. 27,200 of the overnight visitors and 57,400 of the day trip visitors were from overseas. The release noted that a lot of effort had gone into increasing the number of visitors staying overnight. Compared to Hunter Valley, Bendigo seems to have more scope to significantly expand its regional tourism.

The Coonawarra wine growing area is famous for its Cabernet Sauvignon wines and is situated in the Limestone Coast region, which is 4+ hours' drive from Adelaide (population 1.36 million). Orange is a somewhat lesser distance inland from Sydney. Therefore, they are both more suitable for special interest visitors who plan to stay for at least a few days. Both also have a long wine history, with extensive and sophisticated wine production capacity. Both promote a full range of attractions for visitors.

According to a visitor analysis [32], the Limestone Coast region attracted 670,000 day-trippers who spent AU$125 million, in the year ended March 2021. It also saw 596,000 domestic overnight visitors who stayed for a total of 1.4 million visitor nights with an average stay of 3 nights. 77% of the overnight visitors were from South Australia. Because of COVID-related border closures, there were no international visitors. Orange is part of the Central region of New South Wales, and in the year ended December 2021, the region received 4.4 million visitors who stayed for 5.9 million room nights and spent AU$1.5 billion. 46% of visitors stayed overnight and accounted for 73% of the total spending [33].

As to be expected, each of the regions aims to attract a broad spectrum of visitors, mostly from nearer large cities. Regions that are closer to large cities (especially Bendigo and Hunter Valley) naturally have a stronger focus on day-trippers and generally seem to attract substantially more visitors. Nonetheless, as to be expected because of their higher spending on food, beverages, and lodging, overnight visitors are much preferred and highly prized in all wine regions. Interestingly, the Sirromet property, which is very close to Brisbane has a strong events and food and lodging focus as well and has also developed a golfing facility to add to its expanding amenity base. Other case study properties also focus specifically on different niche tourist groups, as discussed later, and summarized in **Table A1** in the Appendix.

All these wine regions have quite temperate climates, mostly with hot, dry summers and cooler, wetter winters (but little chance of frost) because this is the kind of climate needed to successfully grow grapes. They all have quite picturesque geography and a mix of native flora and fauna and agriculture They also have architectural and other heritage and a broad range of cultural, sports, and adventure facilities. In addition, these regions all have substantial local wine, food, and lodging industries, and all the manpower and other resources and support services needed to operate food, wine, and lodging businesses. This all means that food and wine tourism can be a relatively steady year-round activity, albeit peaking during summer holidays and long weekends.

Based on the previously noted number of cellar doors, each of the regions contains a potentially overwhelming number of wineries that can be visited (except for Mount Cotton). Wine trails are a common way of minimizing this issue. Tourism authorities typically recommend collections of several wineries to visit that are relatively close to each other and which are particularly suited for specific sub-sets of visitors, e.g., "pet-friendly" wineries that are known for their red wines. A given wine trail may also include food outlets and accommodation options.

All except one of the case study wineries are in well-known and popular wine-growing regions with extensive and strongly promoted year-round food and wine tourism. These regions offer many recreational activities for a very broad spectrum of

visitors with all kinds of interests besides food and wine. The skilled manpower and infrastructure needed to develop and operate a new boutique winery business in these regions are also well established. This maximizes the potential customer base for each property and the manpower and other support they need to operate successfully is available. Even the singleton wine property (Sirromet) is on the outskirts of a major city and so has ready access to staff and support services but had to invest more to build a range of visitor attractions.

Clearly, a new boutique winery business venture is well advised to establish itself in a better-known wine tourism region close to a major city to maximize its potential customer pool and leverage regional attractions, marketing efforts and support infrastructure. The decision on whether to locate closer to a major city and focus more on day-trippers or to be in a more remote place and focus more on longer-stay visitors should also be carefully considered. Similarly, the available tourism and other needed business support infrastructure in different potential locations should be carefully weighed.

3.2. Property facilities and amenities

The case study properties are all situated in idyllic natural areas with rolling hills suitable for grape growing and other agriculture and with abundant native and other fauna and flora. The properties range in size from 24 to 227 hectares. The specific features and amenities of the different properties are summarized in **Table A1** in the Appendix.

Looking through the table one column at a time, 5 of the 6 properties have extensive cellar doors for wine tastings and direct wine sales to the public. The Boydell's cellar door is in the nearby Morpeth Village, but all the others are onsite with both indoor and outdoor seating for around 20–50 people. Four of the cellar doors also offer regional food platters to pair with their wines and at least 4 offer picnic and/or BBQ hampers that also include wines.

Three of the properties also have an indoor/outdoor licensed casual dining restaurant onsite, while one has an indoor licensed restaurant adjacent to their cellar door in a nearby town. Outdoor dining seems to be especially important and the photo galleries for each property feature images of groups of visitors enjoying relaxed summer lunches or candle-lit dinners at large open-air tables with picturesque landscapes as their backdrop. Picnic areas also seem to be important, and at least 2 of the properties also have BBQ areas and hampers for visitors. The lodging-only property can also arrange for picnic and BBQ hampers to be delivered to their glamping sites. Two of the larger properties (Balgownie and Sirromet) also have private function rooms and promote themselves as catered venues for weddings, business, and other functions. They can also arrange live music, and one regularly hosts public concerts (Sirromet).

Two of the properties have camping sites, some with electrical power. All six properties have large glamping tents that can house 2–4 people each, ranging from 1 to 18 sites for the different properties. These are not the rustic camping tents that may come to mind, and in 5 cases they are on decks and are air-conditioned with ensuite bathrooms, and most have kitchenettes and outdoor BBQs, and sometimes outdoor

bathing and jacuzzies. Bellwether Wines makes their communal kitchen and in/outdoor guest dining and relaxation spaces a feature of the experience of staying at their property.

As well as glamping tents, two of the properties also have small numbers of cottages and more typical hotel rooms for guest stays. All the properties emphasize the natural and relaxed location of their accommodation offerings so that guests can "commune with nature" and "unwind" during their stays. Generally, because of their unusual location, the tent rates are as high or higher than comparable hotel room charges. It should also be noted that in some cases, only adults can stay on the properties (no children or pets), and one property (Mile End Glamping) limits property access for guests to well-defined roads near the stay sites.

To focus on one example, Mile End Glamping is clearly successful and popular, with rates comparable to 5-star hotel rooms. It is normally fully booked for 2–4 months in advance. In addition, it has many highly complimentary guest reviews and repeat customers who return annually. Surprisingly, there are only 2 sites on the 58 ha grazing property and the most common reviewer complaints are that they are too close together. After examining a map, the authors believe that the property could very comfortably accommodate 10+ glamping units without compromising the quality of the experience of staying there, or the agricultural productivity of the land.

At least 3 of the properties strongly emphasize romantic getaways for couples for overnight stays but most are more flexible for day visitors, and welcome singles, couples, families, and smaller groups for day visits. Some of the case properties are "pet friendly" but most are not.

To encourage visitors to spend more time at the winery, build stronger customer relationships, and increase cellar door sales, 4 of the 5 properties also offer winery tours. One also offers other tours of the property, and another offers wine-tasting courses. Three properties can also arrange vineyard picnics, and one regularly arranges "long table" lunches in their vineyard. Two of the properties can also host weddings and conferences and one organizes corporate retreats and school formals and has regular live music. For guests staying at the property, Mile End Glamping can arrange various personalized activities, including training & fitness sessions, art classes, massage sessions, scenic helicopter flights, and chauffeured winery and town tours.

As outlined in **Table A1** in the Appendix, all the case study properties have strong and sophisticated online presences, and this is clearly a crucial part of developing and maintaining the large and loyal groups of repeat customers that are undoubtedly the lifeblood of these businesses. All the case study websites give basic information about the properties and their histories, nearly always supported by extensive photo galleries and YouTube videos. For all except Mile End Glamping, home-delivered online wine sales are core website functions, in combination with wine clubs that offer discounts and special deals for regular wine purchases. In 3 cases, these are further supported by online blogs or email newsletters.

As already noted, 5 of the properties have cellar doors and 4 have full-service restaurants; all are onsite except for Boydell's Wines where the cellar door and restaurant are in the nearby Morpeth Village. All the corresponding websites provide extensive cellar door/restaurant information and enable online bookings, along with home-delivered wine purchasing. All the case study websites also describe their

lodging offerings in detail and enable online bookings for these as well. Finally, 5 of the 6 websites explain the different events and activities that will be happening on premises and enable website visitors to book their attendance; 4 of the websites also promote regional activities that their customers may be interested in. As well as their websites, all the case study properties are active on social media, especially Facebook and Instagram, and some are also active on X (formerly Twitter) and Pinterest.

3.3. Common features and attractions

Clearly, cellar door and online wine sales are the core of all boutique winery businesses and thus developing and maintaining strong and loyal customer relationships are crucial. Grape growing and winemaking in an attractive landscape that is within a recognized and popular wine-growing region is central to initially attracting potential customers. Tastings, meals, and other onsite activities are very important for getting visitors to stay on the property longer to build customer rapport. This effect is strongly enhanced by adding functional spaces and lodging options to the property.

Based on the background industry information and the cases examined here, new boutique wine ventures should target more sophisticated and wealthier food and wine aficionados because they have the discretionary spending power and desire to become wine tourists and may like to establish long-term relationships with smaller, high-quality wineries. Additionally, new wineries should consider setting up in already established wine regions where climate and terroir are already proven to help produce excellent fruit. This will also maximize the “passing trade”, which is crucial for their long-term success. New winery ventures need to have a strong online presence that includes a capability for home-delivered wine sales and subscription newsletters for upcoming events and special offers. These are good ways to maintain ongoing communications with past winery visitors.

While any of these components (grape growing, winemaking, cellar door, food, lodging, online) can be left out for a particular boutique winery business, it is very clear that they all work together synergistically to greatly enhance the chances of business success and to provide complementary revenue streams to strengthen customer relationships and business resilience. Combining these revenue streams can also greatly reduce the time till initial income is generated by the venture.

Where possible, it seems best to concentrate all business activities at a single site to strengthen brand identity and give more reasons for repeat visits by customers. Where Boydell’s chose to split the vineyard/winery from the cellar door/restaurant, it located the latter in a historic town to maximize visitor traffic. Once it has built initial relationships with customers Boydell’s then offers them private tours and related vineyard/winery activities.

Having a range of food offerings from platters and picnic and BBQ hampers to full meals in attractive indoor and especially natural outdoor locations seems to be a particularly good way of showcasing food and wine pairings and getting visitors to stay longer and become friendly with staff. Bellwether Wines seems particularly adept at this by adding a market garden, bread-making and winery tours, regular guest gatherings, and communal wine-paired meals. The catered function spaces for

weddings and other events and regular music concerts offered by Balgownie Estate and Sirromet also add another important dimension to onsite customer experiences.

Glamping accommodation and other lodging options add a further valuable complementary revenue stream that can be very attractive for many visitors. However, it seems unwise and limiting to unduly focus on romantic getaways, as some of the case study properties do, and restrict access for families with children. The common caveat against pets also seems overly restrictive in some cases. Provided there are suitable vendors nearby, the range of additional personal guest services offered by Mile End Glamping seem very worthwhile (and range from food hampers to personal chefs, fitness trainers, art lessons, scenic helicopter flights, and chauffeured winery and town tours).

For small wineries that are located further from major population centers, accommodation is an especially important onsite amenity. In this context, glamping tents and cabins provide a cost-effective means for adding high-quality accommodation at a fraction of the cost of traditional boutique hotel or bungalow construction, with the ability to scale up in line with growing demand and as investment funds become available.

The very small number of glamping sites at some of the properties is puzzling. More sites would not impact vineyard/winery operations and would significantly increase economies of scale to lower proportional operating costs and increase revenues and wine sales synergies.

Some readers may question combining grape and wine production with food and beverage sales and lodging because it increases business complexity and risk and dilutes business focus. However, the authors strongly argue that the combination of functions and other activities with food and beverage and lodging has been normal practice in the hotel and hospitality industry for centuries. This amply demonstrates that the benefits deriving from the synergies between these business elements far outweigh the additional complexities and risks in most cases. It is a matter of suitably structuring the organization and partitioning responsibilities. Many vineyards/wineries already draw on specialist consulting and other expertise for managing their grape and wine production activities and can adopt similar strategies for their wine sales and food and beverage and lodging operations.

4. A process for developing a boutique winery business

Based on the preceding Australian wine industry and case analyses, the authors believe that entrepreneurs should initially devote considerable efforts to conceptualizing the mature operating scope and scale of their proposed boutique winery business. Resources to implement their vision should only be deployed after it has been fully crystallized and analyzed for financial and economic feasibility.

To guide this initial analysis and introspection, this study proposes the generic business model for a boutique winery business shown below in **Figure 2**. The foundation of this model is the geographic location, topology, flora, and fauna at the location for the proposed business, along with the proposed agricultural, building, and other infrastructure to be built on it. Closely related to this is the online presence of the proposed business as the major conduit for marketing it and managing customer

orders for the products and services that it will provide. Making use of all this, four major business lines should be common, in varying degrees, to all successful boutique winery businesses. Foremost among these are the growing of grapes, the production of wines, and the sale of these (and other) products through the cellar door, online, and distributors. Supporting and complementing wine production and sales, many boutique wineries will also have lodging and food operations. Finally, every boutique winery business must clearly define its preferred customer audience and tailor its product and service offering to meet the specific needs of this customer base.

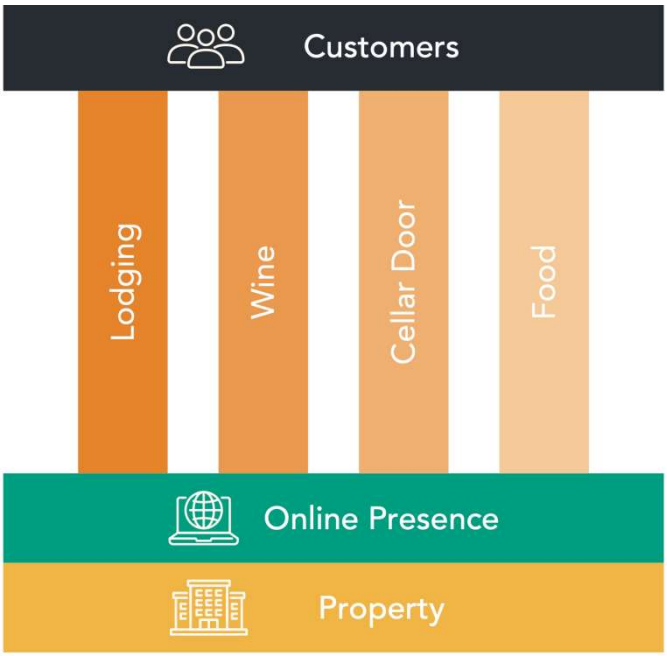

Figure 2. A general boutique winery business model.
Source: Dean et al. (2022).

The timelines needed to establish the different potential business lines for boutique wineries must also always be borne in mind. After planting, it generally takes at least 3 years for a vineyard to start producing harvestable crops, and then the first wines produced need to be aged for at least 1–2 years before they are ready for sale. To be prudent, entrepreneurs should assume a 5-year period from initial planting to first own wine sales. By contrast, licensing for straightforward cellar doors and food sales might take around 6 months. Then construction of the supporting facilities may take another year, so that income from food and beverage sales can often be achieved within 18 months of initiating the project. Lastly, licensing for a camping operation may take about 1 year, but for a permanent onsite hotel, the licensing approval may take several years if it can be obtained at all. Constructing camping facilities may take 6 months, depending on scale, but construction of even a small hotel can take well over 1 year. Thus, entrepreneurs should allow 18 months for the development of an onsite camping facility, but possibly 4 years for a small hotel development. The implementation sequencing and scale of these different potential business lines will have a major impact on the timing and scale of the investments to establish the proposed business and their subsequent corresponding income streams.

The business location will always somewhat constrain the chosen market segment to be served and this will in turn shape and guide the emphasis and focus of the products and services offered and thus the investments in facilities and equipment needed to establish the business and to develop it over time as the market situation evolves.

All these concerns should be thoroughly considered when initially conceptualizing any proposed new boutique winery business. The outcome of this analysis should be a clear and comprehensive long-term vision for the mature and complete business and the development pathway that should be followed to achieve this vision. This conceptualization must incorporate a strong understanding of the risks that may be faced along the way and how these can be minimized.

Having specific and achievable end goals, along with a clear plan for how to achieve them is widely accepted as a key approach to minimizing the risks in successfully completing any project. This approach minimizes the chances of missteps and rework as the project proceeds, which is a major cause of project time and cost overruns. For example, the last thing you want to be doing as you develop a new boutique winery is planting your vineyard and some time (possibly a few years) later deciding that it should be moved so you can build an onsite restaurant in its current location.

The following sub-sections consider the major issues and risks that should be addressed when first conceptualizing a new boutique winery business based on the preceding analysis of the Australian wine industry and the existing successful case businesses.

4.1. Regional location and customer positioning

As explained in the earlier industry and case analyses, boutique wineries need to focus their marketing on attracting customers who are not well served by large mass-market wine producers, i.e., attract and develop longer-lasting relationships with wealthier and more discerning customers, who are passionate about expanding their knowledge of wine and food. If these relationships can be developed, the winery should enjoy repeat sales to these customers. Moreover, boutique wineries should prioritize attracting domestic rather than international customers. It is easier to maintain ongoing relationships with the domestic market, who are more likely to become repeat visitors to the winery. In addition, product delivery to them is quicker, simpler, and less expensive (especially when international tax and import regimes are considered).

Generally, what might be termed “edutainment”, is important for this kind of boutique winery customer. Getting to know the local wines and how they are produced becomes both educational as well as entertaining. The same is true when considering local foods that can be paired with wines. Often, local craft and nature activities can add an even further dimension for engaging with customers. Suitable target customers generally value all these experiences, especially when interacting with the winery owners and winemakers. The more unique and memorable the specific experiences that customers can associate with the winery, the more they will be persuaded to

purchase its products and services, and the more likely they will be to return for repeat visits.

The importance of pairing the wines on offer with food should not be underestimated. The same is also true for accommodation, especially for boutique wineries further from major cities. Regional support for tourism is very important and should be another important factor considered when deciding where to locate a new boutique winery business and the full range of products and services to be offered.

Many demographic groups fit within the umbrella of nature-loving, domestic food and wine aficionados. These can include independently traveling retirees and other couples, families with children, and individuals and groups of friends on holiday. As for most new business development planning, boutique winery businesses are well advised to focus their efforts on specific demographic groups and tailor their product and service offerings accordingly.

4.2. Grape growing and wine production

As the industry analysis and successful cases make clear, boutique wineries usually involve multiple coordinated land uses. As noted earlier in Section 2.4, for grape growing and wine production there are many detailed technical issues related to grape selection and planting and the associated land formation, water management, machinery access, winery construction works, and so on. These are all very technical and specialized matters and expert advice should be sought to help with all these decisions. Nonetheless, the actual vineyards and winery may only occupy a minor part of the entire property.

It should also be recognized that some vineyards do not actually incorporate a winery, and simply sell their grape harvests to other producers. Moreover, there is nothing to prevent a vineyard from having a cellar door that sells wines from several different local wineries, and also having food & beverage outlets, and lodging.

For wine, there is a substantial initial investment to carry out land formation works and to plant the grape vines. Another substantial investment is needed to build and fit out the winery if this is part of the concept for the venture. There is little returning income until the grapevines are mature which can easily take 3+ years. If bulk grapes can be purchased, wine production can begin before the onsite grape vines mature. However, it still takes 2+ years to set up production and build a wine inventory.

Taking the viticulture and grape harvest processing and wine production and storage concerns as a given, other overall business issues should be considered. Vineyard and winery tours are usually important for increasing customer engagement and support for the business and these should be considered as part of the design and implementation. Similarly, it may be important to also incorporate attractive outdoor dining and restaurant facilities and visitor accommodation options near the vineyards and wine-making facilities. Finally, there may be other related onsite agricultural activities, such as olive groves, restaurant market gardens, herb gardens, and animal grazing that need to be incorporated. Generally, all these considerations should form a coherent whole.

4.3. Wine and related sales

For most boutique wineries, cellar doors and online sales of their own wines are key long-term lines of business. They may also sell through niche distributors, but this is often less desirable because of the additional direct and indirect selling costs.

Nonetheless, it is increasingly popular to use wine-making wastes to also make and sell distilled spirits. Similarly, olive groves and olive oils can be a good complementary business line that can increase the utilization of farm labor and processing equipment. In some circumstances, beers and ciders may also be made and sold. Finally, it is very reasonable for a boutique winery to also sell products from other producers. The Wild Dog Estate [23] is a good example of a comprehensive boutique winery that incorporates several different complementary business lines.

It can easily take several years for a new boutique winery to develop a good quality range of wines. Thus, to establish an initial market presence and the required logistics infrastructure, a very good strategy for a new boutique winery can be to begin by selling known wines and other related products sourced from nearby producers. Then selling their wines and other products once they are established and proven.

The entrepreneur proposing to establish the business should properly evaluate the desired long-term range of products to be sold–in-house wines, outside-sourced wines, spirits, olive oils, and so on. This will depend on many factors, including regional expertise and capabilities, land suitability, and potential market scale and customers. The availability of funding and the timing and extent of the needed investments to establish the different products will also affect the decision-making.

Nonetheless, to avoid rework and missteps, the entrepreneur should make initial land use allocations for all the facilities needed to support all of the potential products at the beginning, and then plan the sequence of work and investments and the timeline to establish the full range within a practicable timeframe. This means that locations for all potential vineyards, olive groves, and other agricultural plantings should be decided, along with any associated land formation works (access roads, water storage dams, irrigation lines, etc.). Similarly, placements for all the harvested plant processing equipment must also be decided, along with suitably located product storage facilities. Then decisions can be made regarding the sequence for completing the works, depending on the availability of funding and desired production establishment project deadlines.

It should also be borne in mind that successful onsite sales imply significant traffic to the cellar door so the parking and sales facilities should be located near to a major road to be easily visible. The facilities should also be attractive and inviting for target customers and adequate wayfinding and signage are also important. Cellar door sales are crucial for building the winery's customer base and the focus should be on acquiring repeat customers with high discretionary spending power.

4.4. Food offering

Clearly, from the Australian wine tourism industry analysis and the case studies, food should be a natural complement to wine sales for all boutique wineries and should be an important revenue generator for them. As well as direct sales, pairing food with wine gives winery visitors a strong reason to spend more time at the property and build

stronger relationships with the business, thus increasing the probability of repeat visits and stronger future sales. The investments and returns for food sales are lower than for setting up grape and wine production, but the incremental returns arrive much quicker and will increase individual customer spending (thus reducing proportional marketing costs), and synergistically stimulate wine sales.

Moreover, there is a natural progression from the provision of carry-out food and picnic hampers through to outdoor/indoor casual and fine dining, where increased investment positively correlates with increased spending per customer. To minimize risk and to cost-effectively build paired food and wine sales, the best strategy is to begin by offering tasting platters and carry-out picnic hampers because these involve minimal kitchen, food storage, and dining space investments. Then once demand has proven itself; further kitchen, storage, and seating space investments can be incrementally made to support onsite picnics, BBQs, and outdoor dining events. Finally, further investments can be made to establish outdoor/indoor casual dining restaurant spaces; depending on demand these may sometimes be further complemented by food and wine paired fine dining. These investments can be paced and staged to match growth in actual demand and the progressive development of business expertise in these areas.

Whatever the food offerings, the preceding industry and case analysis indicate that the boutique winery should emphasize the inclusion of local produce and pair its wines with the food it has on offer. Where appropriate, the winery should also feature local arts, crafts, and toiletries, to maximize the resonance between the property and the wider region. Most visitors will value and appreciate the added uniqueness and wish to support local industries. The authors believe that stylish and picturesque outdoor eating spaces are important for boutique wineries because they are symbolic of the relaxed, sophisticated lifestyle they want to project to customers. All onsite catering should focus on high-quality, locally sourced products, and should offer good service and value to attract discerning, high-income customers.

Prudent boutique winery entrepreneurs will initially decide their long-term food offering goals when envisioning their proposed new business. They should conceptualize the fully established and mature paired wine and food offerings for the business and then identify their best strategy for progressively implementing this vision. To minimize risks, this strategy should phase investments in lockstep with the achievement of specific and measurable sales goals and the business reaching specific capability milestones.

4.5. Guest accommodations

Especially for boutique wineries further from major cities, accommodation is a very important attraction for repeat customers. More remote properties are more likely to attract dedicated food and wine aficionados who want to stay longer, learn more, and develop closer relationships with their hosts. For these customers, attractive onsite accommodation can be very important. Current drink-driving laws also mean that many customers visiting boutique wineries close to their home city can still very much like the option to stay overnight after a longer food and wine-paired meal. The

preceding industry and case study analyses clearly indicated the high value that longer-staying repeat customers bring to all boutique winery businesses.

Thinking about onsite accommodation there is a natural progression in the sophistication and the cost and time needed to develop the facilities. There are also definite trends in the potential profitability of these facilities. Finally, different customer profiles for the proposed business can have very different preferences, such as extended self-directed travel with a caravan or motorhome is very popular among recent retirees, and serviced campsites are often their preferred choice.

In particular, the simplest, easiest, and least expensive option is unserviced campsites, i.e. just access roads to designated sites where visitors can pitch and use their own tents for a relatively small fee. These often do not require licensing, and the land formation work and other support infrastructure are also minimal.

Next in difficulty are serviced campsites, followed by glamping tents and cabins. Serviced campsites add water, electricity, and possibly, sewage and Internet connection points at the sites, often along with shared bathrooms, washing, and food preparation facilities. They require licensing (which is relatively easily obtained) and the land formation work, utilities, and other infrastructure are significantly more complex than for simple unserviced campsites.

Glamping tents and cabins are facilities semi-permanently located at serviced campsites and rented to visitors, and they are often quite glamorous with good amenities. The licensing for glamping tents and cabins is somewhat more difficult than serviced campsites, and the land formation work, utilities, and other infrastructure are comparable, but there is the added cost of the tents and/or cabins. Many food and wine tourists are nature lovers, making staying in environment-friendly accommodations very attractive. Off-site modular construction also enables the relatively easy construction of such facilities [34].

The most expensive and complex option is a full-service hotel, with all its expected facilities and services. Glamping tents and cabins are significantly less expensive to get licensed and built than traditional hotels. They are also much less expensive to operate because they rarely provide the typical hotel concierge, daily cleaning and turn-down services, meals, etc. Nonetheless, because of their more exotic nature, glamping tents and cabins can often be rented for higher rates than equivalent traditional hotel rooms making them substantially more profitable.

Logically, a good strategy for a new boutique winery is to start by setting up several unserviced campsites. Then as demand increases, further sites can be added and/or progressively upgraded to become serviced campsites and then glamping tents or cabins. In some circumstances, it may be desirable to eventually upgrade some glamping tents and cabins to become a full-service hotel, but this is likely to be quite rare. The added licensing difficulties and higher construction and operating costs, along with minimal increases in room rental rates, typically make onsite hotels difficult to justify for boutique wineries.

Given this progression, it is very prudent for a boutique winery entrepreneur to envision the mature business mix of unserviced and serviced campsites and glamping tents and cabins (and possibly a hotel) from the outset. The distribution of the final accommodation units around the property and the accompanying land formation works and supporting facilities can be planned in their entirety. The integration of

accommodation with the other land uses on the property can also be fully considered. Then, the implementation of all the accommodation elements can be phased and staged to match actual demand growth and the availability of funds with minimal rework and missteps. As is well known in the construction industry, it is very inefficient and expensive to initially put facilities in place and then have to later remove and replace them with others.

4.6. The property and online presence

Maximizing onsite attractions is very important for attracting new customers and encouraging them to repeat their visits. Thus, other onsite events and activities can complement the cellar door, food, and lodging at boutique wineries that should also feature local arts, crafts, and toiletries to emphasize the regional connection. Most customers will appreciate the local connection, and many will want to get unique local mementos of their stay. The types of events and activities to further immerse guests and give reasons for repeat visits, might (non-exhaustively) include:

- Music concerts.
- Showcases of local arts and crafts within a well-designed onsite gallery.
- Fine dining events.
- Weddings and other celebrations.
- Winery tours, fruit picking, and cooking classes.
- Walking and/or biking tracks.
- Petting zoos for domesticated animals and wildlife
- Onsite Spa using local ingredients and treatments if demand exists.
- Wellness and exercise spaces.
- Ziplines and/or other sports spaces (paintball, laser clay pigeon shooting, and so forth).

Yet again, the entrepreneur should consider all this when initially envisioning the mature business and planning for its establishment and evolution. In this, land use allocations are key.

An online presence that is sophisticated and extensive should be a major feature of all new boutique winery ventures. Their websites should contain extensive information about their businesses. Most should also provide subscription-based online wine sales, and email newsletters with promotions to maintain personalized contact with customers. Convenient online bookings and purchases for all the winery's products and services must also be possible, along with moderated customer reviews. A strong online presence is clearly a crucial part of developing and maintaining a boutique winery's customer base. A large, loyal group of repeat customers is the lifeblood of such businesses. Again, the nature of the whole mature business should be considered in the website design from the outset. Then it can be progressively implemented in line with the actual development of the different business lines.

5. Conclusions

This paper has briefly reviewed the development of Australia's wine industry and the position and role of successful boutique wineries within it. Importantly, wine tourism is growing and is now an increasingly important element of the global wine

industry. Ideally, wine tourism pairs wine with food and lodging to create more comprehensive, attractive, and memorable experiences for participants. It is a vital element of the business model for smaller wine producers because it is one of their primary channels for developing a loyal and growing customer base. In this way, food and lodging are nearly always very important complementary business lines, in addition to the core wine production and sales. Additionally, and very importantly, they help to diversify and de-risk the business by developing complementary income streams. It also greatly strengthens and expands the regional economies that underpin the viability of individual local wine businesses.

To maximize their business potential, boutique wineries should combine wine production and both online and distributor-based wine sales with strong food, lodging, and other wine tourism activities. Luckily, there are natural progressions in the development of a new boutique winery so that investments can be made incrementally over time to "test the waters" as anticipated market demand proves itself and the business evolves. These investments can be paced to the growth and maturity of the business and can be at least partially funded from initial revenues to lower the overall financial burden on the entrepreneurs backing the venture.

To minimize risk and avoid too many missteps and backtracking, it is crucial that boutique winery entrepreneurs thoroughly consider and fully crystallize an overall vision for the entire mature business at the very beginning. In this way, the business can be systematically developed according to a well-considered master plan and not evolve chaotically, based on random observations and whims.

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Appendix

Table A1. Summary of the case study properties.

Property	Cellar door	Food & beverage	Lodging	Other attractions	Target customer	Online presence
Balgownie Estate Bendigo www.balgownie.com/bendigo/ 33ha vineyard/winery 2-3 hours driving from Melbourne	• book or walk-in • onsite in/out door seating • wine tastings/sales • snacks and regional tasting platters	• in/out door restaurant • meals focused on regional produce • catered private functions (events & weddings) • picnic hampers	**10 x Bell Tents (single/ twin)** • private deck • air-conditioning **5 x Safari Tents** • private deck • air-conditioning • ensuite & kitchenette • deck tub **7 x Hermitage Rooms** • standard/deluxe • air-conditioning • ensuite • communal kitchen • communal lounge **2 x Cottages** • air-conditioning • ensuite (with spa) & kitchenette • living area	• winery tours • weddings • conferences • vineyard picnics	• romantic getaways • singles, couples, families & small groups • child friendly • pet friendly • free property access	• wine sales • wine club (purchase discounts) • promote and book onsite activities • promotion of regional activities • facebook, instagram, twitter • youtube videos
Bellwether Wines (Coonawarra) www.bellwetherwines.com.au 4 hours driving from Adelaide	• book or walk-in • onsite in/out door seating • wine tastings/sales • snacks and regional tasting platters • picnic hampers	• in/out door restaurant • meals focused on regional produce • picnic & BBQ hampers • catered meals	**6 x Campsites** • some powered **6 x Bell Tents** • Communal kitchen & living areas • Communal shower block	• winery tours • garden tours • bread making • guest gatherings	• singles, couples, families & small groups • child friendly • pet friendly • free property access	• wine sales • wine club (purchase discounts) • promote and book onsite activities • facebook, instagram, twitter • youtube videos
Boydells Vinyard (Hunter Valley) www.boydells.com.au 80ha vineyard/winery 2-3 hours driving from Sydney	• book or walk-in • offsite in Morpeth village • indoor seating • wine tasting/sales	• indoor restaurant • offsite in Morpeth village • meals focused on regional produce	**1 x Safari Tent** • private deck • air-conditioning • ensuite & kitchenette • partly covered deck with BBQ	• vineyard "long table" lunches • vineyard picnics	• romantic getaways • no children • no pets • free property access	• wine sales • wine club (purchase discounts) • promote and book onsite activities • facebook, instagram • email newsletter
Property	**Cellar door**	**Food & beverage**	**Lodging**	**Other attractions**	**Target customer**	**Online presence**
Mile End Glamping (Margaret River) www.mileendglamping.com.au 58ha livestock farm 3 hours driving from Perth		• For lodging guests only • picnic & BBQ hampers • catered meals	**2 x Geodesic Domes** • air-conditioning • ensuite • kitchenette • living area • partly covered deck with BBQ and jacuzzi	• personal training & fitness • private art classes • massage • scenic helicopter flights • chauffeured winery and town tours	• romantic getaways • no children • no pets • very limited property access	• gift vouchers • promote and book lodging and onsite activities • promotion of regional activities • photo gallery and youtube videos
Nashdale Lane (Orange) www.nashdalelane.com 24ha vineyard/winery 4+ hours driving from Sydney	• book or walk-in • onsite in/out door seating • wine tastings/sales • snacks and regional tasting platters • no pets inside		**2 x Tents** • air-conditioning • ensuite • kitchenette • deck with BBQ		• romantic getaways • no children • no pets • free property access	• wine sales • wine club (purchase discounts) • promote and book onsite activities • selected promotion of regional activities • facebook, instagram, pinterest • photo gallery and youtube videos • email newsletter

Table A1. (*Continued*).

Property	Cellar door	Food & beverage	Lodging	Other attractions	Target customer	Online presence
Sirromet (Mount Cotton) www.sirromet.com 227ha vineyard/winery 1 hour driving from Brisbane	• book or walk-in • onsite • in/out door seating • wine tastings and sales • snacks and regional tasting platters	• in/out door restaurant & cafe • function rooms • meals focused on regional produce • catered private functions (events & weddings) • picnic hampers	**40 x caravan sites** • no facilities/power **18 x Pavilion Tents (single/twin)** • air-conditioning • ensuite • kitchenette • deck with BBQ **2 x Cottages** • air-conditioning • ensuite • kitchenette • deck with BBQ	• winery tours & wine tasting courses • weddings • conferences • vineyard picnics • corporate retreats • school formals • music concerts	• romantic getaways • singles, couples, families & small groups • child friendly • pet friendly • free property access	• wine sales • wine club (purchase discounts) • promote and book onsite activities • extensive promotion of regional activities • facebook, instagram, twitter • photo gallery and youtube videos • blog posts

Property	Cellar door	Food & beverage	Lodging	Other attractions	Target customer	Online presence
Balgownie Estate Bendigo www.balgownie.com/bendigo/ 33ha vineyard/ winery 2-3 hours driving from Melbourne	• book or walk-in • onsite in/out door seating • wine tastings/sales • snacks and regional tasting platters	• in/out door restaurant • meals focused on regional produce • catered private functions (events & weddings) • picnic hampers	**10 x Bell Tents (single/twin)** • private deck • air-conditioning **5 x Safari Tents** • private deck • air-conditioning • ensuite & kitchenette • deck tub **7 x Hermitage Rooms** • standard/ deluxe • air-conditioning • ensuite • communal kitchen • communal lounge **2 x Cottages** • air-conditioning • ensuite (with spa) & kitchenette • living area	• winery tours • weddings • conferences • vineyard picnics	• romantic getaways • singles, couples, families & small groups • child friendly • pet friendly • free property access	• wine sales • wine club (purchase discounts) • promote and book onsite activities • promotion of regional activities • facebook, instagram, twitter • youtube videos
Bellwether Wines (Coonawarra) www. bellwetherwines.com.au 4 hours driving from Adelaide	• book or walk-in • onsite in/out door seating • wine tastings/sales • snacks and regional tasting platters • picnic hampers	• in/out door restaurant • meals focused on regional produce • picnic & BBQ hampers • catered meals	**6 x Campsites** • some powered **6 x Bell Tents** • Communal kitchen & living areas • Communal shower block	• winery tours • garden tours • bread making • guest gatherings	• singles, couples, families & small groups • child friendly • pet friendly • free property access	• wine sales • wine club (purchase discounts) • promote and book onsite activities • facebook, instagram, twitter • youtube videos
Boydells Vinyard (Hunter Valley) www.boydells. com.au 80ha vineyard/ winery 2-3 hours driving from Sydney	• book or walk-in • offsite in Morpeth village • indoor seating • wine tasting/ sales	• indoor restaurant • offsite in Morpeth village • meals focused on regional produce	**1 x Safari Tent** • private deck • air-conditioning • ensuite & kitchenette • partly covered deck with BBQ	• vineyard "long table" lunches • vineyard picnics	• romantic getaways • no children • no pets • free property access	• wine sales • wine club (purchase discounts) • promote and book onsite activities • facebook, instagram • email newsletter

Table A1. (*Continued*).

Property	Cellar door	Food & beverage	Lodging	Other attractions	Target customer	Online presence
Mile End Glamping (Margaret River) www. mileendglamping. com.au 58ha livestock farm 3 hours driving from Perth		• For lodging guests only • picnic & BBQ hampers • catered meals	**2 x Geodesic Domes** • air-conditioning • ensuite • kitchenette • living area • partly covered deck with BBQ and jacuzzi	• personal training & fitness • private art classes • massage • scenic helicopter flights • chauffeured winery and town tours	• romantic getaways • no children • no pets • very limited property access	• gift vouchers • promote and book lodging and onsite activities • promotion of regional activities • photo gallery and youtube videos
Nashdale Lane (Orange) www. nashdalelane.com 24ha vineyard/ winery 4+ hours driving from Sydney	• book or walk-in • onsite in/out door seating • wine tastings/sales • snacks and regional tasting platters • no pets inside		**2 x Tents** • air-conditioning • ensuite • kitchenette • deck with BBQ		• romantic getaways • no children • no pets • free property access	• wine sales • wine club (purchase discounts) • promote and book onsite activities • selected promotion of regional activities • facebook, instagram, pinterest • photo gallery and youtube videos • email newsletter
Sirromet (Mount Cotton) www.sirromet. com 227ha vineyard/ winery 1 hour driving from Brisbane	• book or walk-in • onsite • in/out door seating • wine tastings and sales • snacks and regional tasting platters	• in/out door restaurant & cafe • function rooms • meals focused on regional produce • catered private functions (events & weddings) • picnic hampers	**40 x caravan sites** • no facilities/ power 18 x Pavilion Tents (single/ twin) • air-conditioning • ensuite • kitchenette • deck with BBQ **2 x Cottages** • air-conditioning • ensuite • kitchenette • deck with BBQ	• winery tours & wine tasting courses • weddings • conferences • vineyard picnics • corporate retreats • school formals • music concerts	• romantic getaways • singles, couples, families & small groups • child friendly • pet friendly • free property access	• wine sales • wine club (purchase discounts) • promote and book onsite activities • extensive promotion of regional activities • facebook, instagram, twitter • photo gallery and youtube videos • blog posts

Source: Whitfield, 2022.

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Article

The European Union toward a green economy: Current situation and perspective in the use of renewables for electricity generation

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Abstract: The European Union (EU) is making significant progress in its energy transition strategy, positioning itself as a global leader. The use of renewable energy sources for electricity generation is increasing yearly. In 2012, the share of renewable electricity in gross electricity consumption in the EU was 24.1%. This figure rose to 38% in 2020, overtaking fossil-fired generation for the first time, which fell to 37%. In 2021, the EU produced 4032.5 TWh using all energy sources. Renewable energies generated 1670.4 TWh or 41.4% of the total. Conventional and nuclear energy sources produced the remaining 58.6%. In the coming years, conventional energy sources are expected to generate less electricity than renewable and nuclear energy sources. In the coming years, solar and wind energy will remain the two main renewable energy sources for electricity generation in the EU. The EU's energy transition is a concern and a key apprehension for the European Commission (EC), which strives to ensure sustainable, secure, and reasonable energy prices in the coming years. In February 2015, the EC set out its energy strategy, focusing on five key areas: Energy security, solidarity, and trust; a fully integrated European energy market; Energy efficiency contributing to moderation of demand; decarbonizing the economy; research, innovation, and competitiveness.

Keywords: renewable energy; fossil fuels; electricity generation; European Union; green economy; energy transition

1. Introduction

The EU comprises 27 continental European countries. These countries are Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden (see **Figure 1**) with a population exceeding 500 million. The EU is undergoing a historical energy transition driven by increasingly strong decarbonization policies and quick low-carbon technology developments. The Paris Agreement marked a major step forward in global efforts to address global warming. For the first time, developed and developing countries committed to act in order to limit global average temperature increase to well below 2 ℃ and to pursue efforts to further limit this to 1.5 ℃ above pre-industrial levels [1].

One of the European Commission's (EC) main concerns is the EU's energy problems associated with the transition to ensure sustainable and secure energy at reasonable prices. In February 2015, the EC set out its energy strategy to ensure the EU can deal with an energy crisis in the coming years. The strategy focuses on five key areas: Energy security, solidarity, and trust; a fully integrated European energy market; Energy efficiency contributing to moderation of demand; decarbonizing the economy; and research, innovation, and competitiveness. In 2016, the EC presented a

package of legislative proposals called 'Clean Energy for all Europeans' to translate the strategy adopted into reality. The EC's proposals were discussed within the Council and at the European Parliament, and negotiations started in 2017. By May 2019, all legislation in the package was adopted [2].

Figure 1. Member state of the European Union.
Source: ai.inspiredpencil.com.

On 18 May 2022, the EU explained, as part of the REPower EU Plan, how it would support energy transition to ensure sustainable, secure, and affordable energy [3].

This article describes the current participation and perspective of the different renewable energy sources within the EU's energy mix and, based on the information offered, suggests their future participation in a green economy.

2. Research method

A review of the published literature was conducted to prepare this paper, which provides the reader with the most relevant updated data and information on the EU energy transition from a society based on burning fossil fuels for electricity generation to a green economy using different renewable energy sources for the same purpose.

The methodology used to prepare the manuscript is the "Historical-Logical Method." This method allows the author to describe the facts through their logical development.

3. Discussion

3.1. Key elements of the 2030 European Commission on energy policy

According to IMEDIA [4], the cornerstones of the 2030 EU's energy and climate policy are the target of a 40% reduction in emissions compared to 1990 levels in each Member State, a binding EU-wide target for using renewable energy for power production, transforming its current energy system into a more competitive, secure, and sustainable energy system; a new power policy considering energy efficiency as a key factor in achieving all the objectives of the new policy; and a set of key indicators to assess ongoing progress and provide a factual basis for possible policy responses.

The 2030 EC Energy Policy suggests a new policy based on national plans to ensure a competitive, secure, and sustainable energy supply, drawing from the guidelines provided by the EC.

3.2. Primary energy production in the European Union

Primary energy production within the EU in 2022 accounted for 23,566 petajoules (PJ), 5.9% lower than in 2021. Primary production increased for solid fossil fuels but decreased for oil, natural gas, and renewables from 2021 to 2022. In the case of renewables, this is an exception in its long-term increasing trend. Renewable energies accounted for the highest share in primary energy production in the EU in 2021 (43.2%), followed by nuclear energy (27.6%), solid fossil fuels (16.4%), natural gas (6.2%), oil and petroleum products (3.3%), and non-renewable waste (2.4%). Over the past decade (2012–2022), the trend in primary energy production was generally negative for solid fossil fuels, oil, natural gas, and nuclear energy. Natural gas production saw the sharpest decline (−64.9%), followed by solid fossil fuels and oil and petroleum products (with a drop of 38.7% and 38%, respectively). The production of renewable energies followed a clear positive trend over the same period, with a 32.6% increase, similar to waste (non-renewable), which saw a 22.3% increase [5].

3.3. Final energy consumption in the European Union

Final energy consumption in the EU in 2022 was 37,771 PJ, 3.9% less than in 2021. Final energy consumption slowly increased from 1994 until it reached its highest value of 41,447 Mtoe in 2006. By 2022, it had decreased from its peak level by 8.9% [5]. It is important to note that the final energy consumption was 1.6 times the EU's primary energy production. **Figure 2** shows the EU's final power consumption by sector in 2022.

In 2022, the services sector was the one that consumed more energy within the EU. The household sector was the one that consumed less energy within the EU in that year.

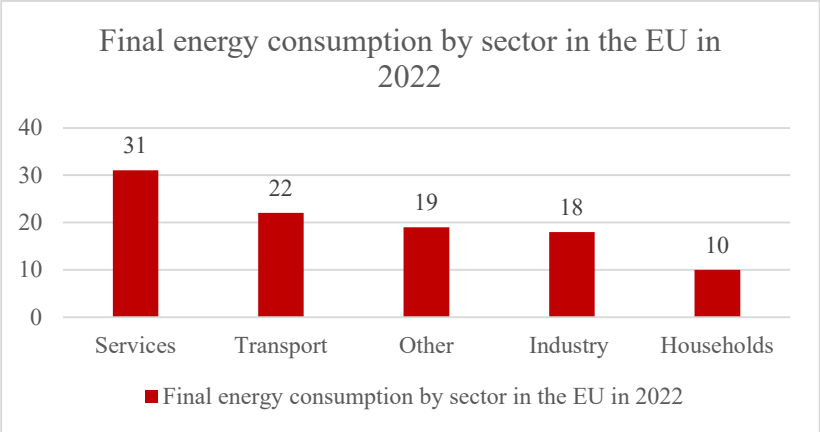

Figure 2. Final power consumption by sector in the EU in 2022 [5].

3.4. The role of fossil fuels in the European Union

The decrease in fossil fuel utilization in many EU Member States economic sectors is significant. The largest reduction was reported in coal and lignite electricity production, which was replaced mainly by electricity generated from natural gas. However, natural gas has also lost ground inside the EU due to the increased use of renewable energy and its higher prices.

Replacing coal and oil with alternative clean energy has significantly reduced greenhouse gas emissions in sectors closely linked to the EU's electricity consumption. This substitution plays an essential role in the energy transition process in the EU, from a system based on using conventional energy sources for electricity production to another based on clean energy sources.

One important aspect must be carefully studied before a decision is adopted to replace fossil fuels with other energy sources during the energy transition towards a green economy in the EU. This aspect is unpredictability. Renewable energies are unpredictable because they depend on the weather, so there is no guarantee that they will generate at any given time the level of electricity that will satisfy the required needs (Unlike coal, oil, or gas, electricity cannot be stored easily. It must thus be generated and delivered at the precise moment it is needed, something that most renewable energy sources cannot ensure. The demand load curve is the most important element to be considered when addressing power generation. A load curve shows the variation of load (in kW or MW) over time (in hours). The load curve can be plotted for 24 h a day; it is then called a daily load curve; if one year is considered, it is called an annual load curve. The load curve is important because the electricity capacity demanded by consumers (industry, residential, and commercial) varies over time. Typically, industrial activities are the highest during the day, commercial activities are high during the day and the early evening hours, and residential activities are high mainly in the evening when everybody is at home and turns on the lights, watches television, and uses other electric devices [6]). To guarantee this, for the time being, nuclear energy or natural gas power plants must be ready to supply the electricity needed when renewable energy cannot.

3.5. Energy mix in the European Union

The energy available in the EU comes from energy produced inside the EU or imported energy. Therefore, to get a good overview of the total energy available in the EU, both types of energy should be considered. In 2021, the EU produced around 44% of its energy needs, while 56% was imported. In other words, the EU's consumption depends heavily on power imported.

In 2021, the energy mix in the EU was the following:

- Crude oil and petroleum products (34.2%);
- Natural gas (23.3%);
- Renewable energy (17.2%);
- Nuclear energy (13.8%);
- Solid fossil fuels (12%);
- Other (0.2%) [7].

Crude oil and petroleum products are the most consumed energy sources in the EU, accounting for 34.2% of the total energy produced in the country, followed by natural gas, 23.3%, and renewables, 17.2%. In 2023, the EU energy mix capacity was structured in the following manner:

- Renewables: Wind (34.1%), hydro (23.8%), solar (40%), bioenergy (5.4%), and geothermal (0.1%);
- Fossil fuel: Coal (12.8%), oil (1.7%), and natural gas (21.1%);
- Nuclear: 24.6%;
- Others: 0.7% [8–10].

However, energy production is very different from one EU member to another. For example, renewable energy was the exclusive source of primary power production in Malta and represented the main power source in several EU Member States, with shares of over 95% in Latvia, Portugal, and Cyprus [7]. The nuclear share was particularly high in France (62.6%), Slovakia (59.2%), Hungary (47%), Belgium (46.4%), and Slovenia (42.8%) [9]. Solid fuels were the main source of energy produced in Poland (72%), Estonia (56%) and Czechia (45%). Natural gas had the largest share in the Netherlands (58%) and Ireland (42%), while the share of crude oil was the largest in Denmark (35%) [7].

3.6. The European Green Deal

The EC has been fully committed to transforming the EU into a clean, resource-efficient, and competitive economy, in line with the goals of the Paris Agreement. To achieve the goal mentioned above, the European Green Deal was adopted. Its objective is to ensure zero emissions by 2050, making Europe the first climate-neutral continent in the world. In 2021, the EU approved its first European Climate Law. Its objective is to allow Europe to become climate-neutral by 2050 and to establish a target of 55% less emissions by 2030 compared to 1990. As required under the Climate Law mentioned above, the EC recommended, in February 2024, an additional intermediate target of 90% less emissions by 2040 [11].

However, the European Green Deal is about setting targets and creating the right enabling environment. First, it is about putting people at the core of the transition to Europe's green economy. That is why the EC has been ensuring that the clean

transition is fair by supporting those more vulnerable and most affected by the effects of climate change. For this reason, the EC will create the following funds:

- Just Transition Fund: The EC has supported workers and regions to develop new skills and thrive in the EU green economy through this fund.
- Social Climate Fund: Partly funded via the EU Emissions Trading System (While market mechanisms—such as the EU Emissions Trading System (EU ETS)—that set price signals for market actors are important in changing investment and behavioral patterns, they have significant regressive distributional effects, disproportionally affecting low-income households [12]), it will provide EU Member States with dedicated funding to support vulnerable groups thanks to investments in energy efficiency, renovation of buildings, and clean heating.
- Solidarity Fund: This fund and the Civil Protection Mechanism have brought support where needed most, including farming communities, after climate-related disasters such as wildfires, storms, and floods [11].

Second, to achieve the EU climate-neutrality goal, its Member States need a power system that is cleaner, more efficient, and no longer dependent on conventional energy sources. Therefore, the EC must ensure that capital flows in the right direction and that people and businesses can access the financial resources needed to make green investments [11].

Third, the EU has mobilized private and public funding to support the deployment of low-carbon energy sources and increase buildings' energy efficiency. An estimated €275 billion will be needed to support clean investments and €118 billion until 2027 for the clean energy transition [11].

Fourth, the EU has ensured that the European economy and industries are ready to reap the benefits of the energy transition while acting to maintain a level playing field with their economic competitors. For this reason, in February 2023, the EU adopted the Green Deal Industrial Plan, which includes the Critical Raw Materials Act and The Net-Zero Industry Act to create a predictable and simplified regulatory environment in their respective fields of action and enable the scaling up of manufacturing capacity for the net-zero technologies and products that the EU economy needs [11].

One of the main objectives of the European Green Deal is to increase the use of renewables for electricity production. The transition to a climate-neutral energy system in 2050, largely based on renewable energy sources, can be seen as a technological rupture vis a vis the still largely fossil fuel-based energy and economic system in place. It is a source of challenges and opportunities for economic actors in the EU and globally. Research and innovation will be crucial in the transformation through individual technology development or systemic innovation. The key to success in the long term is to develop a wide portfolio of cost-effective and efficient carbon-free alternatives in combination with solutions for an integrated energy system built on digitalization and sector integration. Understanding this complex transition of the energy system and its components requires a sound methodology to capture the dynamics within different fields and their interplay. Given the 2050 time horizon for reaching climate neutrality, the interaction between technology development and energy system design becomes crucial. While many technologies required for the energy transition are known in principle, costs may change rapidly, as seen for

renewable energy during the last decade. Research and innovation will define the speed at which decarbonization can occur and at which costs [13].

The current role and perspectives of the different energy sources within the energy transition of the EU to a green economy are explained in the following sections.

3.7. The current situation and perspectives on the use of renewable energies for electricity production

The EU promotes using renewable energy for electricity generation to decarbonize the power sector by 2050 because using conventional energy sources for electricity generation is the largest source of greenhouse gas emissions in its Member States. Three-quarters of the EU's greenhouse gas emissions are due to electricity production, heat, and transport. Accelerating the implementation of projects on renewable energies is indispensable to drastically reduce greenhouse gas emissions and achieve the EU's goal of climate neutrality by 2050.

More than 20% of the power consumed in the EU comes from renewable energy sources, more than double that in 2004. The possibility of increasing the EU target in 2030 is currently being reviewed, as are the objectives for buildings, heating and cooling, and industry. In September 2022, the EU Parliament demanded that the renewable energy target be raised to 45% by 2030 from the 32% already approved. **Figure 3** shows the contribution of renewable energies to the EU energy mix.

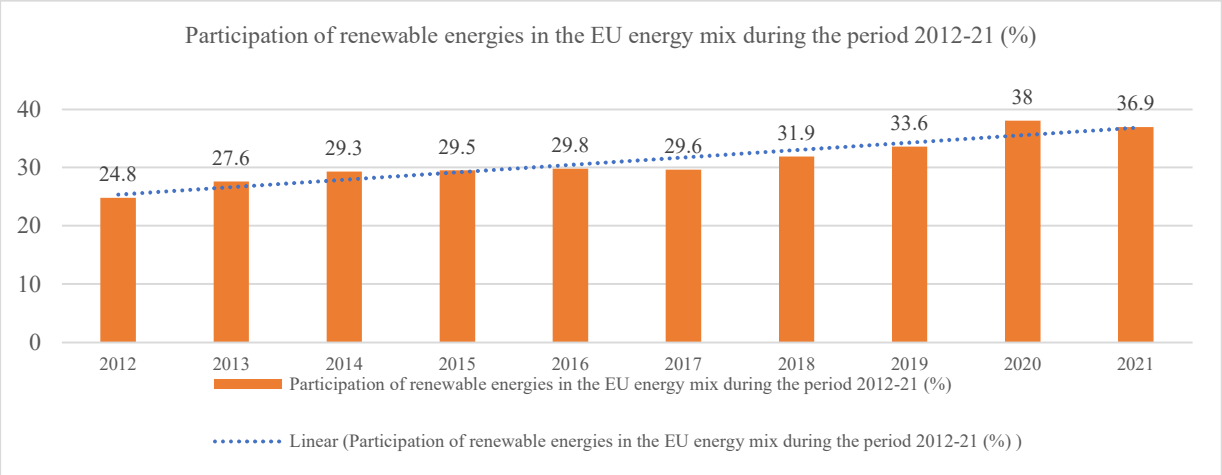

Figure 3. Participation of renewable energies in the EU energy mix during 2012–2021 [14].

Figure 3 shows that renewable energy participation in electricity production in the EU grew from 24.8% in 2012 to 36.9% in 2021, an increase of 12.1%. **Figure 4** shows the capacity of renewable energy plants installed in the EU from 2014 to 2023.

According to **Figure 4**, the capacity of renewable power plants installed in the EU grew 81.9%, from 352,565 MW in 2014 to 641,478 MW in 2023. Considering measures adopted by the EU to decarbonize its energy sector, the capacities of renewables in the EU are expected to grow to 42.5% in 2030.

It is important to note that by the end of 2023, renewable energies accounted for 43% of global installed power capacity. However, as countries move closer to a world where renewable energy accounts for half the total capacity installed, many new renewable power plants still need to be constructed. These new capacities will push

renewables as the most significant source of electricity generation—including in the context of grid flexibility and adaptation to variable renewable power.

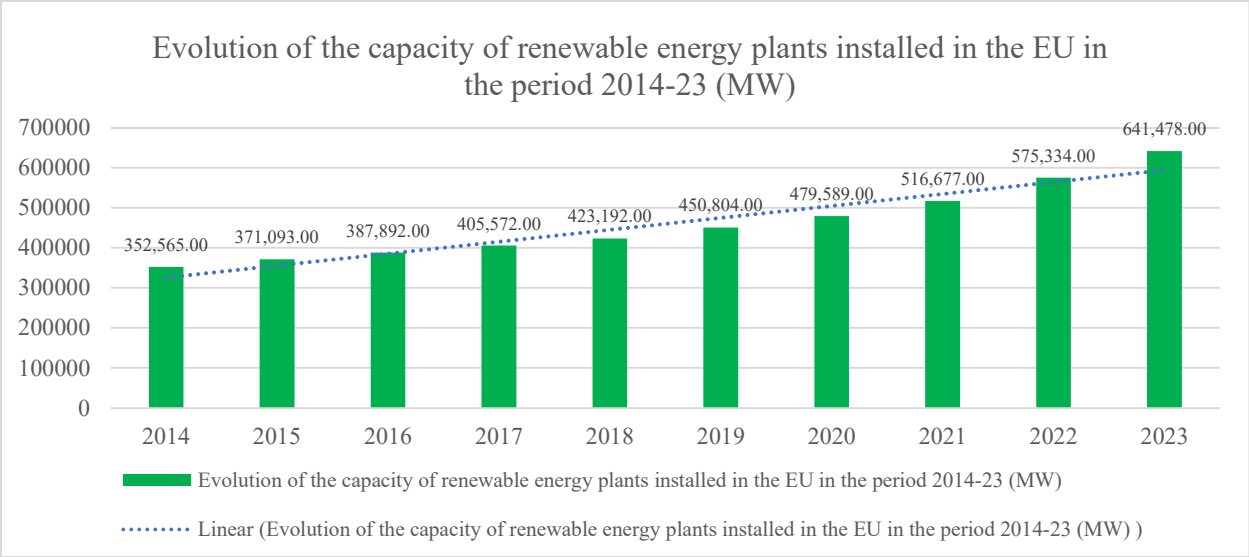

Figure 4. Evolution of the capacity of renewable energy plants installed in the EU in 2014–2023 [10].

Figure 5 shows the electricity generation using renewables in the EU during 2013–2021.

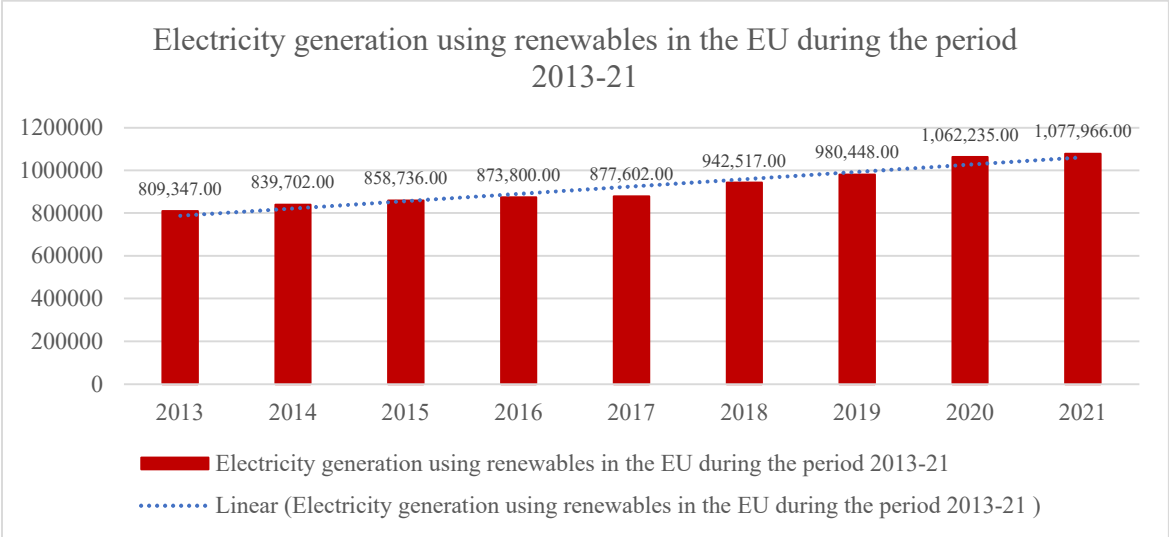

Figure 5. Evolution of electricity generation using renewables in the EU during 2013–2021 [14].

According to **Figure 5**, the electricity generated by all renewable energy sources in the EU during 2013–2021 increased by 33.2%, growing from 809,347 GWh in 2013 to 1,077,966 GWh in 2021. The countries with the highest electricity generation in 2021 within the EU are Germany with 230,800 GWh, Spain with 125,747 GWh, France with 122,377 GWh, and Italy with 116,352 GWh.

Finally, it is important to stress that 2023 saw the largest increase in renewable energy capacity to date—with the addition of 473 GW of renewables—expanding the stock of renewable power by 13.9%, reaching 86% of global power additions. That increase was due to significant solar and wind power growth. Solar power accounted

for nearly three-quarters of new additions, with a record 346 GW, while one-quarter or 116 GW was due to wind energy additions [10].

3.7.1. Hydropower in the European Union

There are three hydropower generation types. These are run-of-river, hydro storage, and pumped storage. The electricity generation in all these three types of hydropower plants follows the same principle, as water is used to turn one or multiple turbines. One can calculate the power output of a hydroelectric turbine with the following formula:

$$P = \eta \times p \times q \times g \times h$$

where P is the power output, η the efficiency of the turbine (generally between 0.8 and 0.95), ρ the density (approximately 1000 kg/m^3 for water), q the site-specific water flow in m^3 per second, g is the gravity (9.81 m/s^2), and h stands for the hydraulic head, that is, the falling height in meters [6].

In hydropower plants, water located in a reservoir and retained by the dam accesses a turbine through high-pressure forced pipes in which the water acquires a great speed that will later be transformed into energy. The water reaches its maximum speed in the turbine room thanks to rotational movement. These turbines transfer the energy obtained through the force of the water to an electric generator that will be in charge of transforming it into electrical energy. In hydropower plants, the difference in the two elevations that conform plant is called the "head" (see **Figure 6**).

Figure 6. Hydropower plant.

Source: Free photo on Pixabay.

Hydroelectric power plants are usually located on dams that dam up rivers, thus raising the water level behind the dam and creating as much head as possible.

In most communities, the demand for electric power is different at different times of the day. Pumped-storage hydroelectric plants are sometimes built to balance the load on generators. These plants have two water reservoirs located at different elevations. They are designed to lift water to a reservoir at a higher elevation when the electricity demand is low. During peak power demand, water flows from the highest-placed reservoir through the turbine to generate electrical power.

Hydropower installed capacity

The installed capacity of hydropower plants in the EU has been growing in recent years. In 2023, France was the country with the highest installed capacity with 25,881 MW or 16.9% of the total, followed by Italy with 22,887 MW or 15% of the total, Spain with 20,140 MW or 13.2% of the total, Sweden with 16,399 MW or 10.7%, and

Austria with 14,708 MW or 9.6%. Outside the EU, but within Europe, the country with the largest capacity in hydroelectric plants installed is Norway, with 34,401 MW [10]. **Figure 7** shows the growth of the capacity of hydroelectric plants in the EU from 2014 to 2023.

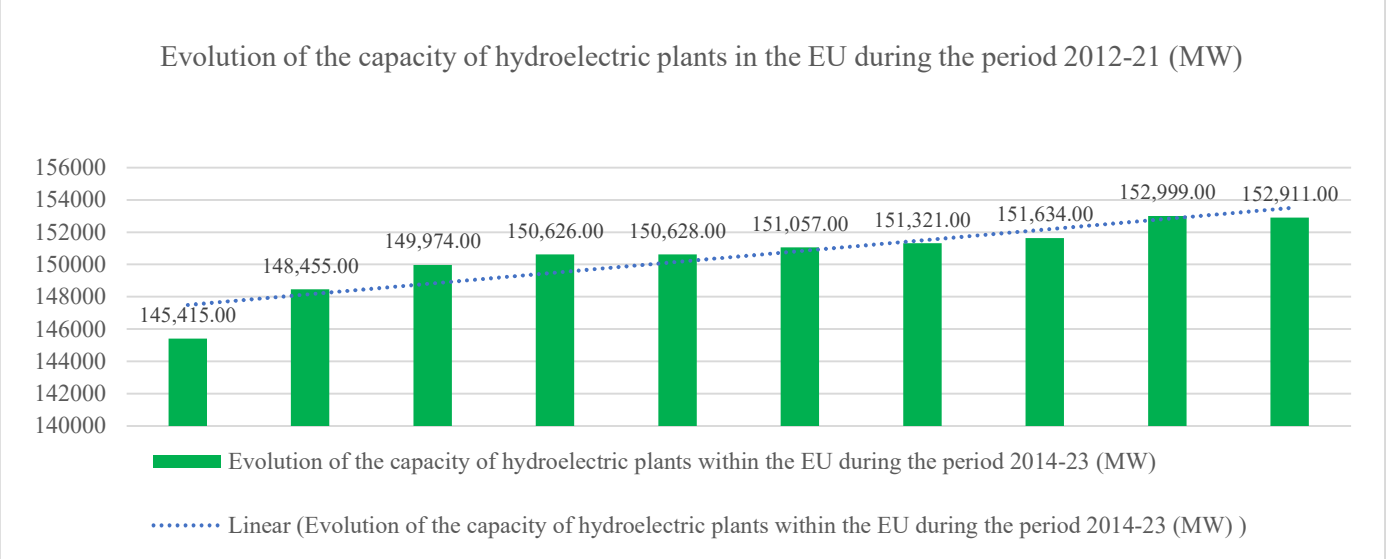

Figure 7. Evolution of the capacity of hydroelectric plants within the EU during 2014–2023 [10].

According to **Figure 7**, the capacity of hydroelectric plants within the EU grew by 5.2% during the 2014–2023 period, growing from 145,415 MW in 2014 to 151,911 MW in 2023. Considering the plans approved by the EU to decarbonize the energy mix of its Member States by 2050, it is projected that hydropower capacities will continue growing over the coming years, even though the growth potential is not very broad as a result of strong opposition from public opinion of many of EU's Member States. Most of the population in several EU Member States are against increasing the hydroelectric capacities installed to avoid further environmental damage.

Hydropower electricity generation

The EU's electricity production from hydroelectric plants reached 375,804 GWh in 2021, representing 8.5% of the world's total (4,400,679 GWh). In 2021, the regions that surpassed the EU in terms of generating electricity through hydroelectric plants were Asia, with 1,917,754 GWh or 43.6% of the world's total; North America, with 692,113 GWh or 15,7%, and South America, with 632,279 GWh or 14.4% [14].

Figure 8 shows the evolution of electricity generation through hydroelectric plants from 2013 to 2021.

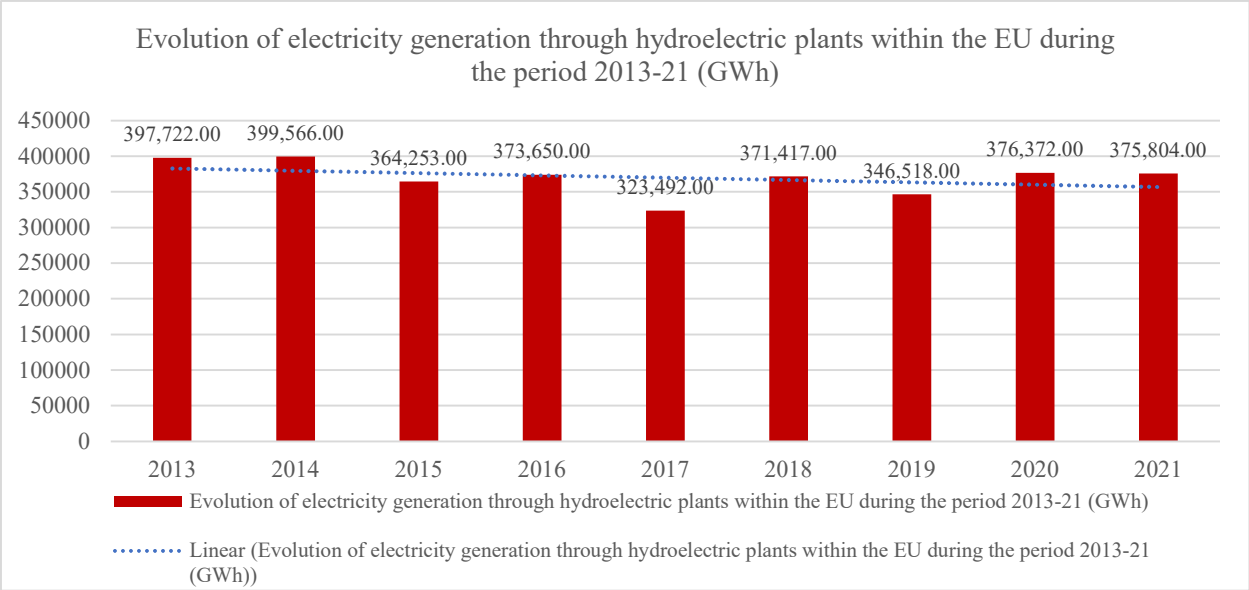

Figure 8. Evolution of electricity production through hydroelectric plants during 2013–2021 [14].

According to **Figure 8**, electricity production through hydroelectric power plants in the EU decreased by 5.5% during the period under consideration due to the drought that affected several countries in 2011, 2012, 2015, 2016, 2017, and 2019.

It is important to single out that the increase in electricity production using hydroelectric plants in the EU will be limited in the coming years, not only due to the droughts that climate change may cause in the region but also due to the strong opposition that exists in many EU Member States to increasing already installed hydropower capacities due to the reason mentioned above.

In summary, the following can be stated: in 2022, renewables accounted for 23% of total energy consumption in the EU. The share of renewables in electricity consumption was even higher at 41.2%. Wind power produced 37.5% of total electricity generated from renewable sources (a significant increase from 4.9% of all renewables in 2000). The share of wind power in total electricity production was 16% (14% onshore and 2% offshore) [15].

3.7.2. Wind energy in the European Union

Wind energy is a relevant part of the “green” or “ecological energies” that are more environmentally friendly. That is why constructing wind farms worldwide, particularly in the EU, has become an important component of the EU energy mix in recent decades. These wind farms are usually built on the seacoast, as well as on plains and large plains where the wind is constant and considerable.

Undoubtedly, wind power is an important element in the current energy mix of many EU Member States and is likely to play an important role in electricity generation during the coming decades [16].

Wind farms installed capacity

Figure 9 shows that the capacity of wind farms installed in the EU during 2014–2023 has grown yearly.

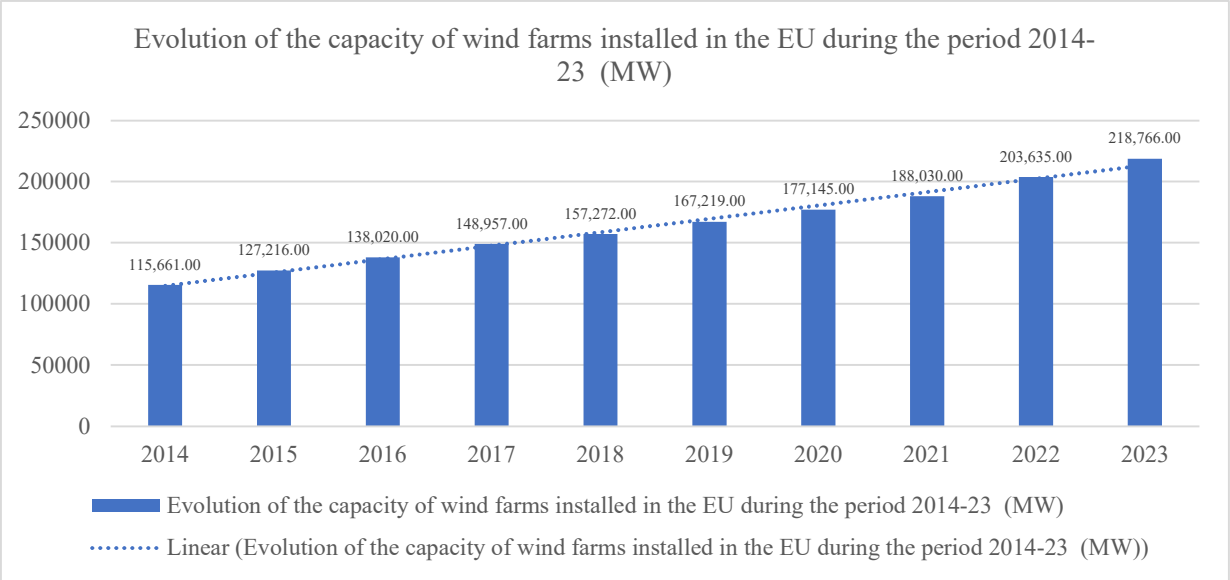

Figure 9. Evolution of the capacity of wind farms installed in the EU during 2014–2023 [10].

Based on **Figure 9**, it can be stated that the capacity of the wind farms installed in the EU grew by 89.1% during 2014–2023, growing from 115,661 MW in 2014 to 218,766 MW in 2023. The EU wind farms capacity in 2023 represents 21.5% of the world's total (1,017,199 MW), behind Asia with 508,452 MW or 50%. China has the largest installed wind capacity, with 441,895 MW or 43.4% of the world's total (86.9% of the region's total). Germany has the EU's largest installed wind farm capacities, with 69,459 MW or 31.8% of the region's total, followed by Spain, with 31,028 MW or 14.2%. The capacity of wind farms in the EU is projected to continue growing every year until 2030, helping to decarbonize the region's energy mix by 2050.

Wind farm electricity generation

Figure 10 shows the evolution of electricity production from wind farms established in the EU from 2013 to 2021.

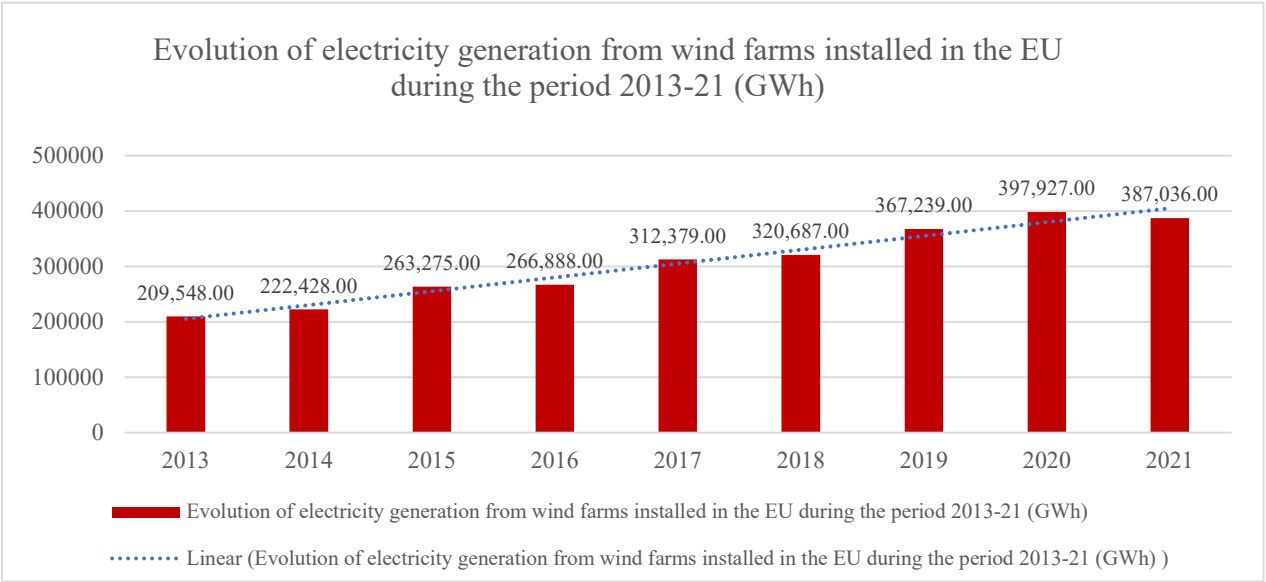

Figure 10. Electricity generation from wind farms in the EU during 2013–2021 [14].

Based on **Figure 10**, it can be affirmed that the electricity generation through the wind farms installed in the EU grew by 84.7% during the period under consideration, growing from 209,548 GWh in 2013 to 387,026 GWh in 2021, being surpassed only by the Asian region with 747,548 GWh or 35% of the world's total. The EU countries with the highest electricity generation using wind energy were Germany with 114,647 GWh or 6.2% of the world total, Spain with 62,061 GWh or 3.4%, and France with 36,831 GWh or 2%. It is important to highlight that from 2013 to 2020, electricity generated by wind farms in the EU grew yearly. However, this trend stopped in 2021, when the electricity generation by wind farms decreased by 2.8%, but is expected to continue growing until 2030.

Wind energy is crucial to the EU's climate targets and energy security needs. Here are some key points about wind farms in the EU.

- In 2023, the total installed wind power capacity in the EU reached 218,766 MW. Most of this capacity was onshore, accounting for 92% of the total.
- The EU aims for at least 42.5% renewable energy consumption by 2030. To achieve that goal, wind farm capacity must grow to over 500 GW by 2030, overcoming several challenges. For example, the EU wind sector faces important challenges such as insufficient demand, complex permit processes, supply risks, and a shortage of skilled workers, delaying the construction of more wind farms within the EU. Other challenges should also be overcome, such as public acceptance, environmental impact, and co-existence with other activities (e.g., fisheries).

Finally, it is important to note that investment in new wind power technologies like floating wind and hybrid projects (combining wind solar, hydrogen, or battery energy production) is essential to achieving the abovementioned goal. Wind farms are vital to the EU's renewable energy strategy, contributing significantly to electricity generation and the transition toward cleaner energy sources [15].

Onshore wind farms

Wind farms installed in the EU are of two types: a) onshore and b) offshore. The evolution of the capacity of onshore wind farms within the EU grew by 79.3% during 2014–2023, growing from 112,178 MW in 2013 to 201,144 MW in 2023 (see **Figures 11** and **12**). This capacity represents 21.3% of the world's total (944,536 MW), only surpassed by Asia with 468,200 MW or 49.6%. The EU countries with the highest onshore installed wind farm capacities in 2023 were Germany, with 61,052 MW or 30.4% of the EU's total, and Spain, with 31,021 MW or 15.4% [10].

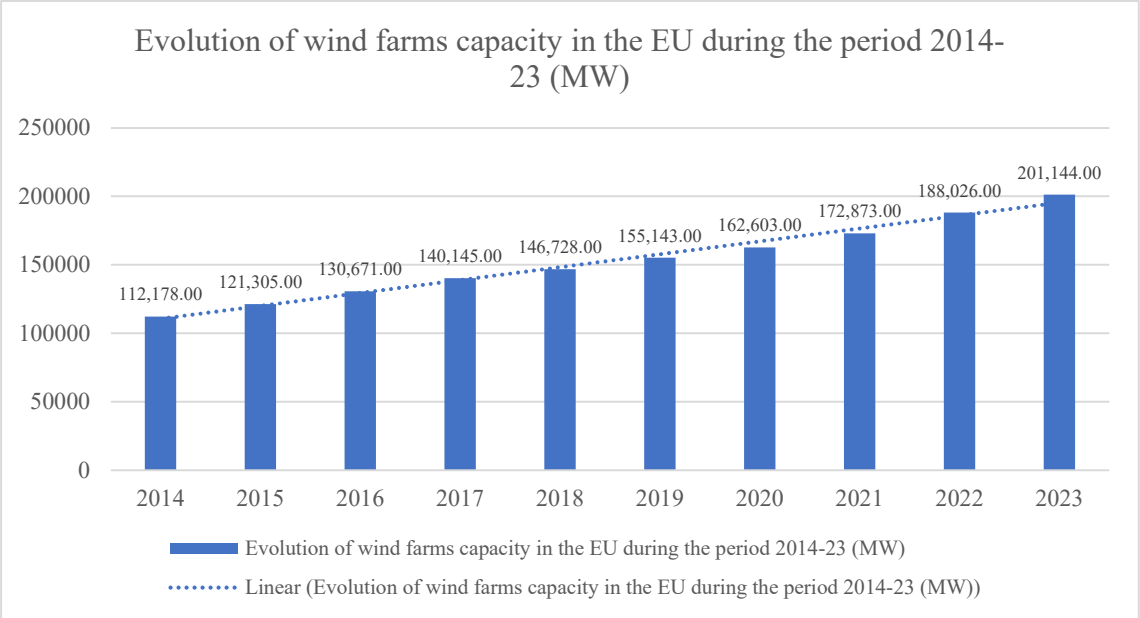

Figure 11. Evolution of the capacity of onshore wind farms within the EU during 2014–2023 [10].

Figure 12. Onshore wind farms.

Source: freepik.es.Free Pixabay photos.

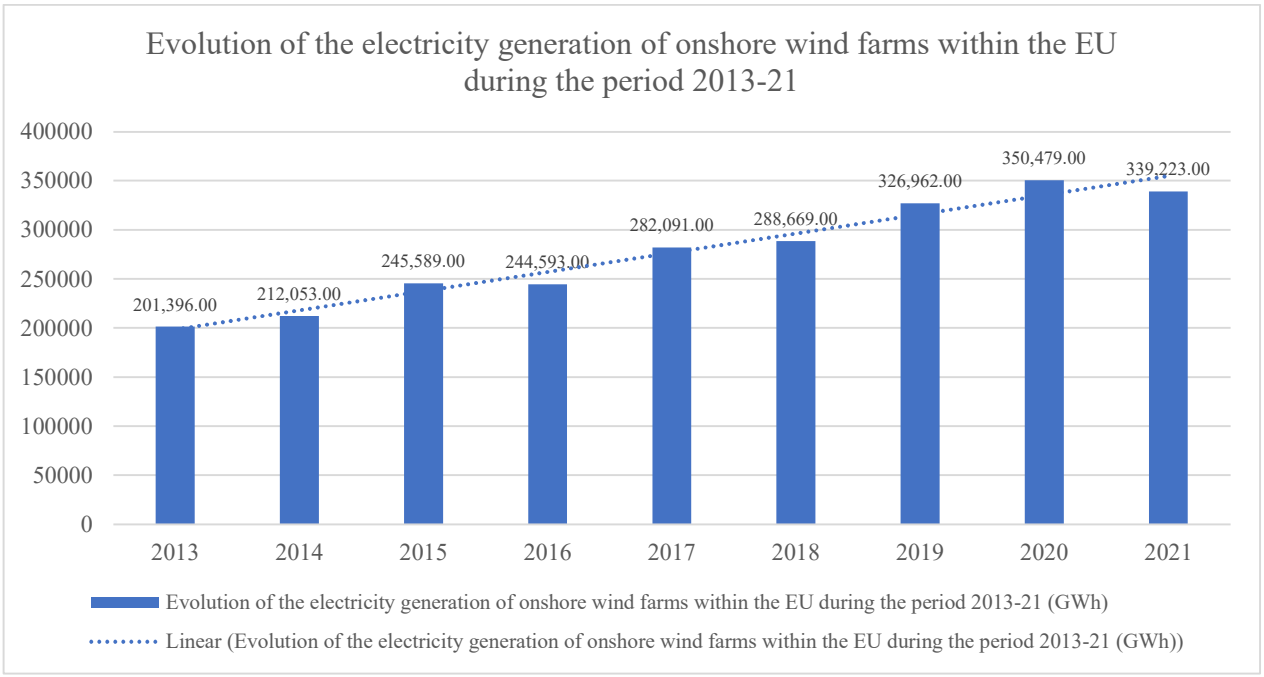

Figure 13. Electricity generation from onshore wind farms installed in the EU during 2013–2021 [14].

Electricity generation from onshore wind farms installed in the EU grew by 68.5% during the 2013–2021 period, growing from 201,396 GWh in 2013 to 339,223 GWh in 2021 (see **Figure 13**). This generation level represented 20% of the world's total (1,700,650 GWh), only surpassed by Asia with 693,397 GWh or 40.8%. China generated most of its electricity through onshore wind farms, with 603,994 GWh or 87% of the region's total [14].

In summary, onshore wind farms play today and will continue to play in the future a crucial role in electricity generation within the EU in its transition toward a green economy. Wind energy is central to accelerating the use of renewables in order to achieve the green transition outlined in the European Green Deal and the REPower EU Plan. The EU aims to have at least 42.5% renewable energy consumption by 2030, which will require installed capacity to grow to over 500 GW.

However, despite its importance, the wind energy sector faces the following challenges:

- Slow, insufficient, and uncertain demand;
- Slow and complex permit application processes;
- High supply risks linked to raw materials;
- High inflation and commodity prices;
- More pressure from international competitors;
- Limited availability of a skilled workforce.

It is expected that regulatory responses, including streamlined permit procedures and support for cross-border projects, aim to address these issues. Successful wind energy deployment must consider public acceptance, which tends to be higher for offshore wind, biodiversity impact, and co-existence with other economic activities like fisheries. Europe continues to invest in wind energy. In 2023, wind energy generated 466 TWh of electricity, covering 19% of electricity demand. New onshore wind farms had capacity factors ranging from 30% to 45%, while offshore wind farms achieved around 50% capacity factors [15].

Undoubtedly, onshore wind farms are vital to the EU's renewable energy strategy, contributing significantly to electricity generation and the transition toward cleaner energy sources for electricity generation.

Offshore wind farms

The first offshore wind farm was installed in Denmark in 1991. Additionally, floating offshore wind turbines are being explored for sites farther out to sea, where winds are stronger and more consistent. Undoubtedly, European companies have valuable experience as pioneers in offshore wind.

The EU capacity installed for offshore wind farms (see **Figure 14**) reached 17,621 MW in 2023. **Figure 14** shows the evolution of the offshore wind farm capacity in the EU during 2014–2023.

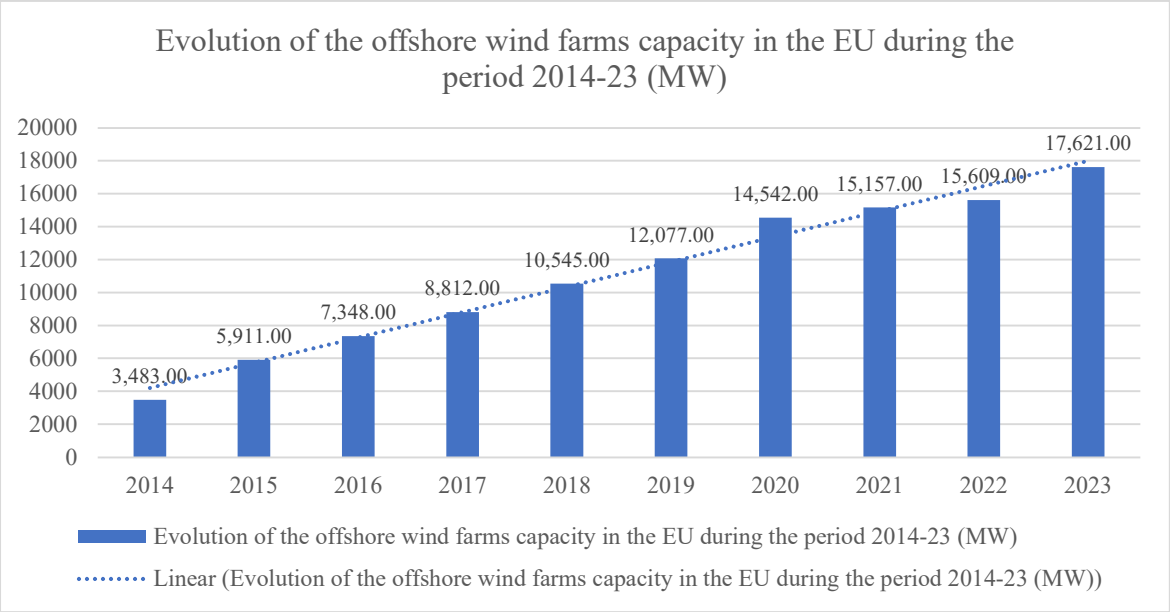

Figure 14. Evolution of the capacity installed of offshore wind farms in the EU during 2014–2023 [10].

Based on **Figure 14**, it can be stated that the capacity installed of offshore wind farms in the EU during 2014–2023 increased 5.1-fold, growing from 3483 MW in 2014 to 17,621 MW in 2023. The country with the largest installed offshore wind capacity in the EU in 2023 was Germany, with 8407 MW or 11.6% of the world's total (72,663 MW). The electricity generated by offshore wind farms installed in the EU in 2021 amounted to 47,804 GWh or 33.5% of the world's total (137,614 GWh). The EU country with the highest electricity generation in 2021 was Germany, with 24,375 GWh or 33.5% of the world's total [14].

In summary, offshore wind farms (see **Figure 15**) have played and will continue to play a vital role in electricity generation within the EU. Without a doubt, Europe is a global leader in offshore wind energy capacity installed, with 17.6 GW in 2023. These farms consist of wind turbines located at sea, harnessing abundant and consistent wind resources. Under the European Green Deal, the EU aims to achieve climate neutrality by 2050. Offshore wind is a critical component to achieving this goal. The EC's strategy targets 60 GW of offshore wind by 2030 and 300 GW by 2050, contributing significantly to clean energy production. Some of the EU's main challenges in increasing the use of wind energy for electricity generation in its Member States are complex permitting processes, supply chain risks, and skilled workforce availability. The EU's strategy addresses broader issues such as sea-space access, regional cooperation, and industrial dimensions. Offshore wind farms are crucial for achieving renewable energy targets and reducing EU dependency on conventional energy sources [15].

Figure 15. Offshore wind farm.

Courtesy: Pixabay free photos.

Figure 16 shows the evolution of electricity generation by offshore wind farms in the EU from 2013 to 2021.

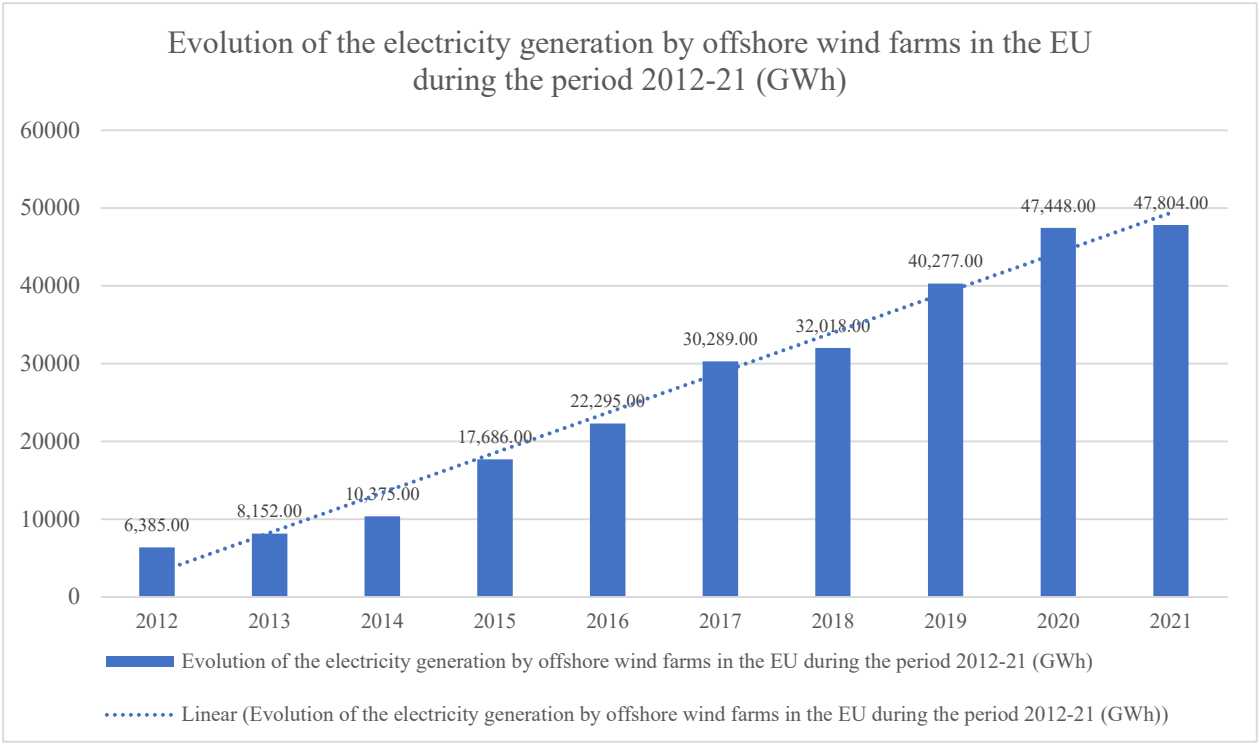

Figure 16. Evolution of the electricity generation of offshore wind farms in the EU during 2012–2021 [14].

Based on **Figure 16**, it can be affirmed that the electricity generation of offshore wind farms in the EU during 2012–2021 increased 7.5-fold, growing from 6.385 GWh in 2012 to 47,804 GWh in 2021. The country with the largest offshore wind electricity generation in the EU in 2021 was Germany, with 24,375 GWh, or 17.7% of the world's total (137,614 GWh).

In summary, the following can be stated: Offshore wind farms play a critical role in the EU's energy transition to a clean economy. Offshore wind energy is abundant, domestically sourced, and increasingly affordable. It contributes significantly to reducing dependency on imported fossil fuels for electricity generation. The global average levelized energy cost for offshore wind farms has declined by 48% between

2010 and 2020, decreasing from 0.14€ to 0.071€/kWh. For this reason, offshore wind is a decisive element in the EU green transition, paving the way for a modern, resource-efficient, and competitive economy, and has become one of the most important pillars of the EU's climate ambitions, according to the European Union [17].

Challenges faced by the wind power sector include insufficient demand, complex permitting processes, supply chain risks, inflation, and a limited skilled workforce. The EU has adopted a group of regulatory measures to overcome these challenges. Among these regulations are the revised Renewable Energy Directive streamlines permit application procedures; the TEN-E framework supports cross-border projects; and the newly announced wind power package aims to strengthen the EU wind industry and develop offshore wind farms further.

The EU aims to add around 30 GW of wind power annually to meet its 2030 targets. Offshore wind farms will be critical to achieving this goal and are essential for achieving renewable energy targets, enhancing energy security, and driving the EU's transition to a greener economy.

3.7.3. Solar energy in the European Union

Another important component of the EU energy mix is solar energy. Solar energy is often used to refer to electrical or thermal energy obtained using solar radiation, the main energy source on Earth. There are three types of solar energy: Solar photovoltaic (Solar PV) (see **Figure 17**), Concentrated solar power (CSP) (see **Figure 18**), and Passive solar energy [18].

Figure 17. Solar PV park.

Source: Pixabay photos gratis.

Figure 18. Concentrated solar power park.

Source: Pinterest.

The total capacity of the solar parks installed in the EU in 2023 amounted to

257,057 MW, representing 18.1% of the world's total (1,418,969 MW) [9]. The EU has been supporting, for several years now, the construction of solar parks in its Member States to reduce electricity generation using coal and oil thermal power plants and strengthen the role of renewable energies in the EU energy mix. The capacity of solar parks installed in the EU from 2014 to 2023 is shown in **Figure 19**.

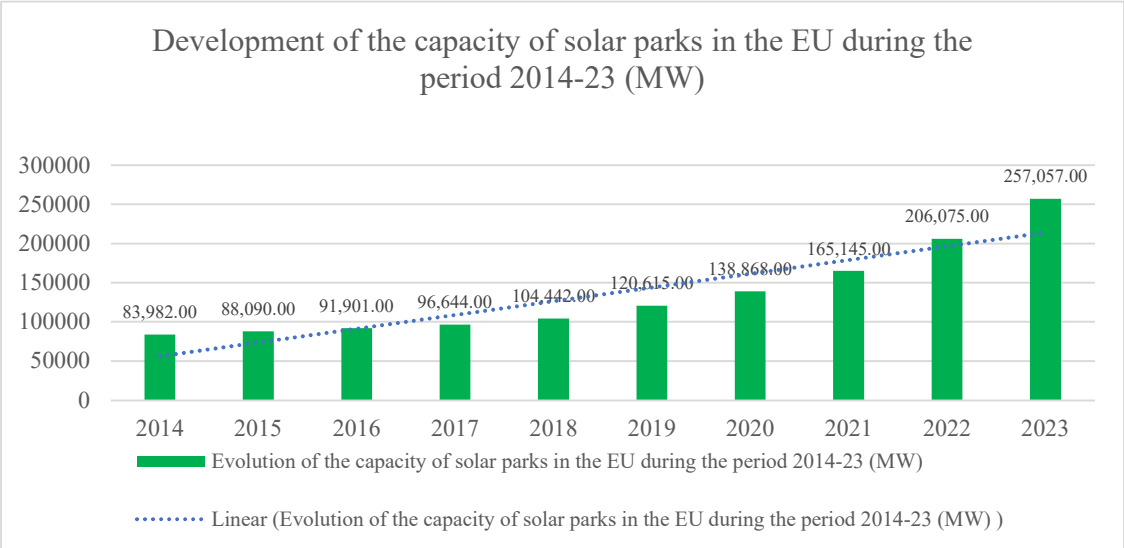

Figure 19. Development of the capacity of solar parks in the EU from 2014 to 2023 [10].

As seen in **Figure 19**, the capacity of solar parks within the EU grew by about 3.1-fold during the period considered, growing from 83,982 MW in 2014 to 257,057 MW in 2023. Throughout 2014–2023, the capacity of solar parks grew steadily but significantly since 2020. This tendency is projected to continue until 2030, helping the decarbonization of the regional energy mix. The countries with the greatest capacities of solar parks installed in the EU in 2023 were Germany, with 81,739 MW or 31.8% of the total for the region, followed by Spain, with 31,016 MW or 12.1%, and Italy, with 29,795 MW or 11.6% (The United Kingdom, which has not been a member of the EU since January 2021, had an installed capacity of solar parks of 15,657 MW in 2024, representing 5.4% of the region's total (288,122 MW) [10].).

Solar Park electricity generation

The evolution of electricity production in the EU by solar parks installed in the region is shown in **Figure 20**.

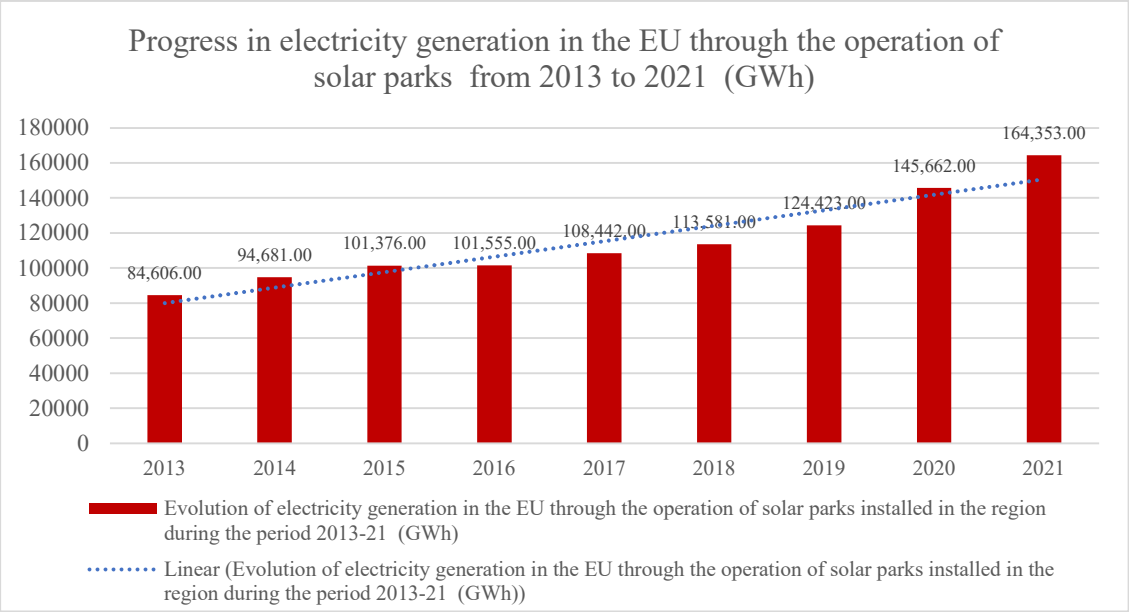

Figure 20. Evolution in electricity generation in the EU by solar parks installed in the region during 2013–2021 [14].

According to **Figure 20**, the electricity generated by the solar parks installed in the EU grew 94.3% during the period under consideration, growing from 84,606 GWh in 2013 to 164,353 GWh in 2021. In all these years, there was a systematic growth in electricity generation through solar parks installed in the EU, a trend that is expected to continue at least until 2030.

Solar photovoltaic capacity

Solar photovoltaic is the renewable energy source most used in the EU for electricity generation. Its installed capacity reached 254,736 MW in 2023, representing 18% of the world's total (1,412,093 MW) [10], generating 159,165 GWh in 2021, or 15.6% of the total electricity generated worldwide (1,020,297 GWh) in that year [19]. **Figure 21** shows the growth of the capacity of solar PV parks in the EU from 2014 to 23.

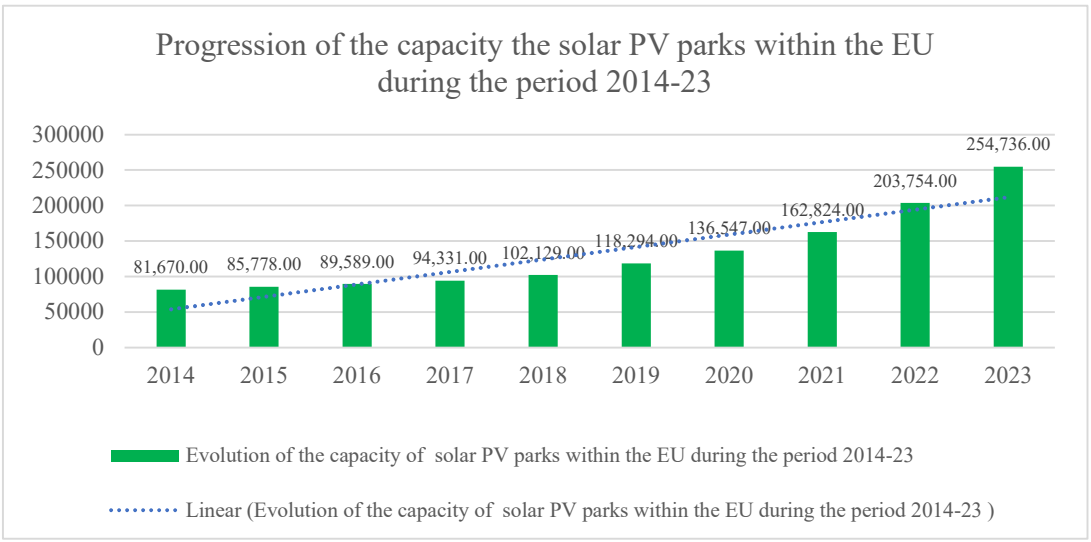

Figure 21. Progression of the capacity of solar PV parks installed in the EU during 2014–2023 [10].

Based on **Figure 21**, it can be stated that the capacity of solar PV parks installed within the EU grew 3.1-fold during 2014–2023, growing from 81,670 MW at the beginning of the period to 254,736 MW at the end of it. In all these years, the capacity of solar PV parks installed in the EU grew systematically, particularly after 2018. It is expected that this trend will continue until 2030. The countries with the largest solar PV park capacities already installed within the EU are Germany, with 81,737 MW or 5.8% of the world's total (1,412,093 MW), followed by Italy, with 29,789 MW or 2.1%, and Spain, with 28,712 MW or 2%.

Solar photovoltaic electricity generation

Figure 22 shows the electricity generated by solar PV parks installed in the EU from 2013 to 2021.

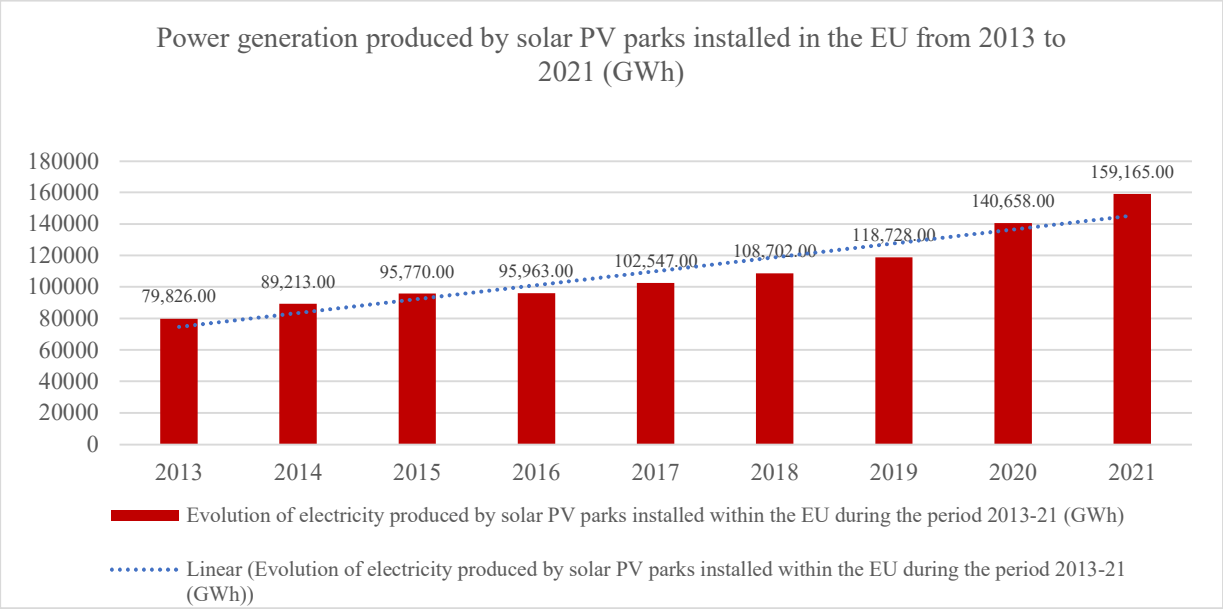

Figure 22. Electricity produced by solar PV parks installed in the EU during 2013–2021 [14].

According to **Figure 22**, electricity produced by solar PV parks installed in the EU grew 99.4% during 2013–2021, increasing from 79,826 GWh in 2013 to 159,165 GWh in 2021. The electricity produced by solar PV parks increased yearly within the abovementioned period. This trend is foreseen to stay without change during the coming years.

EU measures to increase the role of solar energy include installing solar panels on the rooftops of new buildings obligatory, simplifying permitting procedures for solar PV projects, improving the skills in the solar PV sector, and boosting the EU's capacity to manufacture photovoltaic panels. Several challenges still need to be addressed, including competition for land use for other purposes, technological issues, skills shortages, and the need to prevent a new energy dependency on non-EU solar panel producers. The ambitious plan includes doubling the current level of solar PV capacity by 2025 and to reach almost 600 GW by 2030. Achieving these goals will depend on continued commitment to solar PV deployment, success in addressing several challenges faced by the solar PV sector, and the ability to unlock the full potential of solar energy in the EU, for instance, by boosting domestic solar production

and using new technologies [20].

Solar PV is crucial in the EU's transition to a green economy. Under the European Green Deal and the REPower EU Plan, solar PV is relevant for reducing the EU's dependence on imported conventional energy sources. It contributes to the clean energy transition and the goal of reducing reliance on energy imports from Russia and China, among others. Solar PV is currently one of the cheapest sources of electricity production, with costs having decreased by 82% over the past decade.

Concentrated solar power park capacity

The current capacity of the CSP parks installed within the EU is very small (2321 MW or 0.9% of the total) compared to the solar PV parks installed in the region (254,736 MW). In 2023, the countries with CSP park capacity installed in the EU were France (9 MW or 0.4%), Germany (2 MW, or 0.09%), Italy (6 MW or 0.3%), and Spain (2304 MW), the country with 99.3% of the total CSP capacity installed [10]. These CSP parks generated, in 2021, a total of 5188 GWh, a very small amount compared to the electricity produced during that year by other renewable energy sources, including solar PV. The EU countries with electricity generation using CSP parks reported in 2021 were Italy, with 12 GWh, or 0.2% of the total, and Spain, with 5176 GWh, or 99 [14].

3.7.4. Bioenergy in the European Union

Bioenergy is another of the main components of the EU energy mix, through which a stable power supply is ensured. According to FAO [21], bioenergy is energy from biomass, for example, wood, dung, or charcoal, excluding material embedded in geological formations and transformed into fossils. The IEA and the IPCC consider bioenergy a central element to achieving zero net growth and compliance with the Paris Agreement on Climate Change.

Bioenergy provides flexible power generation and the potential for negative emissions through carbon capture and storage. Biomethane is key to diversifying the EU gas supplies, while liquid and other gaseous bioenergy carriers are promising in the longer term.

According to Pelkmans and Georgiadou [22], the following are the main outcomes included in a report on the implementation of bioenergy in the EU in 2021:

- Renewable energy share in final energy consumption was 19%. Around 60% is from biomass;
- Solid biofuels represent almost 70%. Liquid biofuels, biogas, and renewable waste represent around 10%;
- Fossil fuels still dominate heat and transport energy in the EU. Bioenergy/biofuels are the main sources of renewable energy in these sectors. Fuel/heat consumption (excluding electric heating) in the EU is still more than 70% based on fossil fuels, with 15% directly using biomass for heat.

In 2010, bioenergy was the source of approximately 7.5% of the energy consumed in the EU. However, it is important to be aware that forest biomass and productive land are limited resources in the European region, and, therefore, all existing resources must be used to form the region's energy mix in the most efficient way possible before deciding to add new land for energy production.

Bioenergy plant capacity

According to EU Statistical Pocketbook 2022 [10], the most common bioenergy plants are the following:

- Solid biofuel and renewable waste plants (in all EU countries);
- Renewable municipal waste plants (in 19 EU countries);
- Bagasse plants, only in Portugal;
- Other solid biofuel plants (in 25 EU countries);
- Liquid biofuel plants (in 13 EU countries);
- Biogas plants (in all EU countries).

The capacities of bioenergy plants installed in the EU in 2023 amounted to 34,466 MW. Germany, with 9950 MW, or 6.6% of the world's total (150,261 MW), Sweden, with 4507 MW, or 3%, Italy, with 3434 MW, or 2.3%, and Finland, with 3059 MW, or 2%, were the EU countries with the largest bioenergy installed capacities in 2023 [10].

Figure 23 shows the development of bioenergy plant capacity installed in the EU from 2014 to 2023.

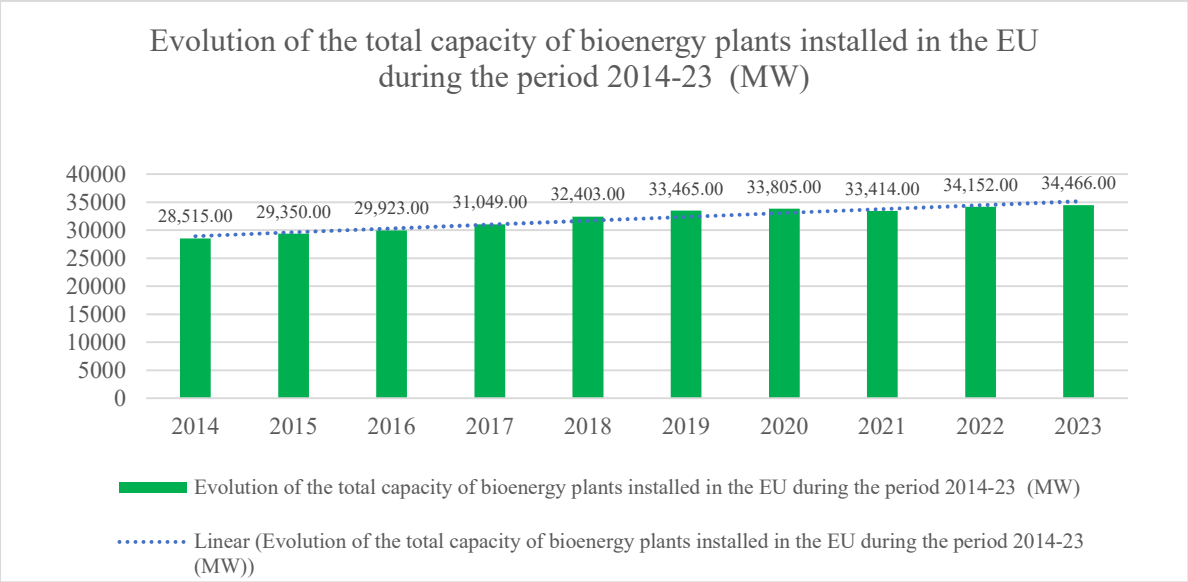

Figure 23. Evolution of the total capacity of bioenergy plants installed in the EU during 2014–2023 [10].

As shown in **Figure 23**, the bioenergy plant capacity installed in the EU grew by 20.9% during 2014–2023, growing from 28,515 MW in 2014 to 34,466 MW in 2023. The bioenergy plant capacities in the EU grew yearly in 2014–2023, and this trend is expected to continue without change until 2030.

Bioenergy plant for electricity generation

Figure 24 shows the electricity generation from bioenergy plants installed in the EU from 2013 to 2021.

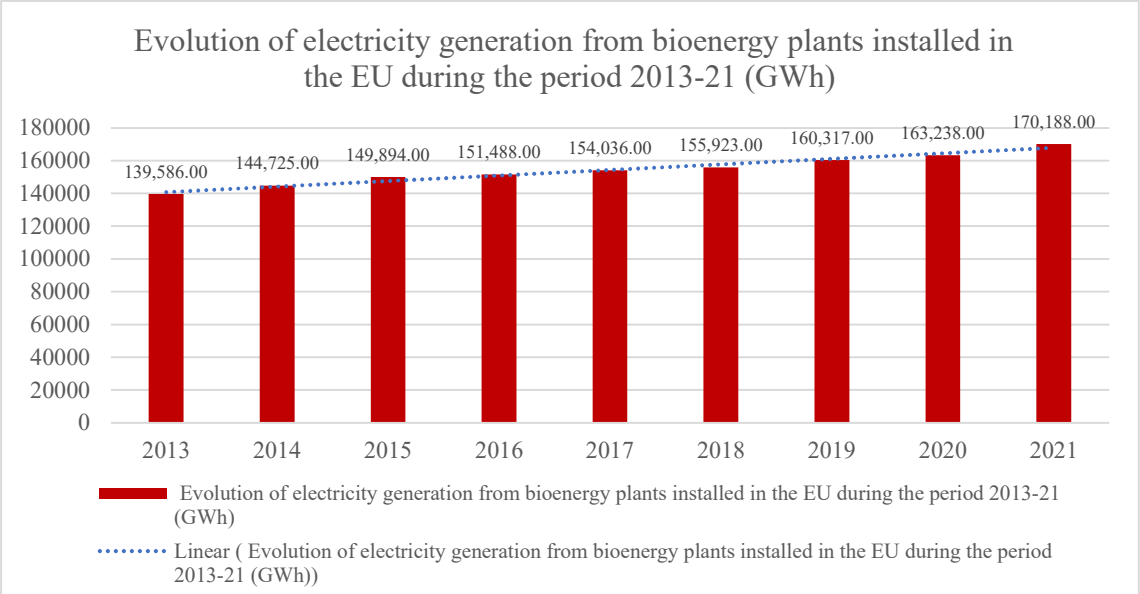

Figure 24. Evolution of electricity generation from bioenergy plants installed in the EU during 2013–2021 [14].

As shown in **Figure 24**, electricity generation through bioenergy plants installed in the EU grew by 21.9% during 2013–2021, growing from 139,586 GWh in 2013 to 170,188 GWh in 2021. The bioenergy plant capacity installed in the EU grew yearly during the period under consideration. This trend is expected to continue during the coming years, thus contributing to the decarbonization process of the EU energy sector approved by all its Member States.

Regarding the solid biofuels and renewable waste plants installed in EU countries, the information on their installed capacities in 2023 and their electricity generation in 2021 was, according to the EU Statistical Pocketbook 2022 [10] and IRENA Renewable Energy Statistics 2023 [14], as follows:

- In 2023, renewable municipal waste plants were installed in 19 EU countries. The installed capacity is 4018 MW, generating 19,577 GWh in 2021;
- Bagasse plants exist only in Portugal. The installed capacity is 2 MW, generating 15 GWh in 2021;
- Other solid biofuels are installed in 25 EU countries. The installed capacity is 16,652 MW, generating 91,475 GWh in 2021;
- Liquid biofuel plants are installed in 10 EU countries. The installed capacity is 2090 MW, generating a total of 4480 GWh in 2021;
- Biogas plants are installed in all EU countries. The installed capacity is 11,594 MW, generating 52,640 GWh in 2021.

3.7.5. Geothermal energy in the European Union

Geothermal energy is produced by harnessing the heat from inside the Earth. This heat is transmitted by convection and conduction through hot rock bodies or reservoirs (see **Figure 25**).

Figure 25. Geothermal power plant.
Courtesy: Pixabay free photos.

There are three geothermal power plants: a) Dry steam, b) Flash, and c) Binary. Dry steam, the oldest geothermal technology, extracts steam from fractures in the ground and uses it to directly drive a turbine. However, most future geothermal power plants will be Binary [23]. It is important to note that geothermal power is considered renewable energy that can provide reliable baseload power at a relatively low cost.

Where could it be built, considering the specific characteristics of the geothermal power plants? They are points on the map where a higher temperature can be found for natural reasons. These are the sites where a geothermal power plant can be built. There are four types of geothermal reservoirs:

- High-temperature reservoirs. There is a heat source where the fluid is stored at around 100 ℃;
- Low-temperature reservoirs. Their temperature is between 100 ℃ and 60 ℃;
- Very low-temperature reservoirs (above 15 ℃);
- Hot rock reservoirs. These are rocks that are between five and eight km underground.

Geothermal energy is generated in more than 20 countries. In the EU, only eight countries (around 30% of the membership) use this energy source for electricity generation. The geothermal capacity installed in the EU in 2023 amounted to only 895 MW, almost all concentrated in Italy, with 772 MW or 86.3% of the region's total. The power generated by this type of power plant amounted, in 2022, to 6832 GWh, of which Italy generated 6022 GWh for 88.1% of the regional total. Other EU countries with geothermal power plants in operation in 2023 were Croatia (10 MW or 0.1%), France (16 MW or 0.2%), Germany (50 MW or 0.7%), and Portugal (29 MW or 0.4%). Outside the EU, but within Europe, the country with the second largest geothermal energy capacity installed is Iceland, with 756 MW in 2023. This country generated, in 2021, a total of 5802 GWh [10,14].

Geothermal energy accounts for over 1% of total power generation worldwide. However, in some countries like Iceland, the proportion is significantly higher due to the great potential that the country has due to its high volcanic and geological activity.

Above all, future geothermal power generation prospects are good because the exploration and exploitation costs are much lower than in previous years. The greatest

difficulty lies in the extensive technical knowledge in the area and a significant initial investment in the exploration and construction of geothermal power plants. Undoubtedly, the geothermal power plant is one of the best options to preserve the planet and satisfy the needs and requirements of people and the EU industrial sector in those countries where this type of energy source exists.

4. Conclusion

From the war in Ukraine to worsening climate change, the EU is under intense pressure to accelerate its green transition and to identify the potential obstacles that may arise on the road to energy security [12]. The war in Ukraine and its consequences for world energy supplies and especially for the EU, "the sudden cut in the supply of fossil energy after Russia's invasion of Ukraine has led to an explosion of energy prices that has turned into a cost-of-living crisis. The energy and cost-of-living crisis can be seen as a stress test for both the European Green Deal and the European Social Model" [13]. High energy prices and the worsening effects of climate change, among others, are issues of special concern to the EU. The volatile global energy prices, limited energy suppliers, winter power shortages (Europe managed to get through the much-feared 2022/23 winter without energy shortages, power cuts and recession, showing a considerable level of resilience although at some considerable cost: between September 2021 and March 2023 EU Member States allocated 646 billion euros to shield consumers from rising energy costs [17]), and historic droughts affecting the production of agricultural products at a time when food prices were already rising are all interrelated issues. If the EU could replace conventional energy sources with sufficiently abundant renewables, it would lower energy prices, cut greenhouse gas emissions, cut energy dependency on external oil and energy supplies, and mitigate future risks of climate change and its impacts on food production.

In recent years, EU policies have set ambitious targets to accelerate the shift towards a green economy. In 2021, more than 22% of the gross final energy consumed in the EU came from renewable energies. The share of renewables in the energy mix varies considerably within the EU. In Sweden, it is around 60%; in Denmark, Estonia, Finland, and Latvia, more than 40%; and in Belgium, Hungary, Ireland, Luxembourg, Malta, and the Netherlands, between 10% and 15% [8,9].

According to Eurostat data, in 2020, in the EU, wind energy and hydropower accounted for 69% of the total electricity generated from renewable energy sources (36% and 33%, respectively), solar energy (14%), solid biofuels (8%), and other renewable energy sources (8%). Wind and hydropower energies are projected to continue to have the largest share in the EU energy matrix in 2050. By 2030, the EU should significantly increase the share of renewable energy in the global energy mix, following the SDG 7 goal target.

The energy system of the future must be resilient and adaptable to the inevitable impacts of climate change. Due to the increasing role of wind and solar power (The two most abundant forms of power on Earth are solar and wind. Both have been and will be becoming more cost-competitive compared to other energy carriers for electricity generation and thus are key factors in achieving climate reduction targets [1]), the EU energy system must be flexible enough to satisfy energy demand, even

without wind or sunlight. That means the energy system should have baseload energy sources, such as nuclear, geothermal, and hydrogen, among other available energy sources, to stabilize the system and satisfy energy demand under any circumstance.

5. Recommendations

Based on the analysis of the present situation and the perspectives of greater participation of renewable energies within the EU energy mix for the generation of electricity, and taking into account the goal in the energy sector included in the objective of sustainable development (SD7), a set of recommendations for consideration by EU competent authorities have been prepared. These are the recommendations:

1) To speed up the transformation of a society based on using conventional energy sources for electricity generation to a society based on using renewable energy for the same purpose. However, this process must be carried out based on a well-prepared technical and economic plan, and where the replacement of thermal power plants by renewable energy plants warrants a stable supply of energy at a reasonable price during the whole process, ensuring universal access to energy sources, reliable, and up-to-date power services according to the SDG 7 goal target, and without any undue political interference.
2) Establish a special EU fund to support vulnerable households and small businesses during the energy transition.
3) The type of renewable energy to be installed must be selected, considering the advantages and disadvantages of each type of energy source, the geographic characteristics of the location selected, the level of electricity demand, the time of construction, energy efficiency, public opinion, and the investment to be made, among other elements.
4) During the decarbonization process, several baseload power plants that are the least polluting but can stabilize the system in case of interruption of the operation of the renewable energy plants due to weather problems, droughts, and cloudy days, among others, are necessary.
5) To promote and support the connection of the energy infrastructures between EU countries to diversify supply and address possible energy supply interruptions.
6) To promote using hydrogen as an important energy source to produce energy because it does not emit greenhouse gases.
7) To increase the participation of marine renewable energy within the EU energy mix in the future.
8) To enhance international cooperation to facilitate access to new renewable energy research and technology, energy efficiency, advanced and cleaner fossil-fuel technology, and support and promote investment in energy infrastructure.
9) Expand infrastructure and upgrade technology to provide modern and sustainable energy services for developing countries, particularly least-developing states, small islands, and land-locked developing countries.

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Article

Special research on well-being and earning of rice farmers in Laos: Survey of Official Development Assistant (ODA) projects and economic analysis

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Abstract: Farmers in rural areas can only earn revenue from rice farming which rice farming supports their better lives. Agricultural knowledge is a potential incentive for promoting well-being. This paper was survey research, there were two sections: 1) the author utilized an econometric approach to analyze the earnings of farmers from 10 provinces from 2017–2021; there were 1120 farmers involved in the survey; 2) the author used an economic evaluation approach to analyze effectiveness and efficiency of ODA by using data from 1110 farmers in 2018; 1205 farmers in 2019; and 1330 farmers in 2020. ODA is Instrumental Variables (IV) in the mincer model, ODA promotes agricultural knowledge for farmers, and of course, agricultural knowledge promotes revenue for farmers. The 2SLS and maximum likelihood are essential for the quartic function of mincer. Evaluation approaches from OECD/DAC and PCAP/JICA were utilized to compare the results of well-being indicators called basic human needs (BHN). According to the results of this study, the earnings of farmers who joined ODA projects were higher than the earnings of farmers who did not join ODA projects. The result of the economic evaluation approach found 'ineffectiveness'; on the other hand, the author could find the efficiency of ODA projects. Finally, the recommendation is that the government policy on BHN should be consistently linked to the ODA program made by both the government and donors. Certainly, BHN policy for farmers who are minorities is necessary such as providing rice fields to be utilized for free, this will lead to chances for farmers to enhance their well-being from rice production.

Keywords: basic human needs; economic analysis; ledge of agriculture; (2E) effectiveness-efficiency

JEL Classification: C36; I25; R1

1. Introduction

Lao People's Democratic Republic (Lao PDR) is well known for the origin of glutinous or sticky rice to Muto et al. [1], 'Laos has a long history of seasonal changes, Lao PDR or Laos has a tropical humid climate caused by a period of monsoons, the annual rainfall in the wet season from May to October covers 90%, while some months during the dry season between November and April may have no rainfall', see Eric and Ponnarong [2]. Rice is a very famous product exported to overseas markets. Laos' agricultural production is the basis for both Lao people's income and national revenue. Regarding the geographical areas of Laos, 'rice is primarily produced in the country's lowland', see Eric and Ponnarong [2]. Many of the leading provinces for rice production are located along the main river (Mekong River) composed of Vientiane, Khammouan, Bolikhamxai, Savannakhet, Salavan, and Champasack. Rice production and other agricultural products have substantially strengthened economic development in the past forty years after independence in

1975. ‘Rice production is the main farming activity in Laos, it is accounted for over 80% of the total agriculture products cultivated from the farming area’ by Bestari et al. [3]. Annually Laos has received funds from developed countries and international organizations such as GIZ, JICA, and OECD through implementing rice plantations.

Rice is important for rural people in terms of income and food security while they are having difficulties accessing food, income, and well-being. The problem of this study demonstrated that the poverty rate in rural areas of Laos was above 20%. The Lao Statistics Bureau (Read more: The Lao Statistics Bureau [4]. Where are the poor in Lao PDR? Small area estimation: Province and district level results. https://laosis.lsb.gov.la/tblInfo/TblInfoList.do) [4] reported that in 2019, in northern areas, Bokeo province had a poverty headcount rate of 21.42%, Odomxay had (28.59%), Luangprabang had the lowest rate (20.69%), and Huaphan had the highest rate (29.11%); in southern areas, Salavan had the highest rate (31.17%), Savannakhet had (29.50%), and Attapue had the lowest rate (26.75%). Based on these data, poverty remained in many areas. To improve the well-being of people, reduce poverty, and increase income, one way is to promote agricultural activity in local communities. Thus, since early 2015, the Lao government has started to introduce technical promotion projects to assist agricultural farmers in rice production and their earnings as well as well-being. This study has two purposes to examine such as 1) to investigate how the effectiveness and efficiency of agricultural projects support farmers, and 2) to examine how the income of farmers impacts their livelihood and well-being.

The government regulates the value chain for rice such as setting price floors. In the meantime, merchandizers are seeking to export rice products to both domestic and overseas markets Food and Agriculture Organization [5]. Small farmers have been emphasizing green and sustainable growing techniques by the Ministry of Agriculture and Forestry in Laos [6], the government has forced rice products to export to 5 million metric tons from the current export of 1 million metric tons by 2025. Certainly, increasing irrigation to improve rice production and other seed varieties is very essential to meet Laos’ national development goal.

It is essential to improve rice production with new tools such as using cheap and good quality fertilizer to increase the production and value of rice for the Lao people. Irrigation provides water for farmers not just for growing rice but for fisheries consumption as well. ‘Village farming is generally conceived as a basic unit of social life in a spontaneous community’ (See also, Etsusaka [7].) for enhancing their quality of life. Currently, despite the rainfed paddy fields, the paddy fields are also characterized by irrigation paddy fields which have been funded by ODA donors. In recent years, paddies have been irrigated by systematically pumping irrigation which has been introduced to Lao farmers, this induces a high quantity of rice products for consumption and export.

In current development, another interesting phenomenon is that Lao farmers have been struggling to give up their farming activities due to the cost of production increasing and the loss of land due to many developmental projects, many farmers are now moving to cities to find work instead of doing rice farming, this situation probably affects rice cultivation in the future, and reduce the fundamental food for Lao people, markets, economy and so forth.

The distribution of agricultural land in Lao PDR is reasonably satisfactory for farmers in the current condition. There is not much difference in the quality of paddy fields between provinces by Onphandala [8]. However, 'the average rice farms are small added' by Eric and Ponnarong [2], 'averaging only around 1–2 hectares' production can vary significantly between years, but the adaptation of higher yield varieties depends on an increased irrigated acreage. There is no irrigated acreage in the highland area which limits the highland rice farmers to grow crops per year from April to November, while some lowland rice farmers have been able to cultivate rice two times a year with irrigated farms near a river. Planting time is in June and July, farmers will cultivate rice products from October to December.

Laos is socialist in the LDCs with a weak economy and has a low income per capita compared to some neighboring countries in the pre-and post-period of education reform in 1996. Laos remained inequality in well-being in many areas, even the portfolios such as FDI, ODA, and Government expenses have played important roles in promoting the Lao economy since 1986, in NSEDP [9].

Table 1 shows the opposite trend movement between ODA disbursement and well-being indicators from the macro-economic perspective such as employment and income. Every 5 years during 2001–2020, ODA from OECD countries had been increasingly disbursed to Laos, otherwise, the employment and income of Lao people had been sharply decreased.

Table 1. Trend of ODA disbursement and macro-economic indicators.

NSEDP phases	ODA disbursement in average (US million)	The employment rate in average (percentage)	The income per capita in average (percentage)
2001–2005 (5th NSEDP)	232.98	4.6	78.43
2006–2010 (6th NSEDP)	374.21	6.23	77.90
2011–2015 (7th NSEDP)	430.29	6.17	77.25
2016–2020 (8th NSEDP)	523.84	3.63	76.51

Source: OECD [10] and World Bank [11]. Data from 2001–2020.

Table 2 shows basic human need indicators (BHN) of farmers such as assets, food and drink, life satisfaction on health, elderly people care, and basic education. These BHN indicators in **Table 2** indicate that between the years 2020, 2015, and 2010; farmers had a higher degree of tension such as accessing clean food and drink is more difficult, buying new assets is not available due to insufficient income, having healthier is impossible, to access for elderly care is also difficult and to have basic education is not widely opened in local areas. These issues are explained by the percentage change of each BHN indicator in **Table 2** from the year 2010 to 2015, and the year 2015 to 2020.

Despite the diminishing return on the well-being of rice farmers, the ODA disbursement has increasingly added funds to the Lao economy, which leads the author to strive to understand this issue. Certainly, the author sets the research question and research objective as given below:

1) Research question:

Is there any efficiency and effectiveness of ODA projects in the field of rice farming? on promoting the income and well-being of rice farmers.

2) Research objectives:

Find out the outcome of income and well-being indicators of farmers, while they partnered with ODA projects.

Table 2. Trend of ODA disbursement and well-being or BHN[a] indicators.

Year	OECD (ODA) US$ million	Rice farmers	BHN indicators					
			Assets	Clean water	Food	Life satisfaction (health)	Elder people care	Basic education
2010	389.21	4309	47% of interviewees answered that rice farming revenue did not increase the assets of their families.	65% of interviewees answered that they could not access irrigation water.	29% of interviewees answered that they could not access food security.	23% of interviewees answered that they do not have good health conditions.	56% of interviewees answered that they do not have good care for their old age.	66% of interviewees answered that they could not access to good education (at least vocational).
2015	471.09	5720	53% of interviewees answered that rice farming revenue did not increase the assets of their families.	62% of interviewees answered that they could not access irrigation water.	31% of interviewees answered that they could not access food security.	26% of interviewees answered that they do not have good health conditions.	59% of interviewees answered that they do not have good care for their old age.	72% of interviewees answered that they could not access to good education.
2020	529.08	6982	58% of interviewees answered that rice farming revenue did not increase the assets of their families.	76% of interviewees answered that they could not access irrigation water.	36% of interviewees answered that they could not access food security.	28% of interviewees answered that they do not have good health conditions.	64% of interviewees answered that they do not have good care for their old age.	75% of interviewees answered that they could not access to good education.

Source: Author's data collection from every 5 years: 2010. 2015 and 2020 from rice farmers in Laos.
[a] The right of human for Basic Human Need is necessary, access to clean water, food, sanitation, and satisfaction in life, these are required for our humankinds, read attachment: https://www.epw.in/tags/basic-human-need-index.

2. Literature review

A scale of return is a key factor in determining the demand for knowledge because knowledge becomes a factor that induces income by Onphundala [8]; concepts of knowledge and farm efficiency through the worker effect, and choice of production technique were well defined in Schultz [12] and Welch [13]. The agricultural sector in Laos plays a vital role in promoting products from agriculture, building capacity for farmers, and providing knowledge on rice farming to farmers. Good quality of rice and high yield are affected by knowledge and technique of growing rice, the volume of rice production is much grower compared with previous years.

Jamison and Lau [14] 'surveyed the worldwide literature on education and small farming production in countries of Asia, Africa, and South America and produced 37 datasets, authors revealed that the educational level of households 20 educational levels can enhance modern farm operating and used 14 levels in the same way for rice production', they showed that 'the positive correlation between education attainment and farm efficiency is 31 out of 37 studies; education was positive in the modern agricultural economy'. Similarly, other studies have also

found a positive effect of education on enhancing the efficiency of farming, but the effect was quite small.

Table 3. ODA works as a distributional channel for promoting well-being.

Distribution channel	**Developmental sector**	**Indicators promote development**		
1. Private Investment	Industry			
2. FDI	Agriculture			
3. ODA	Service	Job/Employment	Income	Wellbeing
4. Government budget	Education (knowledge)			
	Tourism, etc.			
This research's purpose	**Developmental sector**	**Indicators promote development**		
3. ODA	Knowledge of rice farming	Job/Employment	Income	Wellbeing

Source: OECD [10] and JICA/PCAP has 5 criteria [15].

However, in **Tables 3** and **4**, knowledge is an important dominator for income earnings in market economies, which means people have better knowledge, the income earning and well-being will be received afterward people get employment, however, ODA performs the role of strengthening the knowledge. Studies from centrally planned economies have shown that low rates of returns on income earning occurred in good education, many researchers carried out their analysis by utilizing the capital earning model using OLS and Maximum Likelihood to estimate the impact of education on income for example by Wei et al. [16] and Xie and Hanman [17]; the result of education promotes income was low in planned economies in the early stage of transition, for instance, in Vietnam by Moock et al [18], in Slovenia by Orazem and Vodopivec [19], and in Czech Republic and Slovakia by Chase [20].

Table 4. ODA works as a distributional channel for rice farming and well-being.

ODA	**Developmental sector**		**Indicators promote development**		
	Program for knowledge/education	**Participants**	**Employment**	**Income**	
JICA[a]	Workshop/training projects for agricultural plantation	Agriculturist of Laos	Join a training program for capacity building on agricultural farming	Salary/wage	Wellbeing
EU[b]	Training projects for enhancing knowledge of sustainable plantation	Farmers in Laos	Have good knowledge from workshops and practice growing rice on their rice farms	Revenue/income from selling rice products	
OECD[c]	Training programs for agricultural production (the purpose of the program is to reduce the gender gap)	Investors and farmers	Investor runs investment in rice farming, joins with local farmers to grow rice and sell rice production		

Source: OECD [10] and JICA/PCAP has 5 criteria [15].

[a] JICA provided training project on building capacity for agriculturist in Laos on producing organic agriculture product OA with OA standard in the internal control system ICS. Website of JICA for OA is available at https://www.jica.go.jp/project/english/laos/026/materials/c8h0vm0000f8rwvm-att/leaflet.pdf.

[b] EU leaded by some countries such as France, Switzerland, Germany, Luxembourg disbursed funds on promoting farmers for sustainable farming, Lao farmers enable their benefits from sustainable farming production. https://international-partnerships.ec.europa.eu/system/files/2021-12/mip-2021-c2021-9087-laos-annex_en.pdf.

[c] OECD program on enhancing female participation in agricultural farming in Laos, the rate of women participation in the agricultural farming was 70% which is the highest rate in ASEAN and followed by Myanmar 45% and Vietnam41%. https://asean.org/wp-content/uploads/2021/07/Background-Report-Strengthening-Womens-Entrepreneurship-in-Agriculture-1.pdf.

Abadzi [21] 'analyzed systemic problems in education in several countries: Africa, Asia, and South America, the study revealed inefficacy of educational practices under the instability of socio-economic development, many more students had no intense to attend class'. However, some papers showed a decreasing rate of absence, which improved the quality of education and income. Another research paper by Eric and Ponnarong [2] 'explored the link between educational quality and economic growth, according to their analysis, policies that aim to improve educational systems in developing nations have significant economic returns'. Many authors found that long-term improvement in education will substantially increase GDP compared to countries that make no changes. Additionally, a report [22] showed that 'quality of education can provide an employment opportunity, good livelihood, and economic growth, of course, the report provided broad policies that help people acquire skills and increase knowledge'. In this study, asserting the knowledge of agriculture for promoting the earning of rice farmers will be an important factor in revealing snapshots of farmers' livelihood and well-being.

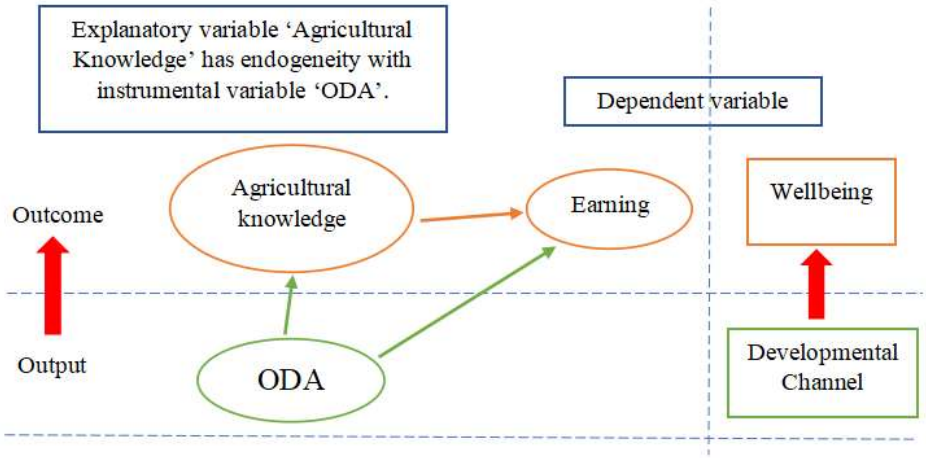


Figure 1. Flow of ODA as an instrumental variable for promoting agricultural knowledge and income.

This paper focuses on how agricultural knowledge promotes income earning of rice farmers (assume that people with agricultural knowledge, will have better opportunities to earn income), The Mincer model will be deployed in the analysis; in **Figure 1** the flow chart of ODA projects impact on income earning for farmers, namely, ODA projects promote agricultural knowledge for farmers and after the stage of rice plantation and production, farmers be able to gain their incomes from selling those rice production, in consequences, farmers will make expenses or purchase things to serve their lives for their wellbeing.

Another scenario is that measuring the effectiveness and efficiency of ODA in promoting well-being is privileged by adopting evaluation approaches from OEDC/DAC [23] and PCAP/JICA [15] in **Table 5**. Finally, the study also revealed possible policies that can bolster local areas' development with the participation of ODA.

Table 5. Economic evaluation criteria created by organizations.

Criteria	Main checking points on economic evaluation	
	OECD/DAC	**PCAP/JICA**
Effectiveness	1) To what extent were the objectives achieved/are likely to be achieved? 2) What were the major factors influencing the achievement or non-achievement of the objectives?	The output and objectives of the project are coherent and estimate the results of the project achievement by looking at the real implementation of the project compared with the designed activities in the project in the beginning phase.
Efficiency	1) Are Activities cost-efficient? 2) Objectives achieved on time? 3) Project implemented most efficiently compared to alternatives?	Output and input management of the project are well progressive, estimate budget used in the project's activities, estimate utilizing inputs such as natural resource and human resource.

Source: OECD/DAC has 6 evaluation criteria [23] and JICA/PCAP has 5 criteria [15].

3. Methodology and data

To find a concrete result of ODA impacts on the income and well-being of rice farmers, the author utilized two approaches to estimate the connection between ODA and other indicators like income and well-being. Focusing on the 'efficiency and effectiveness' of ODA is necessary. Thus, to carry out the estimation of the efficiency and the effectiveness of ODA project impacts on income and well-being; the first estimation used the evaluation approach; and the second estimation used the econometric approach by relying on the Mincer [24] equation.

3.1. Economic evaluation

The survey was conducted to find out whether is there any efficiency and effectiveness of ODA projects in promoting the well-being of rice farmers. In this analysis, there were farmers between 1000–1350 people who had been interviewed by the survey team in 2018, 2019, and 2020 (3 years). Evaluation approaches from OECD/DAC [23] and PCAP/JICA [15] were used as the typical model for the author in this research, the author relies on the evaluation criteria from OECD and JICA to formulate some evaluation indicators in **Table 6** in this study. Indicators of well-being or BHN indicators such as agricultural knowledge, employment opportunity,

Table 6. Economic evaluation estimation for this research.

Criteria	Main checking points on economic evaluation and BHN indicators		
	OECD/DAC	**PCAP/JICA**	**This research**
Effectiveness	1) To what extent were the objectives achieved/are likely to be achieved? 2) What were the major factors influencing the achievement or non-achievement of the objectives?	Are the outputs and objectives of the project coherent? estimate the project achievement by looking at the real implementation of the project and the designed activities in the pre-project.	1) Does the ODA project support rice farmers with new knowledge for rice farming/employment opportunities? 2) Does the ODA project improve your well-being? Such as having many more assets, better life expectancy for elderly care, health, food, and drink.
Efficiency	1) Are activities cost-efficient? 2) Objectives achieved on time? 3) Project implemented most efficiently compared to alternatives?	Are output and input management of the project well-progressive? estimate the budget used in the whole project's activities and estimate inputs such as natural resources and human resources.	1) Does the ODA project help cost minimization on rice farming? 2) Does the ODA project reduce the gap in life between you and other farmers?

Source: OECD/DAC has 6 evaluation criteria [23] and JICA/PCAP has 5 evaluation criteria [15].

assets of farmers, nutrition of farmers from clean water and food, life safeguard on health; life expectancy on elderly people care, cost minimization on rice production, and gap reduction among ethnicities are entirely used in the analysis, based on Robin Loveridge et al. [25].

1) Analysis factors in the economic evaluation approach, developed by the author:

$$\sum_{i_{=1}}^{n}(X_{it}+Y_{it})=\sum_{i_{x=1}}^{n_x}X_{it}+\sum_{i_{y=1}}^{n_x}Y_{it} \quad (1)$$

Replace E for the summation

$$E(X_i+Y_i)_t=E(X_i)_t+E(Y_i)_t \quad (2)$$

$$E(X_i)_t=E(X_i+Y_i)_t-E(Y_i)_t \quad (3)$$

Vice versa:

$$E(Y_i)_t=E(X_i+Y_i)_t-E(X_i)_t \quad (4)$$

let, $E(X_i + Y_i)$ is the total number of farmers from rice farming who were interviewed as to 'well-being indicators', and 't' refers to the year.

Then, the extent:

$E(X_{ia})$ is a farmer who answered 'agree' to the ODA projects to increase well-being.

$E(Y_{id})$ is farmers who answered 'disagree' for the ODA projects increase well-being.

Next, Find the percentage mean of $\%\bar{E}(X_{ia})_t=\frac{E(X_{ia})_t}{E(X_i+Y_i)_t}\times 100\%$

And the percentage of mean $\%\bar{E}(Y_{id})_t=\frac{E(Y_{id})_t}{E(X_i+Y_i)_t}\times 100\%$

2) Interpretation of factors:

- Single factor:

$\bar{E}(X_{ia})$ > 0.5 or 50%, there is efficiency or effectiveness, means $\bar{E}(X_{ia}) > \bar{E}(Y_{id})$

$\bar{E}(Y_{id})$ > 0.5 or 50%, there is inefficiency or ineffectiveness, means $\bar{E}(Y_{id}) > \bar{E}(X_{ia})$

- The single factor with time determinant (n–k):

't' represents the year, while k is the determinant of year lag $|k|$ = 0, 1, 2, 3, …, K

If mean $E(X_{ia})$ has ~ $E(X_{ia})_{t-0} > E(X_{ia})_{t-1} > E(X_{ia})_{t-2} \ldots > E(X_{ia})_{t-k}$

Or in any case, ~ $E(X_{ia})_{t-0} < E(X_{ia})_{t-1} < E(X_{ia})_{t-2} \ldots < E(X_{ia})_{t-k}$

~ $E(X_{ia})_{t-0} > E(X_{ia})_{t-1} < E(X_{ia})_{t-2} \ldots < E(X_{ia})_{t-k}$

~ $E(X_{ia})_{t-0} > E(X_{ia})_{t-1} > E(X_{ia})_{t-2} \ldots < E(X_{ia})_{t-k}$

~ $E(X_{ia})_{t-0} < E(X_{ia})_{t-1} > E(X_{ia})_{t-2} \ldots > E(X_{ia})_{t-k}$

But if 2/3 of $\bar{E}(X_{ia})$ is greater than 0.5 or 50%.

Accepts, that there is effectiveness/efficiency.

If mean $E(Y_{id})$ has ~ $E(Y_{id})_{t-0} > E(Y_{id})_{t-1} > E(Y_{id})_{t-2} \ldots > E(Y_{id})_{t-k}$

Or in any case, ~ $E(Y_{id})_{t-0} < E(Y_{id})_{t-1} < E(Y_{id})_{t-2} \ldots < E(Y_{id})_{t-k}$

~ $E(Y_{id})_{t-0} > E(Y_{id})_{t-1} < E(Y_{id})_{t-2} \ldots < E(Y_{id})_{t-k}$

~ $E(Y_{id})_{t-0} > E(Y_{id})_{t-1} > E(Y_{id})_{t-2} \ldots < E(Y_{id})_{t-k}$

~ $E(Y_{id})_{t-0} < E(Y_{id})_{t-1} > E(Y_{id})_{t-2} \ldots > E(Y_{id})_{t-k}$

But if 2/3 of $\bar{E}(Y_{id})$ is greater than 0.5 or 50%.

Accepts, that there is ineffectiveness/inefficiency.

3) Data

The survey was conducted in 2018, 2019, and 2020 in many provinces in Laos, namely, there are 5 provinces from the northern part: 'Phongsaly, Bokeo, Odomxay, Huaphan, Luangprabang', and 6 provinces from the middle and southern part: 'Attapue, Champasack, Saravan, Xekong, Bolikhamxay, and Vientiane Capital', totally there are 11 provinces in the survey, there were 1120 farmers in 2018, 1,205 farmers in 2019 and 1330 farmers in 2020 involved in the interview of the survey team. These provinces are areas where ODA projects in the field of rice farming have been implementing the agricultural framework made by the Lao government and donors.

3.2. Empirical approach (econometrics)

1) The model specification is based on Mincer [24].

$$\ln Y_i = \beta_0 + \beta_1 S_i + \beta_2 EX_i + \beta_3 EX_i^2 + \mu_i \quad (5)$$

mincer mentioned the variables such as Y_i represents income from the monthly earnings of the individual, S_i is the total years of school attendance of the individual (between basic school to vocation), EX_i is the total years of working experience of the individual i represents the individual; μ_i is residual. Potential experience $EX_i^2 = (\text{Age} - \text{Education year} - 6)^2$, 6 is the beginning year for the individual to start his or her primary school.

In Equation (6) the author extents:

Y_i presents the income earnings of the individual farmer.

S_i is the level of agricultural knowledge of individual farmer, there are four levels of agricultural knowledge for farmers: 1) No knowledge of agriculture or rice farming, 2) Basic knowledge of agriculture, 3) Good knowledge of agriculture, 4) Better skill of agriculture, 5) Depth knowledge on rice farming, 6) Advanced knowledge of agriculture, 7–9) Professional rice farmer.

EX_i is the total years of working experience of individual farmers.

The potential experience EX_i^2 is $(\text{Age} - S - a)^2$, Age is the total age of the individual farmer, S is total years of school attendance of individual farmer, a is the beginning year of the individual farmer to start his or her vocational school in between the age of 12 to 18 years old ($12 \leq a \leq 18$).

Then, let the fitted income-earning model be:

$$\ln Y_i = \beta_0 + \beta_1 S_{\text{agricultural knowledge (i)}} + \beta_2 EX_i + \beta_3 EX_i^2 + \mu_i \quad (6)$$

In Equation (6), to solve the quadratic function of Mincer, the author considered Instrumental Variable (IV) Technique by using 2SLS estimation and Maximum Likelihood Estimation.

2) Data

The research was conducted in many provinces in Laos, namely, 11 provinces including Phongsaly, Bokeo, Odomxay, Huaphan, Luangprabang, Attapue, Champasack, Saravan, Xekong, Bolikhamxay and Vientiane Capital. The data in this analysis was surveyed in 2017–2021 by totally interviewing 1120 rice farmers.

4. Results

This paper investigated ODA and agricultural knowledge in association with income earnings and the well-being of rice farmers. The study revealed some interesting results as explained below:

4.1. Economic evaluation analysis

1) Effectiveness

Table 7 shows the number of farmers involved in the interview of the survey team, in 2018, 1110 farmers responded to the interview as well as in 2019 there were 1205 farmers, and 1330 farmers in 2020 participated in the interview; Interestingly, the result revealed that ODA projects do not make any effect on promoting the wellbeing of farmers, such a result is based on observing BHN indicators include: agricultural knowledge of farmers, employment opportunity of farmers, assets of farmers, food and drink, elderly care, and life satisfaction on health; there was over fifty percent of farmers replied that ODA projects cannot promote the wellbeing of farmers in terms of effectiveness, for instance in 2018 the percentage of mean $E(Y_{id})$ of life satisfaction on health was 55%, in 2019 $E(Y_{id})$ was 50% and in 2020 $E(Y_{id})$ was 51%, these percentages of mean $E(Y_{id})$s are relevant to rise the ineffective level of ODA projects. Overall, the percentage of mean $E(Y_{id})$ of every HBN indicator in **Table 7**, from 2018 to 2020, was greater than the percentage of mean $E(X_{ia})$; of course, in the symbolic interpretation is '$E(Y_{id}) > E(X_{ia})$'.

Table 7. Result of effectiveness, based on the designed evaluation criteria.

Year	Rice farmers	BHN indicators for rice farmers' wellbeing													
		Knowledge of agriculture		Job/employment opportunity		Assets		Water access		Food security		Life satisfaction (health)		Elderly people caring	
		$E(Y_{id})$	$E(X_{ia})$	$E(Y_{id})$	$E(X_{ia})$	$E(Y_{id})$	$E(X_{ia})$	$E(Y_{id})$	$E(X_{ia})$	$E(Y_{id})$	$E(X_{ia})$	$E(Y_{id})$	$E(X_{ia})$	$E(Y_{id})$	$E(X_{ia})$
2018	1120	41%	59%	54%	46%	62%	38%	51%	49%	61%	39%	55%	45%	61%	39%
2019	1205	56%	44%	53%	47%	62%	38%	51%	49%	48%	52%	50%	50%	52%	48%
2020	1330	57%	43%	53%	47%	62%	38%	52%	48%	49%	51%	51%	49%	53%	47%

Source: Author's calculation and evaluation.

2) Efficiency criteria

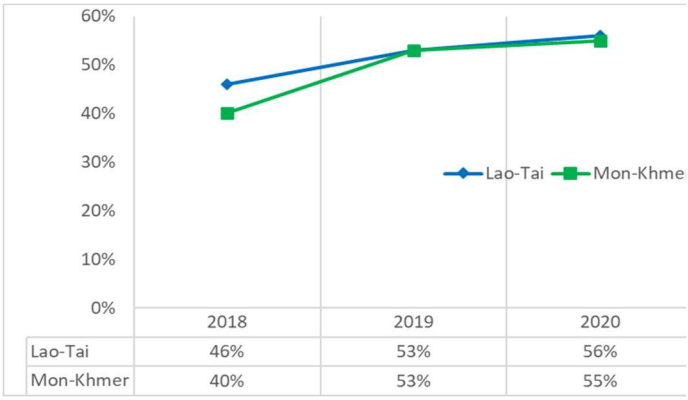
Table 8 shows the results of farmers joining the interviewing of the survey team, the interpretation is similar to the detail in **Table 7**. In **Table 8**, there are two BHN indicators: cost minimization for rice production and gap reduction among ethnic groups, these indicators are used for estimating the efficiency of ODA projects. The result revealed that ODA projects can assist farmers in minimizing the cost of rice production due to the reason of ODA projects provide bio-fertilizer for free to rice farmers, farmers do not pay any cost for purchasing this material, simultaneously, ODA projects can reduce the gap among ethnics in local communities because facilities provided by Lao government and ODA projects such as roads, sanitation and welfares, these facilities are undoubtedly accessible by farmers, even some farmers are from minor tribes in the community. In **Table 8**, the percentage of mean $E(X_{ia})$ of cost minimization was 65% in 2018, 54% in 2019, and

63% in 2020, these percentages of $E(X_{ia})$s are greater than the percentages of mean $E(Y_{id})$; likewise, farmers said, ODA projects were efficient in terms of cost minimization and gap reduction among ethnics, the symbolic interpretation is $E(X_{ia}) > E(Y_{id})$, and there are 2/3 of $E(X_{id})$ from the result.

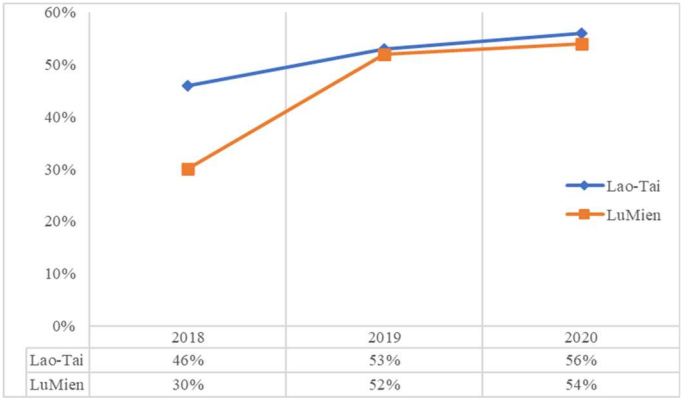
Table 8. Result of efficiency, based on designed evaluation criteria.

Year	Rice farmers	BHN Indicators for rice farmers' Wellbeing			
		Cost minimization for rice production		Gap reduction among ethnics	
		$E(Y_{id})$	$E(X_{ia})$	$E(Y_{id})$	$E(X_{ia})$
2018	1120	35%	65%	62%	37%
2019	1205	46%	54%	49%	51%
2020	1330	47%	53%	49%	51%

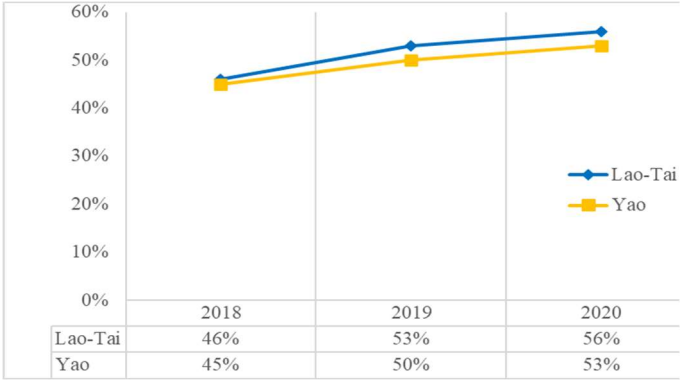
Source: Author's calculation and evaluation.



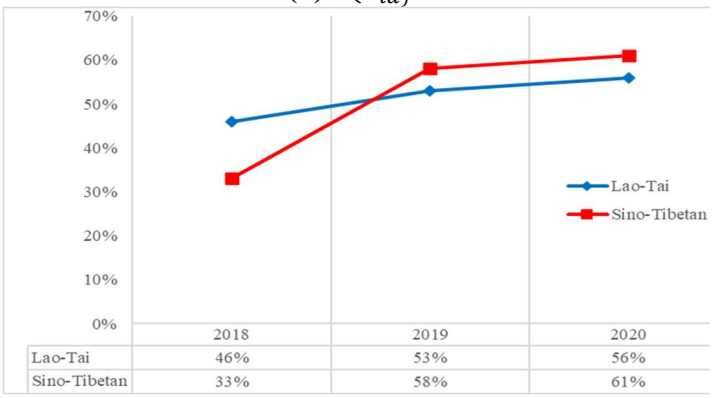
(a) $\bar{E}(X_{ia})$



(b) $\bar{E}(X_{ia})$



(c) $\bar{E}(X_{ia})$



(d) $\bar{E}(X_{ia})$

Figure 2. Comparison of the gap reduction among minor ethnics and major ethnics 'Lao-Tai'.

Figure 2, this figure shows the percentage of mean $E(X_{ia})$ on the gap reduction between minor ethnics of Lao people including LuMien, Mon-Khmer, Sino-Tibetan, and Yao, and the major ethnic of Lao people called Lao-Tai, gap reduction among minor ethnics and major ethnic had been substantially diminished during 2018–2020, for instance in **Figure 2a**, in 2018 the minor ethnic called LuMien had 30% of the percentage of mean $E(X_{ia})$ which compare with Lao-Tai had 46% of the percentage of mean $E(X_{ia})$, this means that the gap among Lao-Tai and LuMien was very different, but in 2019 and 2020 the gap was reduced to almost the same percentage

of mean $E(X_{ia})$, of course, in 2019 the percentage of mean $E(X_{ia})$ of Lao-Tai was 53% and LuMien was 52%, and in 2020 $E(X_{ia})$ of Lao-Tai was 56% and $E(X_{ia})$ of LuMien was 54%. Despite the percentage changes in **Figure 2**, farmers from minor ethnics said, they have more chances to use facilities provided by the Lao government and ODA projects such as good roads, expandable markets, better sanitation, and more satisfying welfare; these are facilities comfort the activity for rice plantation and production to farmers.

4.2. Econometric analysis

Table 9 shows the result of ODA impacts on agricultural knowledge, and then agricultural knowledge impacts on the income of farmers, simultaneously, the experience of farmers also impacts on income of farmers, these results are interpreted by relying on the Mincer [24] model. Firstly, ODA is used as an instrumental variable or endogenous variable of the agricultural knowledge which rice farmers gained this agricultural knowledge from ODA projects through workshops and training in the article related to agriculture and rice farming. Secondly, according to the procedure of rice production, farmers used agricultural knowledge for their rice farming activities, in consequence, after selling rice production most farmers will have income and eventually farmers will purchase things for their lives, this circumstance will reflect the quality of life or wellbeing for farmers. In **Table 9** the author used the variable called agricultural knowledge 'Tertedu' in Equation (6), the result from 2SLS and MLE estimation showed that there was a positive relationship between Tertedu and income of farmers, the coefficient of Tertedu is 0.063, this means increase 1 level of agricultural knowledge will increase 6.3% in the income of rice farmers; the interpretation is the same for the variable 'Jobexp' which is the experience of farmers, the coefficient of Jobexp is 0.0247, this means increase 1 year for the experience of farmers will increase 2.47% in the income earning of rice farmers, but not for potential experience 'Jobexp2'.

Table 10 interprets the result of the income earning of rice farmers who partnered with ODA and rice farmers who did not partner with ODA. The coefficient of Tertedu of rice farmers partnered with ODA was 0.0143 and the coefficient of Tertedu without ODA was 0.0132, which means farmers partnered with ODA projects can earn income 'LnYi' higher than farmers who did not partner with ODA projects, for instance, increases 1 level of agricultural knowledge to farmers will increase 1.43% in income earning for farmers with ODA projects and 1.32% in income earning for farmers without ODA projects; also, for the experience of rice farmers 'Jobexp', the author interpreted that increases the 1-year experience of farmers who partnered with ODA projects will increase 0.73% in income earning, as well as the income of farmers who did not partner with ODA projects, will also increase 0.89% in income earning. Even though the coefficient value of Jobexp for rice farmers without ODA is higher than the coefficient value of rice farmers partnered with ODA, however, both coefficients have a positive relationship with the income earning of rice farmers. but not for potential experience 'Jobexp2'.

Table 9. Impact of ODA, region, and gender on education and income.

2SLS Estimation				
Variables	**Tertedu**	**Jobexp**	**Jobexp2**	**Cons**
Logincome	0.063708	0.0247152	−0.0003365	2.596943
	(12.83)	(11.37)	(−7.66)	(89.73)
R-square: 0.3602				
Observations: 1120				
Instrument variables: ProgODA, Region, Gender				
Test for endogeneity: (P = 0.0132), Tertedu is endogenous variables with instrument variables				
First stage least square testing of IV: (P = 0.0000), *R*-square: 0.5826, Adjust *R*-square: 0.5807				
Test for the validity of IV model: (P = 0.9684), accept the null hypothesis, this IV model is valid				
Maximum Likelihood Estimation				
Variables	**Tertedu**	**Jobexp**	**Jobexp2**	**Cons**
Logincome	0.0637088	0.0247152	−0.0003365	2.59694
	(12.83)	(11.37)	(−7.66)	(89.73)
R-square: 0.3602				
Observations: 1120				

Source: Author's Calculation in 2022 by applying the Instrumental variables (IV) with 2SLS estimation and MLE estimation.

Table 10. Impact of ODA on promoting education and income

	MLE			
Variables	**With ODA**	***P***	**Without ODA**	***P***
Tertedu	0.0142875	(0.0000)	0.0131978	(0.013)
	(8.53)		(2.50)	
Jobexp	0.0073123		0.0089813	
	(6.09)		(7.09)	
Jobexp2	−0.0001029		−0.0001197	
	(−4.61)		(−5.18)	
Cons	1.012901		0.9758029	
	(63.67)		(41.65)	
R-square:	0.30292915		0.26467609	
Observations:	653		467	
Instrument variables: Region, Gender, With ODA or Without ODA				
All coefficients are related by the significance at the 5% level.				

Source: Author's calculation in 2022 by applying the Instrumental variables with MLE estimation on Mincer's income function.

5. Discussion

Laos has become a country for rice farming due to the availability of geographical areas and rivers. Rice plantation makes revenue for the local farmers, enhancing their well-being after selling rice crops, and contributing to the Gross Domestic Product (GDP). In developing countries with natural resources and wide nature-based land fields for rice plantations, this condition can grow the locality's

economy and livelihood of residents in Schultz [12]. However, it is particularly vulnerable to narrative economic improvement, not a broad incentive to grow the economy in the least developed country by Abadzi [21]. As a result, the agricultural sector of Laos has experienced a complete halt, the trade for rice was expected to continue to grow throughout 2021–2030 due to ongoing rice projects supported by the Lao government in research of Sethboonsarng [26]. However, a weak capacity of rice production in Laos will lead the local economic activities to result in a decrease in income earning for local farmers, unemployment issues will further hinder economic performance and overall GDP markets in the study of the Food and Agriculture Organization [5].

6. Conclusion and recommendations

6.1. Summary

The economic evaluation approach has two criteria such as effectiveness and efficiency, the result of the effectiveness revealed that ODA projects for rice farming do not show any effectiveness in promoting the BHN of farmers, this meant evaluating some BHN indicators include: agricultural knowledge, employment opportunity, assets of farmers, clean food and drink, life satisfaction on health, and elderly people care, these indicators did not show any outstanding participation of ODA projects on promoting the BHN of rice farmers; each BHN indicator had the percentage of mean $E(X_{ia})$ smaller than the percentage of mean $E(Y_{id})$. On the other hand, the result of the evaluation on efficiency found that ODA projects are 'efficient' for promoting cost minimization on rice plantation and production as well as promoting the gap reduction among ethnics in local areas, the cost minimization and gap reduction among ethnics have the percentage of mean $E(X_{ia})$ greater than the percentage of mean $E(Y_{id})$, likewise, there are also 2/3 of the percentages of mean $E(X_{ia})$s are higher than 50%. Despite the results, farmers from minor ethnics said, they have better chances to access some facilities provided by the Lao government and ODA projects such as good roads to rice farms, and expandable markets for selling rice products, these are facilities comfort the rice plantation, and production for farmers in minor ethnics. Thus, in terms of efficiency, ODA projects play a vital role in cost minimization and gap reduction for farmers. On the other hand, in terms of effectiveness, ODA projects do not work effectively in promoting villagers' well-being via BHN indicators.

According to the result of the econometric approach by relying on the Mincer model, the study found that farmers who partnered with ODA can earn income higher than rice farmers who did not partner with ODA projects in **Table 10**. Certainly, agricultural knowledge of rice farmers 'Tertedu' in **Table 9** will support the income earning of rice farmers 'LnYi'. Simultaneously, the experience of rice farmers 'Jobexp' is also a factor in promoting the income earning of rice farmers 'LnYi' in Equation (6) of this survey analysis.

6.2. Recommendation

6.2.1. Policy

Even though minimizing the cost of rice production can be efficiently done by the participation of ODA projects, the policy required for lower input prices is vitally needed for rice farmers.

In the study, of course, ODA can reduce the gap among ethnics, however, the government policy on providing free utilizing facilities such as new roads to rice farms, sanitation, and health care without fee, are important facilities to all local farmers and recently such facilities are still required in their local communities.

6.2.2. Further study

ADB evaluation approach paid much attention to the ex-post evaluation of ODA projects. Thus, the next study will grapple with to use of the ADB evaluation approach in the phase of ex-ante evaluation of ODA projects.

Female opportunity to access well-being is more difficult than males, well-being estimated by observing female participation in rice production is also challenging.

Informed consent: Participants in the survey were beneficiaries who had been informed of ethical consent by the beginning time of interviewing and in the questionnaire made by the author. Participants were informed they could withdraw from the survey if they wanted, and their data could be deleted without any personal information captured and identified.

Conflict of interest: The author declares no conflict of interest.

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Article

Impacts of quality management principles in supporting sustainable development in the Mauritian hospitality sector

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Abstract: The notion of sustainability has greatly evolved since the 1960s. As the global population is increasing along with the consumption rate, it is becoming urgent to alleviate the negative impacts of this growth while, in parallel, allowing for continuous enhancements in environmental quality and overall living standards. This is where the need for sustainability becomes apparent. This research focuses on the hospitality industry, one of the top pillars of the Mauritian economy, which has expanded drastically during the last two decades. The study aims at assessing sustainability practices through an investigation of the different sustainable practices adopted by the hospitality industry. A survey was conducted with the main stakeholders in the hotel industry. The outcome of the survey, including an overview of the gaps faced by the hotels during their sustainability system implementation or maintenance, contributed to designing a framework linking quality and sustainability. The survey revealed that most hotels possess sustainability certifications. It was noted that more than 80% of the respondents calculate or estimate their CO_2 emissions, and that around the same percentage of interviewees use the LCA technique. Further, this study depicts that hotels in Mauritius have started their sustainability journey, which is a positive sign. To help the industry overcome barriers to Sustainable Development (SD), it is recommended to use and include quality management as a tool to support and enhance overall efficiency.

Keywords: sustainability; sustainable practices; hospitality industry; quality management principles; Mauritius

1. Introduction

The concept of sustainability was devised explicitly to indicate that it was feasible to attain economic growth and industrialization without damaging the environment [1]. The population has grown fast since then, and productivity has progressed. The preservation of the world's life support systems has become increasingly challenging because of the quick and continual environmental changes produced by humans [2]. The tourism sector in Mauritius contributes significantly to economic growth and acts as a vital driver in the country's overall development [3].

However, due to COVID-19 and the implementation of several containment measures like travel bans, closed borders, and quarantine periods, the tourism industry has been the most negatively impacted. Mauritius was no exception. Before the lockdown, the island was already showing signs of the pandemic's damaging effects on tourism. The virus forced several hotels, travel companies, and guesthouses to close for a prolonged period, in addition to lowering travel moods throughout the world. The situation worsened during the initial Mauritius shutdown in 2020. According to Statistics Mauritius, overall visitor arrivals plummeted by 68.6% in 2020 compared to the same time in the previous year; those arriving by air decreased

by 70.9%, while those arriving by water increased by 16.2%. Revitalizing the industry will need coordination and coordinated measures throughout the whole travel and tourism ecosystem [4]. Sustainability was characterized in the Brundtland Report as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' [1]. The approach to business sustainability emphasizes the need to consider economics, the environment, and equity when making company choices [5].

Companies are thus making substantial changes in how they create, produce, and distribute products and services to their consumers as there is an increase in expectations for change [5]. To allow the tourist sector to recover and reimagine the prospect of tourism in a new post-COVID-19 climate, policymakers must begin focusing on an action plan and a long-term strategy [4]. Uncontrolled tourism expansion can result in major consequences such as cultural and environmental deterioration, the destruction of vulnerable ecosystems, and pollution, to name a few [6].

Studies have outlined the effects of adopting management strategies linked to the Quality Management (QM) paradigm and their potential benefits for company sustainability and environmental management. The goal of quality development is to meet and exceed customer requirements while also improving efficiency, i.e., how to provide more customer value with fewer resources. Sustainability might be addressed in a practical way by incorporating the information and approach used in high quality work into sustainability initiatives [7].

The aim of this study is to identify and analyse the various sustainable practices adopted by 3 to 5-star' hotels in Mauritius and recommend a framework using quality management principles to help the organisations overcome the obstacles they are facing in developing sustainability and achieving customer satisfaction. The objectives are as follows:

1) Investigate the different sustainable practices adopted by the hospitality industry with regards to the three dimensions of sustainability, namely, social, economic, and environmental.
2) Assessing the context in which sustainability practices benefit the hotels in Mauritius.
3) Identifying gaps or issues faced by the hotels that can prevent them from attaining their sustainability goals.
4) Designing a framework using quality management principles and dimensions of sustainability to help the hotels enhance their sustainability objectives.

2. Literature review

2.1. Three dimensions of sustainability

Governments modifying legislation and regulations, businesses engaging in voluntary social responsibility initiatives based on conscious consumption, and consumers being educated to change their consumption patterns are all instances of a growth in the need for sustainability initiatives [8]. The challenge for current and future generations is to avoid or alleviate the negative impacts of this increase while simultaneously allowing for continuous improvements in environmental quality,

human health protection, and overall living standards [5]. The three-pillar concept of sustainability has gained widespread acceptance. This concept is generally represented as three intersecting rings with overall sustainability in the center, as shown in **Figure 1** below. 'Sustainability' is still a fluid notion with many different interpretations and meanings depending on the situation [9].

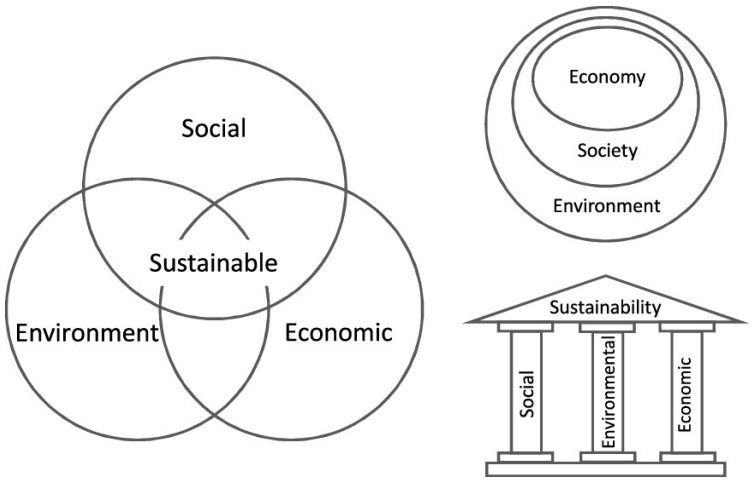

Figure 1. The 3 pillars of Sustainability illustrated [9].

2.2. Business sustainability

The triple bottom line concept is commonly used by businesses, governments, and NGOs to address sustainability challenges. Sustainability will have an impact on context, creativity, process, and the ability to persist [10]. Further, CSR is a rising idea in the larger framework of general business. Some argue that it is the business sector's means of combining the economic, environmental, and social priorities of their operations, like the triple bottom line notion. The economy of this emerging century will be marked by a decline in the energy and material content of items and a rise in their intellectual content. Governments and businesses will have a challenge ensuring that economic growth is both environmentally and socially sustainable [5].

2.3. Sustainability in the hospitality industry

Tourism is one of the world's largest, fastest-growing, and most promising industries, contributing to economic growth, job creation, and poverty reduction [3]. Notwithstanding the worldwide efforts aimed at managing the COVID-19 pandemic, a number of sectors, such as the hotel and tourism industries, have begun to regain their vibrancy. In fact, there is a growing and thriving demand for reservations and hospitality services [11]. The tourist industry, on the other hand, is now facing a variety of difficulties [3]. As per Chummun and Mathithibane [12], several studies have looked at the economic and social consequences of tourism in recent years, and it has gotten a lot of attention from academics. This is because tourism is one of the largest and fastest-growing sectors in the world, contributing 10% to global GDP and fostering the expansion of both official and informal businesses. Tourism has a large income multiplier impact in Small Island Developing States (SIDS), producing economic activity and income in linked tourism-oriented hospitality, recreational, and transportation sectors.

The behaviour of customers and decision-makers is now significantly influenced by the sustainability of the hospitality and hotel industries. Due to rising supply chain operating costs, state environmental restrictions, community pressure, and customer knowledge and demand, hotels are under more pressure than ever to adopt green supply chain management. Energy use in the hotel sector of the tourism business is one of the highest. In addition, hotels use a lot of water. Hotels must therefore implement an environmental strategy more quickly than other firms in order to lessen or eliminate the negative effects of their operations on the environment [13].

Further, the previously mentioned author stated that a hotel that uses green techniques improves its standing, appeal, and value to guests more than other hotels do. Customers are more loyal, satisfied, and prepared to pay more. The tourism industry supports all 17 of the UN's sustainable development goals; in particular, it directly supports goals 8, 12, and 14. Sustainable tourism is securely positioned to advance the UN's post-2015 development ambitions, which ask for a defined implementation framework. Those growing concerns about several key difficulties and problems confronting society, ecosystems, and the economy at various geographical and temporal scales are reflected in a growing interest in sustainability. Continued population increase and urbanisation, as well as all the constraints, namely, natural resource use and food supply, climate change, rising levels of pollution, the loss of natural ecosystems, water stress, and shortages, resulted in an increase in consideration for the notion of sustainability, which is being considered as a possible solution. Designing green hotels, reducing energy consumption, technology innovation, sustainable tourism, and sustainable human resource management practices may contribute to sustainability [14].

Green customers are often characterized as those who engage in ecologically responsible consumer behaviours. Consumers may lessen their influence on the environment by cutting back on their consumption, using public transportation, recycling, buying products with fewer packaging, buying used goods, eating less meat, purchasing locally grown food, organic food, fair-trade goods, and other things [15].

Cingoski and Petrevska [16] stated that tourists have grown more conscious of and begun to think about novel, out-of-the-ordinary topics, such as environmental preservation, waste management, energy effectiveness, renewable energy, greenhouse gas emissions, etc. The management's main goal is to concentrate its efforts on cutting operational costs by implementing new energy sources and preserving the environment by developing an eco-friendly institution. Reducing operating expenses boosts revenue and enhances competition in the tourism industry. The adoption of energy-saving techniques enables improved visitor comfort, higher hotel aesthetic value, fewer maintenance system failures, and other benefits.

In the hospitality sector, the significance of providing high-quality service is widely acknowledged, as hotels cannot thrive in the fierce competition without meeting the needs of their customers. In order to provide high-quality services, a business must comprehend what the customers demand. Enhancing customer loyalty, growing market share, increasing returns to investors, cutting expenses, lessening

susceptibility to price competition, and creating a competitive edge are explained as the fundamentals of service quality [17].

In general, people have started looking for and willingly paying more for "green tourism" or "eco-friendly tourism" as opposed to simply choosing a straightforward, low-cost regular hotel that provides normal facilities. To effectively compete with the always-expanding competition, this entails beginning with the education and training of the hotel staff, then implementing a series of measures step-by-step to improve services, and eventually acquiring green or eco-certificates for the company [16].

Tourism must embrace sustainable practices that serve as conservation instruments and, among other things, enable the preservation of significant natural areas, wildlife, archaeological, and historical sites; more effective resource management; and enhanced community well-being through local investments [6]. As a powerful sector, the hotel industry must strike a balance between commercial interest and long-term viability. Second, they must overcome the threat of climate change, which they are extremely vulnerable to. Green Practice acts as a value-added business approach that helps hospitality businesses engage in environmental protection measures [15].

A challenging economic environment brought on by resource scarcity and population growth necessitates the incorporation of sustainability into all facets of the industry rather than treating it as a separate issue. The issues concerning climate change, global warming, air and water pollution, ozone depletion, deforestation, biodiversity loss, and global poverty must be thoroughly understood by every aspiring hospitality player [18].

Numerous large worldwide hotel chains are gradually highlighting their commitment to sustainability and incorporating it into their fundamental business strategy, even as they pursue further development that places a variety of demands on natural resources. Sustainability may be viewed as the objective or end of a process known as sustainable development [18]. Tourism must advocate for the protection and conservation of these resources, as well as educate tourists about their importance, indicating that they are unique and that their integrity must be preserved for future generations [6].

Destinations are pitching up to formulate brand-new rules to reconcile tourism and the environment through sustainable practices, which has also become a worldwide slogan as the movement of sustainable development and environmental challenges becomes textbook reality [15].

2.4. Linking Quality Management (QM) to sustainability

To exist, the company must satisfy several actors who can cause the company to collapse. However, there may be a gap in global sustainability since not all actors that are impacted by organizational actions have the tools and authority to alter it [19]. A cursory review of the literature will show that the notion of total quality management is dominated by two traditional ideologies. The first one is the operations-adherence perspective that is used to examine TQM. Further, the second method is the integration of dynamics, layouts, processes, and systems designed to

gain a competitive advantage [11]. Quality specialists may demonstrate how their improvement initiatives contribute to the organization's long-term success by reducing material usage, saving energy, conserving water, and so on. It is the most effective technique to demonstrate that environmental stewardship is not an expense but rather a potential for increased profit. Our environmental goal is to decrease the negative impact of the company's operations on the environment. It also demonstrates to the company that quality procedures and tools can be used to improve sustainability as well as quality. Quality may help with this action-oriented, operational sustainability in a variety of ways, and it can begin to be built into the company's management structure [20].

Quality is a wide, multi-interpretable, relative, and dynamic notion, like sustainability. The evolution of the quality approach reveals several elements that are pertinent considering the difficulties addressed [21]. TQM acknowledges leadership dedication to quality, customer orientation, and benchmarking. Additionally, the strategy acknowledges quality evaluation, product design visualization, employee training and development, and empowerment and involvement [11]. The goal of quality development is to meet and exceed customer requirements while also improving efficiency, i.e., how to provide more customer value with fewer resources. Sustainability might be addressed in a practical way by incorporating the information and approach used in high-quality work into sustainability initiatives. Thus, the environment, social responsibility, and the economy are all [7]. **Table 1** shows a list of hotel groups based in Mauritius and a brief overview of the sustainability initiatives being taken by them.

Table 1. List of hotel groups and the sustainability initiatives being taken.

Hotel groups (Based in Mauritius)	Sustainability initiatives taken
A	Triple bottom line approach including environmental, social and financial aspects of sustainability
B	Developed a sustainable management plan that comprises of the following: environmental, socio-cultural, Quality, Health and Safety
C	Developed a comprehensive and inclusive strategy based on the UN SDGs. The latter comprises of social, environmental, and economic aspect of sustainability. Success is tracked through KPIs
D	Developed a substantial action plan based on zero-single use plastic waste. This allowed for the promotion of environmentally friendly substitution.
E	Efficient waste, water and energy management system. Some of the actions taken were to recycle wastewater for irrigation purposes and implementing awareness programs
F	Alignment with the UN SDGs, the hotel group has included through a map, their collaboration with their stakeholders

Adapted from: Sun resorts [22], Constance Hotels [23], Hotels Attitude [24], Beachcomber hotels [25], Veranda Resorts [26], and Lux Resorts [27].

3. Methodology

To achieve the aim of this research work, a questionnaire was designed for knowledgeable staff in the hotel industry with regards to sustainability. The objectives of the survey were to:

1) Investigate the different sustainable practices adopted by the hospitality industry with regards to the three dimensions of sustainability, namely, social, economic, and environmental ones.

2) Assessing the context in which sustainability practices benefit the hotels in Mauritius.
3) Identifying gaps or issues faced by the hotels that can prevent them from attaining their sustainability goals.
4) Propose or recommend improvement areas that can benefit the hospitality industry in Mauritius.

3.1. Sampling and design of the questionnaire

A list of hotels rated 3 to 5 stars was available on the Mauritius Tourism Authority website. A total of 11 hotels across Mauritius were surveyed, and most of the hotels were part of the main hotel groups. The questionnaire for this research work contained mostly closed-ended questions and some open-ended ones. A brief description of the sections is outlined below in **Table 2**.

Table 2. Description of the different sections in the questionnaire.

Section	Title	Brief description
A	Characteristics of hotel	• Name, address, number of employees, classification, certification.
B	Environmental Domain	• Energy Consumption and Conservation. • Waste handling, Disposal, and Reduction. • CO_2 and Greenhouse gases emissions. • Environmental certifications and accreditation. • Environmental Activities and Awareness. • Water consumption, saving, and Recycling.
C	Social Domain	• Customer service. • Employees' welfare. • Hotel's involvement with local businesses. • Hotel's initiative with regards to sustainability.
D	Economic Domain	• Customer rate trend with regards to sustainability initiatives or certifications. • Hotel's energy consumption costs. • Trend in operating costs and returns on investments. • Customer complaint trend.
E	Sustainable development initiative	• Overview on the different sustainable development initiatives, their benefits, the issues faced and how they are tackled.
F	Profile of respondents	• Contact details of respondents, position in hotel, education level, years of experience.

3.2. Pilot testing

A pilot test was carried out with 8 respondents. The comments or feedback of the respondents were taken into consideration. It allowed the revelation of potential misunderstandings, thus giving the opportunity to make necessary amendments to bring improvement to the questionnaire.

3.3. Statistical analysis

The results obtained through the questionnaire will be later analysed using Statistical Package for the Social Sciences (SPSS) 16.0 and Microsoft Excel 2013. The data was transformed into frequencies, charts, and tables. Moreover, further analysis was conducted, namely, Spearman's correlation tests, median, and mode.

3.4. Framework design

The purpose is to review, synthesize, and refine current literature and propose a framework that will link quality and sustainability. The aim is to help the hotel industry in Mauritius overcome various limitations they may encounter in the development of sustainability practices. The limitations were assessed through the survey questionnaire. Incorporating the knowledge and technique from Quality Management (QM) and systematic improvements into an organizational component, might provide new options to succeed in establishing long-term sustainability in a wider sense [7].

QM is defined as a philosophy of practices, principles, and tools, according to one of the most prevalent definitions. The main ideas of QM include continual improvement and customer focus. Furthermore, buyers may regard care for or consideration of sustainability as a need. The goal of QM is to increase the efficiency of organizational operations and remove defects. Specific practices like 'zero defects' are inextricably linked to the environmental management-based system's 'no waste' aim. Furthermore, there is a similar focus on making better use of inputs. Organizations that have embraced QM methods may encourage and build a set of abilities that assist the adoption of sustainable practices because of these commonalities [28].

3.5. Constraints

The main challenge faced during this research work was getting responses from the hotels. To overcome this constraint, a focus was placed on major hotel groups in Mauritius, where sustainability initiatives emanate from the head office before being cascaded down to the individual hotels.

4. Results

The result section depicts the key findings following data collection. The latter have been presented in the form of charts, tables, and figures derived from statistical analysis. **Figures 2** and **3** demonstrated that most of the data collected were from the north and east of Mauritius (36.4% and 36.4%).

Figure 2. Locations where data were collected.

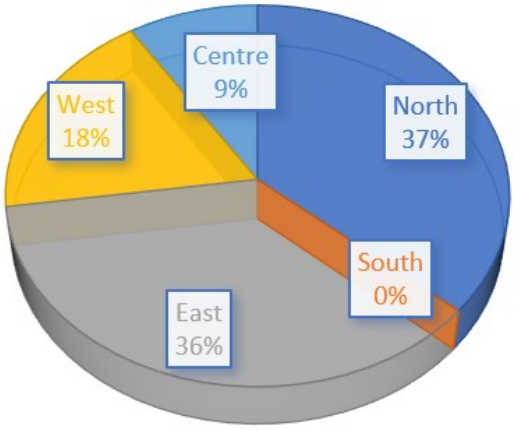

Figure 3. Locations where data were collected.

Most of the respondents' forms are part of major hotel groups in Mauritius, comprising individual hotels and resorts throughout the island.

Most of the hotels interviewed have certifications related to sustainability, namely, Earthcheck (27%), Green Globe (18%), and Travel Life (9%). Some hotels also have several certifications active. For instance, one of the interviewees stated that they possess the following: Green Key, The Pledge on Food Waste, Gold Distinction, and the Sustainable Tourism Awards 2022.

Several questions were asked about the energy consumption and conservation of the hotel groups. It has been recorded that usage of renewable sources of energy is prevalent among the respondents (54.5%). Moreover, the same goes for the implementation of measurable targets for the conversion towards more energy-efficient practices (63.6%). All the respondents agreed about the preference of the hotel to buy green-labelled, energy-efficient, and water-saving labelled products (81.8% strongly agreed).

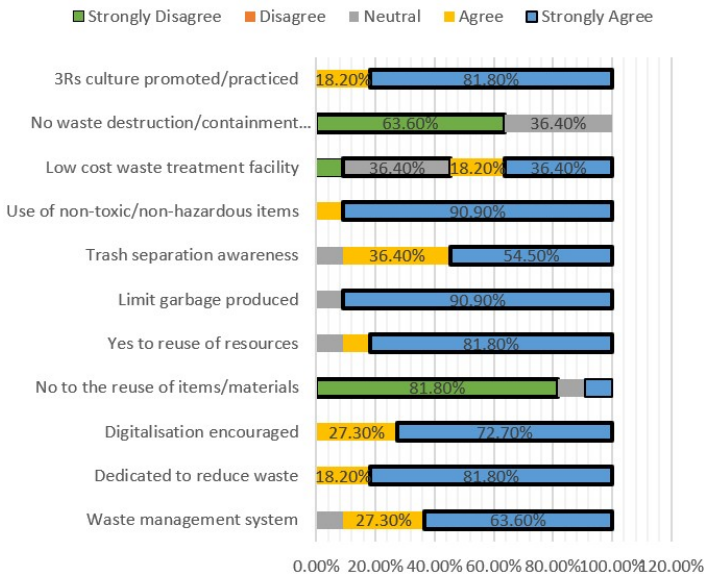

Figure 4. Responses on waste handling, disposal, and reduction.

A series of questions were then asked about the management of waste. The results were quite positive, as indicated in **Figure 4**. It was recorded that waste

management systems are well established and that 3R culture is promoted (100% agreed, 81.8% strongly agreed).

Figure 5 indicates one of the most positive responses recorded during the survey. It was noted that environmental initiatives are well established within the hotels. Awareness on environmental stewardship is raised, and employees are encouraged to engage themselves in sustainability activities being organised (>90% strongly agreed). All the respondents agreed on the hotel's website that detailed actions were undertaken as part of their environmental sustainability programs (90.9% strongly agreed). Further, 72.7% of the respondents strongly agreed about having a routine procedure to inform the clients about their environmental sustainability policies (ESP).

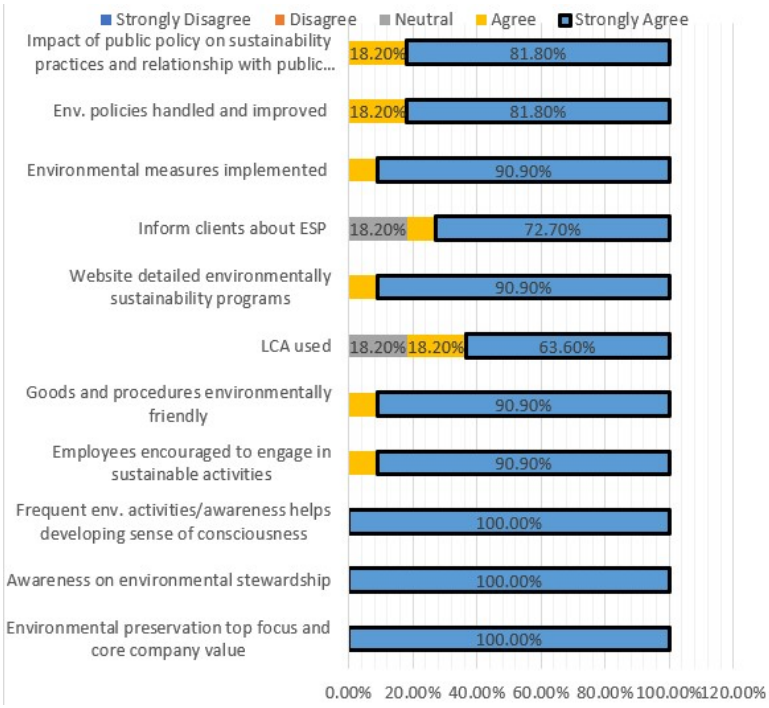

Figure 5. Responses on environmental activities and awareness.

The respondents were asked if the hotels had established a CSR policy. 63.6% strongly agreed, and 27.3% agreed. With regards to a potential increase in occupancy rates following the implementation of sustainability efforts, 45.5% and 27.3% strongly agreed and agreed to this statement. The respondents were then asked whether the number of satisfied guests had increased in recent years and if loyalty and reward programs were made available to them. The highest percentage was checked for strongly agree and agree points (45.5% and 36.4%, respectively). Furthermore, when asked if customers are willing to pay more for programs that promote sustainability, 54.5% were neutral about it, and 45.5% strongly agreed.

Moreover, it was asked if the hotels have improved their cost-cutting through process innovation, green supply chain design, and enhanced technology adoption. 45.5% strongly agreed, and 18.2% agreed. The respondents were requested to indicate whether the quality of products/services has improved in recent years. 45.5% and 27.3% strongly agreed and agreed, respectively. Subsequently, a question

was asked regarding the potential for customer complaints in recent years; 45.5% agreed and 36.4% strongly agreed.

Open-ended questions were asked about sustainability initiatives taken by the hotels. It was also noted that several projects were implemented along the processes to adopt a greener approach to doing business.

The categories of responses are stated below, including some examples:

1) Certifications and commitments; applying/maintaining their certifications; and taking commitments towards sustainability.
2) Reviewing activities and processes towards a more sustainable approach; using less paper; food waste reduction programs; waste sorting;
3) Working with NGOs; donation of surplus food
4) Digitalization; digital timers for external lighting; hotel information booklet on TV
5) Protection of biodiversity and eco-systems; organising cleaning days; planting trees;
6) Working with local communities; >90% local procurement; supporting and engaging local communities.
7) Climate change concerns approaches, lowering carbon footprints, shifting to low carbon footprints, and focusing on the circular economy.
8) Education and awareness sessions; beach clean-ups; awareness programs; and regular staff trainings.

The benefits of the above-mentioned initiatives were asked, and the following were revealed: An increase in productivity, which includes the effectiveness of staff,. Moreover, education and awareness are promoted, i.e., raising awareness among employees for them to be more conscious and dedicated to sustainability projects and initiatives. The image and competitiveness of the hotel/resort on the market are enhanced as well. It was also mentioned that they gain reputation and pride from working for such organisations.

The respondents were then requested to mention any difficulties they may face with the implementation of sustainability projects/initiatives. The responses were categorised into two parts, mainly the management of change and culture development and the cost incurred. As per the respondents, the main difficulty is bringing about a change in the mindset of staff. They mentioned as well that the expenses incurred to purchase eco-friendly materials are consequential and the return on investment difficult to define.

It was then asked to mention how the different above-mentioned difficulties are tackled. It was noted that various trainings are organised including programs and plans to raise awareness. Moreover, meetings and quality circles are conducted to discuss on-going projects, and lastly, the commitment of some staff that are passionate about this concept is being used mainly for sharing experiences and passion.

A series of variables were chosen based on their pertinence and their link to the objectives of this project. Spearman's correlation tests were used to determine the correlations as they were more adapted to the context, i.e., Likert scales. It has been noted that the majority presents a strong relationship. The results and their interpretation are mentioned in **Tables 3** and **4** below, respectively.

Table 3. Spearman's correlation results.

Sustainability dimensions involved	Variables tested	Results obtained	Correlation
Environmental Domain	Hotels built on a green building idea, And Measurable targets for the conversion towards more energy-efficient practices.	0.168	No or negligible relationship
Environmental Domain	Waste management system in place, And 3Rs culture promoted/practiced.	0.524	Strong relationship
Social Domain	CSR established, And Occupancy rates grown since implementation of sustainability.	0.662	Strong relationship
Social Domain	CSR established, And Trouble putting sustainable initiatives in place.	−0.315	Moderate Relationship
Economic Domain	Customers willing to pay more for programs that promote sustainability, And Annual turnover grown during last few years.	0.509	Strong relationship
Economic Domain	Customers willing to pay more for programs that promote sustainability, And Reduction in customer complaints in recent years.	0.529	Strong relationship

Table 4. Interpretation table of spearman rank-order correlation coefficients.

Spearman (ρ)	Correlation
≥0.70	Very strong relationship
0.40–0.69	strong relationship
0.30–0.39	Moderate relationship
0.20–0.29	Weak relationship
0.01–0.019	No or negligible relationship

Note: This descriptor applies to both positive and negative relationships.

Adapted from de Vries et al. [29].

An average median and mode analysis were conducted based on the responses recorded following Likert scale questions. The following were depicted; the subsections pertaining to more positive than negative responses (≥4) were pointed out. For instance, waste handling, disposal, and reduction (average mode 4.1), environmental certifications and accreditation (average mode 4.2), environmental activities and awareness (average mode 5), and social and economic domains pertain to an average mode of 4.1 and 4, respectively. Further, it was observed that the average median and mode values lie more between 3 and 5, meaning that on an overall basis, the responses were more towards the neutral to strongly agree points.

5. Discussion

Scholars in the field of hospitality have acknowledged the significance of sustainability in corporate business policies. Hotels may benefit from sustainability measures to save operating costs, comply with regulations, gain a competitive edge,

increase employee productivity, meet shareholder expectations, and foster customer loyalty, among others [30]. The hotels interviewed are quite dispersed around the island. Most of them are hotels that form part of the main hotel groups in Mauritius. As per Mauritius Hotels [31], several well-known hotel chains from around the world have decided to invest in the island's tourism industry because of societal and economic development as well as changes in tourism. In the global hospitality sector, hotel chains are defined as a horizontal alliance of hotels operating under a single brand [32]. During the data collection process and literature search, it was noted that most of the groups have been launching and nurturing sustainability practices recently. Those initiatives were reflected in the responses given by the interviewees.

Respondents mentioned having different types of certifications related to sustainability. Those were, for instance, Earthcheck (27%), Green Globe (18%), and Travelife Certification (9%). It was noted that some hotels have certifications that were not listed in the multiple-choice question, i.e., Green Key, the pledge on food waste, and the Sustainable Tourism Award. Further, it was recorded that some respondents have more than one active certification as well. Studies suggest that many hotels are being required to implement more ecologically friendly methods due to the rising interest in sustainable development principles and the pressure that is being placed on them from the media, the government, and consumers [33].

The survey depicts that various hotel groups in Mauritius have invested in concrete projects related to sustainability. For instance, substantial investments in solar thermal systems were made. The goal of the hotel group that implemented this project is to replace conventional hot water boilers powered by fossil fuels with ones using solar energy. It was mentioned that they currently have panels covering a total area of about 3700 [25]. More than half of the respondents strongly agreed about currently using renewable sources of energy, and more than 80% of them also strongly agreed about energy efficiency monitoring to save money.

Moreover, there are several hotels that have been certified by "The Pledge on Food Waste." To eliminate food waste, they have worked to develop new operational procedures; among those initiatives are cutting wasteful spending and giving preference to local vendors who share the same values. This pledge shows the hotel's steadfast determination to start down the road of sustainable development [34]. In parallel, there are instances of hotel chains that have also launched an effort to combat food waste by stating that even if food waste is unavoidable, it is still feasible to turn it into energy by creating biogas or by composting or fertilizing the trash [35].

From both a socioeconomic and an environmental perspective, food waste is a big challenge. Waste presents a sustainability concern since it has a significant negative impact on the environment and public health. Inaccurate demand forecasting in hotels frequently leads to overstocking of food and overproduction of meals. Thus, fostering positive relationships with suppliers may make it easier to reduce food waste. This would assist hotel administrators in placing the right amount of food orders when and if necessary [30].

Maintaining environmental sustainability is essential for businesses to achieve growth, draw in new clients, and satisfy customers as they become more aware of and concerned about how their actions are affecting the environment. Going green

benefits hotels financially, lessens their impact on the environment, and wins them favour with customers. It's a win-win situation [36]. It was noted that all the respondents agreed about being dedicated to the reduction of waste within all the processes and the usage of digital tools instead of papers and stationery.

More than 80% of the respondents agreed on calculating/estimating the level of CO_2 emissions in hotels at regular periods (where 45.5% strongly agreed). This result is in line with what [37] pointed out, namely, that with the tourist sector having a substantial influence on global carbon emissions, it is appropriate to measure tourism-related carbon emissions using standard methodologies and to take essential efforts to reduce the emissions as the need for carbon emission reduction has become urgent. In the same vein, the Mauritian hospitality industry started to offer its first carbon-neutral hotel stays [38]. The industry is still figuring out how to lessen the effects of climate change and adapt to climatic shifts by implementing the energy transition idea. Further, a resort group has created several ways to lessen their carbon footprint in accordance with the facts indicated above. It was stated that twelve solar panels that provide renewable energy and warm up the hotel's water have been installed. Additionally, they chose to utilize LED lamps rather than conventional ones to lower greenhouse gas emissions. Translucent roofing over public places was also picked to reduce the consumption of bulbs [39]. Along with that, initiatives to lower carbon emissions year over year have been taken. It has been done by putting into place targeted energy-efficient techniques, including "Carbon Management Strategies" and "Energy Management Systems," among others [40].

With the rapid development of the tourism industry in Mauritius, matters such as overdevelopment of the coastal region, rising pollution, and indifference to natural resources are becoming crucial concerns. Players in the tourist sector are requested to adopt behaviours that are both socially and ecologically responsible if they want to succeed [41]. Following a series of questions asked on the various activities related to the environment organised at the hotels, it has been observed that the responses are quite on the positive side.

90% of the respondents agreed that water consumption has decreased over the years. Moreover, it can be specified that a water recycling system was implemented (72.7% strongly agreed). To save water, hotel groups in Mauritius have launched several initiatives. For instance, some of them are dedicated to ensuring that their business does not jeopardize basic services, including water [23]. Further, ingenuities to minimize water use, the implementation of water management systems, and the recycling of water for irrigation purposes have been implemented throughout the island by different hotel groups [24,26]. Rodrigues Island has initiated practical efforts by relying on seawater desalination to provide its residents with clean drinking water. Each day, this service may deliver 1000 m^3 of drinking water [42]. Some hotels have also adopted the use of seawater desalination. For example, as part of their sustainability commitment, a hotel group mentioned that some of their hotels have implemented this technique [43].

Nearly 91% of the interviewees strongly agreed about the hotels working closely with NGOs and local communities. Considering the concepts of equality, the significance of community, and its potential, NGOs play an important role in ensuring that benefits reach communities [44]. Various hotel groups in Mauritius

took initiatives towards the economic aspect of sustainability. One of them states that the local economy can be strengthened through tourism. Considering the seriousness of environmental challenges, it may also assist Mauritius in innovating, exploring new areas, and proposing new services that benefit everyone. It was noted that their economic strategy is focused on inclusion and that they think everyone should gain from tourism. This hotel group specified their eagerness to help local business owners and has committed to collaborate with them on this matter [24]. In the same vein, a hotel group developed the idea of "Responsible Hospitality". Within the framework of the circular economy, the latter seeks to balance environmentally responsible economic growth. This means that hospitality encourages a connection with nature, as well as accommodations that are more ecologically friendly and ethical behaviour [26].

Studies suggest that adopting sustainable practices improves a business's performance at many different levels, including employee happiness, brand reputation, image improvement, and stakeholder loyalty, which in turn gives the corporation long-term competitive benefits. The advantages of sustainability for businesses can come in the form of real advantages like lower operating costs and risks as well as intangible advantages like improved brand recognition, talent attraction, and competitiveness [45].

Following spearman's correlation tests conducted, it was revealed that a proper CSR established and the growth of occupancy rates since implementation of sustainability share a strong positive correlation (p = 0.662). With regards to the debate on the willingness of customers to pay more for programs that promote sustainability, it was found that this variable is strongly related to the growth of annual turnover during the last few years (p = 0.529). Therefore, based on those two results, it can be said that indeed, customers are becoming more conscious of the urgent need to take action with regards to sustainability. Those data show how sustainability has helped in the economic aspect of the hotel industry. By having more satisfied customers, an increase in profitability is most likely possible, thus ensuring ROI in the long run.

Implications

The aim of this study was to assess the various practices adopted by the hotels in Mauritius with regards to sustainability. A focus was placed on the three domains of sustainability. This aids in getting a better understanding of the actions being taken by the hotel industry in Mauritius with respect to sustainability. Various research has been conducted on sustainability as a general concept and in various business sectors worldwide. However, placing the focus on the 3- to 5-star hotels in Mauritius was an interesting topic, especially following the COVID-19 pandemic that has drastically impacted this sector. Since the impact of climate change is already affecting Mauritius, there is indeed a need to assess where this sector stands regarding the urgency of developing a more sustainable way of doing business and what difficulties they are facing with this change.

It was noted through a literature search that tourists' mindsets are changing and the demand for 'greener' hotels is increasing. To remain competitive on the market,

it is a must for hotels to change their way of operating for a more sustainable one. It was, however, noted that major hotels have recognized this need for change and have already started to take concrete action. As one of the top pillars of our economy in Mauritius, the hotel industry plays a major role in contributing to a more sustainable country. The latter is facing a great challenge nowadays to coincide with the preservation of our biodiversity and economic development and growth. This sector has greatly evolved through the years, and the number of hotels has considerably increased.

As its definition suggests, sustainability is required to be able to meet the needs of the present without compromising the needs of future generations. The concept consists of finding a balance between the preservation of our environment, ensuring our economic growth, and community involvement. As part of the survey, initiatives taken by the hotels as well as the difficulties being faced by them were assessed and discussed. Based on the analysis made, concrete recommendations to overcome the obstacles stipulated and help in a better transition can be presented. Studies revealed that including some quality management features within the sustainability framework could help the hotels overcome various operational issues that can serve as barriers to reaching sustainability objectives. This research work focused on the history and benefits of QM, mainly for the hotel industry.

6. Conclusion and recommendations

Growing demand for 'green hotels' has encouraged the hospitality industry in Mauritius to take concrete actions towards sustainability. The results revealed that quite diverse initiatives have been taken, irrespective of the domains. This study uncovered that people from all parts of the globe are becoming more knowledgeable and conscious of the urgency to act for a sustainable future. Consequently, as a baseline, most of the hotels interviewed have gone through sustainability-related certifications, which have helped them implement or develop new activities and processes. In parallel, the certification helped in the marketing aspect of the business to distinguish themselves from competitors, attract tourists, and boost their image. The survey allowed us to identify the various barriers to sustainability being faced by this powerful sector as well as suggestions from the respondents to overcome them. It was, however, noted that none of the interviewees possessed an Environmental Management System (ISO 14001) certification, which focuses on the PDCA cycle to achieve continual improvement.

It was pointed out throughout this research work that the goal of a QMS closely joins the sustainability one in the sense that the aim is to achieve or exceed customer satisfaction by increasing efficiency and productivity and, in parallel, reducing costs by mitigating defects/wastes. Therefore, based on the data collected, the framework below (**Figure 6**) has been developed, which depicts how quality can be incorporated along with sustainability in an hotel operation chain to achieve customer satisfaction.

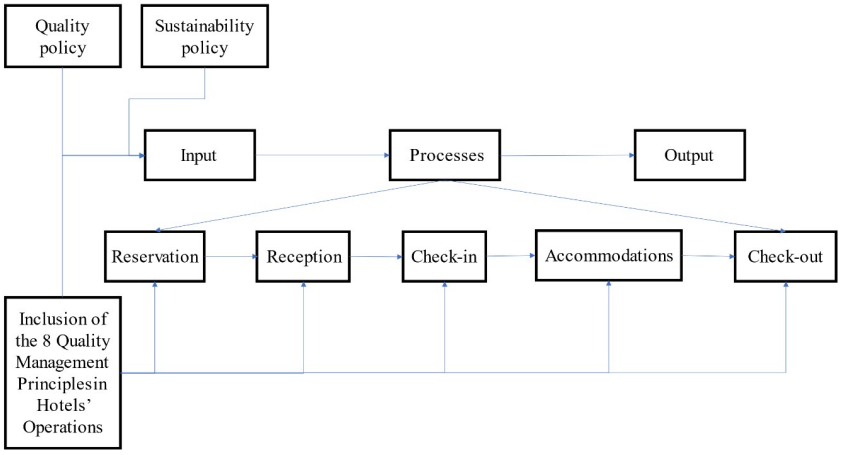

Figure 6. Framework linking quality to sustainability.

It is proposed that a quality and a sustainability policy be designed and used as benchmarks. A policy is defined as a guideline for action. Through the latter, the top management will be able to communicate their commitment and align their sustainability and quality mission, strategic direction, and purpose. The policy will help in cascading clear communication, which will contribute to enhancing employees' understanding, morale, and engagement, thus boosting their productivity.

The hotel does not necessarily need to go for certification to incorporate quality into sustainability. Studies suggest that QM is dynamic and multi-interpretable. Thus, the purpose of this framework is to target strategic aspects of TQM that can be used to optimize efficiency and overcome various specific barriers. The Quality Management Principles (QMPs), shown in **Figure 7**, are proposed to be used as a foundation to implement features of Quality Management (QM).

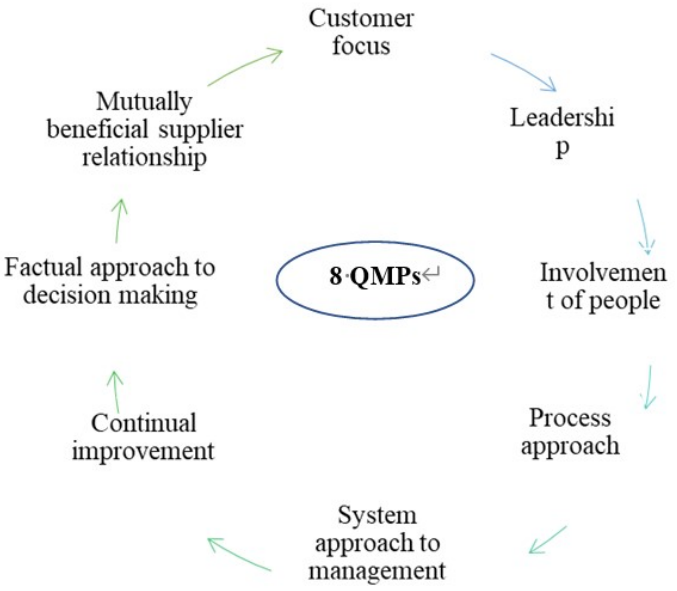

Figure 7. Quality Management Principles (QMPs).

The QMPs can be understood and adopted at each level to ensure that all actors are included in the chain. This process is important to align communication with respect to the customer's demands. The purpose is that all actors in the chain work

toward a common goal, which will alleviate delays in operations and thus improve customer satisfaction. **Table 5** shows the suggested approaches to the QMPs concept. The approaches were designed based on data collected from the survey and knowledge gathered through the secondary data collected. The goal is to support the hotels in continuously improving numerous key factors in a holistic manner.

Table 5. QMPs and the suggested approaches.

QMP		Suggested approach
1	Customer focus	Rising environmental concerns and awareness within customers have triggered more sustainability efforts from hotel industry. Customer focus is about understanding the needs and expectations of the clients to ensure their satisfaction. It is suggested that top management aligns their objectives in this sense. Managing customer relationships through effective communication, feedback mechanisms and measurement of the results can help in enhancing the productivity of the different processes. The purpose is to develop strong customer loyalty thus increasing revenue.
2	Leadership	Leadership has a significant impact in the development of sustainability within a hotel operation. Leaders are needed to identify clear goals and objectives. This will ensure employees' involvement to meet the targets set. Making sure that employees understand the organisation's vision and mission can contribute to boost collaboration and teamwork thus overall efficiency.
3	Involvement of people	Through the survey, some respondents expressed their pride of working in an organisation that is engaged in SD. Employee engagement is about creating loyalty and trust within the workforce. The latter can contribute to an enhancement in the reputation and image of the hotel. TQM approach in parallel suggested that involvement of people comprises that each employee is responsible to assess the quality of the products or services at their respective levels. This will promote empowerment within the workforce thus serving as a tool to attract, recruit, and retain employees. The recommended approach is a combination of sustainability and involvement of employees to create a positive culture.
4	Process approach	A process is defined as a set of interrelated activities that transform inputs into outputs. The process approach is about identifying the different processes in the chain as well as their interrelationships to promote transparency. Process maps can be used to do so. Moreover, the hotel can evaluate the risks associated to each process that can impact on the stakeholders. To ensure effectiveness, each process will need to be monitored, analysed, and measured through KPIs for instance so that actions are taken accordingly to create continual improvement. In QM, this approach is generally referred as Plan-Do-Check-Act (PDCA) cycle and risk-based thinking approach.
5	System approach to management	This principle is about understanding and managing a system of interrelated processes (or a 'whole' which comprises of interdependent parts named subsystems) for any opportunity to improve the hotel's efficiency. The importance of this QMP is linked to the continuous improvement process. An hotel operation is dynamic, this approach is focused on paying attention to the effectiveness of the system as a whole instead of focusing on the subsystems.
6	Continual improvement	Incorporating continual improvement in sustainability is about having a long-term vision for the hotel. The vision can be cascaded down from top management to middle management who will express their commitment to lower-level employees. Developing a strong leadership and aligning the hotel's strategy will promote ongoing improvement of the products/services quality. Through continual improvement approach, teamwork and empowerment of employees will be promoted leading to a reduction of defects and variation in the system.
7	Factual approach to decision making	The ability to make appropriate decisions in SD plays an important role in employee management and customer satisfaction. To ensure that decisions are the most effective ones, it is vital that decision-makers based themselves on analysis of data rather that intuition in some strategic cases. Factual approach can be applied for instance in case of corrective actions that are required after a non-conformity is raised or as a preventive action to avoid a non-conformity. Data collected for decision making process should be correct, reliable, and accessible to all interested parties within the hotel operations. Statistical tools, for instance, the 7 quality tools originally developed by Kaoru Ishikawa can be used to collect or measure data.
8	Mutually beneficial supplier relationship	This QMP is about building a long and healthy relationship with the suppliers. In QM, an organisation and its suppliers are viewed as interdependent. A mutually beneficial relationship will enhance value creation thus allowing for the improvement of the overall chain. Feedback mechanisms between the hotel and its suppliers can be initiated to promote proper flow of communication, alleviate delays in operations and enhance customer service.

7. Future work

The recommendations made can contribute to overcoming the various barriers that have been mentioned by the respondents, namely, the ROI following the cost incurred for sustainable development and the change management difficulties. The approach used was based on the incorporation of QM features in SD. It is believed that the application of the framework can contribute to the improvement of customer service, reduction of defects and waste within the operations, enhancement of employee satisfaction, thus improvement of productivity and an overall upgrade in hotel reputation and image, among others.

As a future project, it will be interesting to test and follow up on the practical feasibility of the framework proposed in this research work. Further, since it was raised that QM features can serve as a potential solution to overcome the sustainability barriers faced by the hotel industry, a case study will complement this project.

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Article

Forecasting corporate social investment in Asian based organizational features of corporate social responsibility

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Abstract: Corporate Social Responsibility (CSR) activities, which target social and environmental challenges, are prompted by pressures from stakeholders. As a result, businesses use Corporate Social Investment (CSI) channels to finance CSR initiatives in the areas in which they conduct business. There is still a dearth of empirical studies in developing regions, especially in Asian countries, despite the large number of CSR studies carried out in wealthy nations. In order to determine the degree to which Firm Size and Organizational Sector predict Corporate Social Investment (CSI) in Asia, this quantitative study used frameworks for CSR and stakeholder engagement. To find out if these two organizational traits, used separately or together, have a substantial impact on CSI, three study questions were presented. Data from 54 Asian-based companies that submitted reports to the Global Reporting Initiative (GRI) between 2018 and 2022 were examined in this study. Multiple regression analysis (MRA) using archival data from GRI reports showed that Organizational Sector emerged as a significant predictor ($b = 0.275$, $p = 0.005$), indicating that manufacturing and fertilizing companies contributed more to CSI than other companies, while Firm Size did not significantly predict CSI spending ($b = -0.089$, $p = 0.259$). This emphasizes how critical it is to take the Organizational Sector into consideration as an important predictor of corporate social responsibility (CSR) and how important it is to take this into account when figuring out how firms might support social development in Asian communities.

Keywords: organizational sector; firm size; stakeholder engagement; corporate social investment; and corporate social responsibility

1. Introduction

Earlier researchers asserted that although corporate social responsibility is important, its precise definition is not widely accepted [1]. This range of CSR interpretations is still present today. According to Carroll, a well-known figure in CSR scholarship, the field is broad rather than narrowly defined, interdisciplinary, and encompasses a wide range of literature [2]. It also has fluid boundaries, diverse GRI memberships, and origins from different academic and professional backgrounds [1]. In their investigation of the sense-making processes of businesses and stakeholders, they reinforced this idea by contending that CSR is a contentious term influenced by personal frameworks and perspectives [3]. In order to reduce misunderstandings about corporate social responsibility and its implications, this research will make use of the terms "corporate sustainability" and "corporate citizenship" in relation to CSR stakeholder involvement and local community development [4]. Waddock acknowledged that the foundation of corporate citizenship (CC) philosophy was laid by Bill Frederick's groundbreaking work in developing CSR frameworks. As a result, companies are seen in this research as members of society with an obligation to their stakeholders to advance social well-being [5].

In this research, the terms Corporate Sustainability (CS) and Corporate Social Responsibility which are frequently used synonymously, are understood to include a range of strategic initiatives, practices, and policies implemented by businesses as part of their obligation to promote the welfare of society at large [6]. The Consolidated Set of GRI Sustainability Reporting Standards (2016) refers to the nation of substantial operation of the reporting organization [7]. Global adoption of Corporate Social Responsibility policies has been fostered by the desire for corporate participation in social and environmental concerns, motivated by a belief in their ethical obligation [8]. A key component of corporate social responsibility is stakeholder engagement, which helps businesses comprehend stakeholder expectations and directs the creation of social development initiatives supported by Corporate Social Investment (CSI) mechanisms [9]. This research variable, which serves as a stand-in for CSR participation, is defined as the monetary contributions made by businesses to the social and socioeconomic advancement of the people living in the areas in which they operate [10]. Social capital is to generate value for communities to enhance their standard of living. Contributions might take the form of trusts or cash [11], and social development initiatives include things like healthcare, education, and skill development [12].

Research on corporate social responsibility in Asia is still scarce, despite the increasing focus on the topic [13]. Nonetheless, given the distinct socioeconomic difficulties faced by the continent, there has been a recent trend toward analyzing CSR practices in developing nations, particularly in Asia [14]. Stakeholders have put more and more pressure on businesses in the past several years to include social and environmental objectives into their operations in addition to financial ones [15]. The dearth of CSR research that is uniquely suited to the Asian environment is a serious leadership problem for companies looking to participate in CSR efforts throughout the continent [16]. Large Multi-National Corporations (MNCs) in a few chosen nations have been the main subject of previous CSR studies in Asia; these MNCs are mostly in the manufacturing and fertilizing sectors [17].

The results of the previous studies showed that CSR practices were more organized and diversified than previously thought, going beyond philanthropy to include institutional construction [18]. In their 2017 study, Gorg et al. examined CSR participation among foreign-owned businesses in some underdeveloped areas [19]. They drew attention to the distinctions between small and big businesses, including SMEs' emphasis on immediate stakeholders and their little participation in official CSR initiatives [20]. Even though CSR programs are important for tackling socioeconomic problems in Asian countries, such as poverty and poor infrastructure, businesses are unable to resolve these problems on their own [21]. Achieving sustained social effects requires cooperation with other stakeholders, such as NGOs and civil society groups [22]. The relationship between Organizational Sector, Firm Size, and Corporate Social Investment in Asia is yet to be explored [23]. The study's scope included businesses operating in Asia that submitted reports to the Global Reporting Initiative between 2018 and 2022, including services and non-services sector organizations [24]. There is a dearth of empirical studies on the organizational dimensions of Corporate Social Responsibility in Asia, despite the fact that CSR has grown significantly due to stakeholder demand to address social and environmental challenges [25]. CSR activities are impacted by both internal and external settings and

are closely tied to socio-economic situations. Therefore, there is a critical need for empirical research that looks at corporate social responsibility in Asia. Such research would be helpful in guiding strategic planning, managerial choices, and corporate social responsibility activities in Asia [26]. In order to determine whether and to what extent Firm Size and Organizational Sector, both separately and in combination, affect Corporate Social Investment in Asia from 2018 to 2022, this quantitative, correlational-predictive study was conducted.

This paper seeks to build partnerships for promoting social development beyond the production of jobs and to offer insightful information to stakeholders about the contributions made by companies to larger societal needs in Asia. By investigating the variables that influence Corporate Social Investment among businesses in Asia, the paper seeks to advance this field. It focuses on how, among Global Reporting Initiative reporting firms in Asia, Firm Size and Organizational Sector affected CSI involvement. In the study, CSI acts as a stand-in for CSR participation from 2018–2022. Moreover, the study intends to assist companies in comprehending the CSR environment in Asia, directing their CSR strategies and CSI expenditure choices, and pinpointing regions for development assistance on the continent. Social investment in people eventually results in increased wellbeing, which benefits the overall society [20].

2. Literature review

The theories and concepts of CSR have evolved over time. In the beginning, social issues and societal concerns were the main focus of corporate social responsibility. This developed to include an emphasis on the standards that society has for business executives and their need to solve these issues. Furthermore, promoting Corporate Social Responsibility, citizenship, sustainability, and ideals is now given more importance. Upholding human rights, preserving the environment, and engaging in moral corporate practices are among the core values of this paradigm [27]. There are as many definitions of Corporate Social Responsibility as there are ideas and concepts related to it. While some definitions place a strong emphasis on the voluntary aspect of CSR efforts, others highlight the concept's political undertones [28]. Furthermore, other definitions emphasize elements like corporate responsibility and transparency, moral principles and norms, philanthropy, and sustainability [29]. Votaw noted thirty years ago that although corporate social responsibility is important, its definition is not widely accepted [30]. Carroll, who emphasized the field's flexible borders, various memberships, multidisciplinary character, and wide-ranging literature [2], observed that there is still a difference in CSR interpretations today in support of this idea [31]. In order to shed light on CSR practices and the importance of local communities as stakeholders, this study takes a stakeholder approach, drawing on Waddock's attribution of corporate citizenship theory to Bill Frederick's seminal work in developing a CSR framework. The study uses the concepts of "corporate sustainability" and "corporate citizenship" in the context of CSR stakeholder engagement and local community development in an effort to reduce confusion surrounding the term CSR [5]. Frederick proposed a classification system spanning the CSR continuum from ethical-philosophical to action-oriented managerial concepts

of social responsiveness, emphasizing ethics, values, and normative references for social issues in management as well as the role of science and religion. Over time, scholars have worked to standardize the field of CSR [32].

As globalization grows, more and more companies are setting up shop in poor nations. Many of these companies have accepted the United Nations Global Compact policy, which was introduced in 2000 and calls on them to follow socially conscious norms of behavior [33]. The Global Compact is the largest CSR program internationally, including almost 13,000 organizations and stakeholders spanning over 170 countries. It has attracted extensive engagement, with thousands of corporations worldwide signing onto this UN mandate [34]. In light of the above, this study examines a wide range of Asian-operating firms, many of which have ratified UN social contracts [35]. When Attig et al. looked at how corporate internationalization affected CSR initiatives, they discovered that businesses with significant global footprints [28]. Expanding upon this realization, the research explores CSR involvement among the intended audience while taking the geographic reach of their activities into account [36].

In order to solve global sustainability concerns, business leaders have a critical role to play in pushing corporate social responsibility agendas, as highlighted in the United Nations' 2010 Blueprint for Business Sustainability Leadership study. In line with the UN Blueprint's guidelines for sustainable leadership practices and CSR performance evaluation, this study focuses on CSR action through Corporate Social Investment expenditure with the goal of improving socioeconomic situations within communities [34]. The present study adds to the growing body of literature on corporate sustainability leadership and its diverse aspects, specifically concerning the distribution of CSR resources and the processes involved in leadership decision-making. In the leadership literature [37], many terms are used interchangeably to describe leadership related to Corporate Social Responsibility in the leadership literature [37]. These terms also describe sustainability and responsible leadership [20]. Notwithstanding the differences, a recurring theme emphasizes that CSR executives usually hold high positions inside organizations and have fiduciary accountability for spearheading CSR programs [15,38]. Researchers often use Upper Echelon Theory (UET) to investigate how senior leadership affects corporate social responsibility [39]. Specifically, they concentrate on the qualities of CEOs and how they affect environmental projects [29] or how CEO traits relate to CSR strategies [40]. The importance of senior executives, including the CEO, in advancing CSR agendas has been highlighted by the notable rise in attention given to corporate sustainability leadership. Research indicates that Chief Sustainability Officer roles are becoming more common in Top Management Teams (TMTs), suggesting a purposeful move to include CSR in corporate governance frameworks [36]. Wiengarten et al. stated that this type of executive leadership is in charge of developing and carrying out the company's CSR strategy [36]. Furthermore, there is a growing recognition of the moral and mandatory social obligations that business executives have towards communities and the environment [41]. In order to better understand the influence of leadership choices on CSR participation and community welfare, this study explores the organizational drivers of CSR and resource allocation, notably in the form of Corporate Social Investment [42].

The analysis of the literature on the relationship between Firm Size and corporate social responsibility reveals that smaller businesses are frequently overlooked in favor of multinational companies. Aguilera-Caracuel and Guerrero-Villegas investigate Multi-National Enterprises. CSR programs and discover a favorable relationship between reputation and CSR performance, especially for MNEs doing business in developing nations [43]. In Ghana's telecoms industry, Muhammad et al. [44] investigate CSR project management across multinational corporations, stressing the significance of stakeholder participation and sustainable solutions. 2019's Abugre and Anlesinya draw attention to the growing demand on multinational corporations to improve their global sustainability and push for a better comprehension of how CSR affects corporate value, particularly in developing nations [45]. Meanwhile, Amusan [46] and Chanakira [47] argue for a more nuanced definition of CSR activities, particularly among small and medium enterprises, drawing attention to the CSR literature's disproportionate concentration on MNCs. Nybakk and Panwar emphasize that further study is necessary to fully understand how SMEs differ from bigger companies in terms of their social responsibility [30]. Ansong highlights the crucial role that SMEs play in different areas, stressing the importance of stakeholder involvement in mediating the link between CSR and external funding availability [48]. By examining whether company size predicts corporate social investment, this study fills a vacuum in the literature on corporate social responsibility across businesses of different sizes [49].

According to Spence [50], some major industries are subject to significant scrutiny when it comes to Corporate Social Responsibility activities because of the significant risks to their reputation. Because of greater openness and globalization, some major industries are susceptible to heightened demands from different stakeholders, including governments, private companies, NGOs, and communities. Fair labor practices have been governed by policies, especially in Asia. As noted by Ackah-Baidoo [51], in spite of the economic importance of CSR, it frequently functions as an enclave, focusing benefits on restricted geographic regions and providing little to no economic benefits to the general public. Multinational corporations are accountable for social advancement in the absence of strong government-led social development, which is frequently obtained through the social license to operate (SLO). As noted by a number of academics, there are still concerns about how well MNEs involve local people in the planning and execution of CSR projects [52].

The rising trend of Corporate Social Investment reporting was examined by Adams et al. [12]. They highlighted the many types of social investment that corporations are engaging in, from more integrated strategies that are in line with core business objectives to conventional philanthropy. They highlighted CSI's importance in generating value for communities outside of corporate borders by identifying important areas that are often supported by CSI, including engagement, charity, education, and community service. According to Lange and Wyndham [11], several host nations are beginning to enact laws requiring CSI payments in order to legitimize CSR operations. Using a case study of Equinor's social investment in Tanzania, they looked at attempts to comply with national laws and policies, especially as it relates to gender equality. Jayaraman et al. [53] talked about passing the CSR Bill, which

required businesses to donate a portion of their revenues to CSR projects in an effort to promote cooperation between businesses and social development organizations. In a similar vein, Wanvik [54] drew attention to CSR legislation, which requires Norwegian businesses to fund regional community initiatives; a CSR framework was put up by Bester and Groenewald [55] also. It complies with national regulations and addresses the demands of social development and historically underprivileged populations. Notwithstanding these endeavors, Lange and Wyndham observed the deficiency of efficacious regulation in many nations, promoting strong laws and oversight procedures, analogous to community-based project law, to guarantee community support and CSR compliance [11].

A key component of corporate social strategy is stakeholder engagement, which enables businesses to understand the needs, wants, and concerns of a variety of groups, including vendors, consumers, workers, and community organizations [56]. Corporations may ensure strategic goals are aligned with CSR resource allocation and facilitate sustainable economic, environmental, and social consequences in communities by understanding stakeholder viewpoints [57]. They are able to defend the organization's decision to allocate resources to the promotion of social development because of this awareness. This study explores the relationship between CSR programs and stakeholder involvement with the goal of shedding light on CSI methodologies, trends, and outcomes [58]. Although many CSR experts supported the stakeholder notion, not all of them agreed with the basic tenet that businesses should deal with social issues [59]. Milton Friedman famously disagreed, arguing that a business's only social duty is to maximize profits [60]. Friedman first proposed this idea in 1970 and called it the "stockholder theory" [61]. But according to Hamidu and Freeman [20], stockholder theory and stakeholder theory are not inherently at odds because both have as their ultimate goal the creation of wealth for shareholders, who are important stakeholders in and of themselves.

Hall and Jeanneret emphasized the mutual advantages of stakeholder engagement and stressed its significance for stakeholders as well as enterprises. Stakeholders get information about corporate social responsibility (CSR) activities, have a say in strategy formulation, and offer input. Meanwhile, firms reduce risks and improve operational efficiency [56]. Hall proposed the notion of "stakeholder-eccentric" methods by examining stakeholder involvement in the Australian water resource management sector [56]. This approach emphasizes the need for limiting risks and raising stakeholder participation. In a similar vein, Hamidu and Freeman [20] highlighted the strategic importance of engaging stakeholders and favored cooperative value generation over antagonistic interactions. They emphasized the executive-level difficulty of increasing value for all stakeholders and created the phrase "jointness of interests" to characterize the alignment of company and stakeholder aspirations. They illustrated the usefulness of stakeholder theory in practice by examining Scandinavian sustainability leaders. This study adheres to the ideas of stakeholder theory and views local community participation as essential to focus and meaningful community investment [4].

As stakeholder expectations changed, Hall and Jeanneret [56] saw an increase in demand for firms to show more social responsibility. The claim is corroborated by Brower and Mahajan [26] longitudinal analysis of 447 American companies that ran

from 2000 to 2007. According to their research, companies that were sensitive to the requirements of their stakeholders had more diversity and demand monitoring, which led to better corporate social performance. The investigation of Corporate Social Investment spending as a measure of corporate social performance, closely associated with stakeholder engagement, is supported by this relationship between stakeholder involvement and social performance. Bowen et al. emphasized that businesses should be actively involved in community development projects and that community involvement is a crucial component of their larger stakeholder management strategy. They outlined a spectrum of community involvement tactics—from transactional to transformational—that businesses use in conjunction with their local communities to solve social challenges [9]. Their thorough analysis emphasized the long-term advantages of successful community involvement, placing more emphasis on reduced social hazards and enhanced business legitimacy than on immediate profits. A qualitative study on corporate-community connections in Quebec was carried out by Delannon et al. [62], adding empirical data to the expanding body of literature on community participation. Similarly, Rodhouse and Vanclay [63] promoted progressive community engagement strategies that go beyond information dissemination to include stakeholder involvement and shared decision-making, and they argued for the inclusion of human rights concerns in corporate CSR and social performance strategies. Drawing from the Rodhouse and Vanclay [63] continuum of community engagement, this study advances our knowledge of community engagement by examining the relationship between corporate social investment expenditure and stakeholder engagement tactics.

Using archival data from many databases, including KLD, Thomson Reuters Asset4 (which is the leading CSR database used by practitioners and researchers), the Global Reporting Initiative, and quantitative research approaches, a number of recent studies have explored the domains of CSR leadership, social effects, and stakeholder involvement. Heng et al. drew attention to the growing acceptance of archive research and attributed it to the Big Data revolution and the availability of digital data [59]. Cotteleer and Wan highlighted how large corporate data warehouses are underutilized and argued that academic research should use them to study organizational issues [24]. The literature-driven method, which starts with accepted theories, and the phenomenon-driven approach, which starts with empirical study, are the two basic strategies for using business data that they described. This study investigated the factors influencing corporate social responsibility in Asia using archival data from the GRI. It was guided by the literature-driven method and built upon previous quantitative research by Strand [38], Strand and Freeman [20], and Wiengarten et al. [36] from GRI. Similar to this, historical data from public sources like Factiva and Google News, firm records, and SEC-standardized data have been used in recent research on CEO leadership and CSR dimensions. This study focuses on variables including Firm Size, Organizational Sector, and Corporate Social Investment, drawing on the practice of using corporate archive data to analyze the influence of organizational determinants on CSR.

Theoretical framework

Scholars have thoroughly examined and discussed a wide range of theoretical frameworks, ideas, and models found in the literature on corporate social responsibility. Scholars have attempted to comprehend and analyze CSR phenomena by drawing on a wide range of theories, including measurement theory, business ethics theories, crisis management theory, and stakeholder theory, among others [25]. Following in this tradition, the organizational drivers of CSR and their relationships to Corporate Social are examined in this study by combining stakeholder and CSR ideas and theories [64]. Jones Christensen et al. looked at how CSR was changing and included aspects of sustainability and corporate citizenship in their conceptual framework [65]. In a similar vein, Haddad [27] and Skilton and Purdy [3] argued in favor of adopting this enlarged terminology in order to account for evolving views, anticipations, and connections between communities, governments, and businesses. The study's examination of business-community ties is informed by their perspectives on sustainability and corporate citizenship.

Small and medium-sized enterprises were included in the CSR discourse by Battistini and Gazzola [66], who emphasized the impact of globalization on this discourse. They acknowledged the role that CSR plays in sustainable development and underlined the significance of CSR for companies of all sizes and industries. As a result, this study recognizes the various effects and responsibilities of a wide spectrum of multinational organizations. Skilton and Purdy conducted a literature review delving into CSR political theories, emphasizing how perceptions of CSR performance are shaped by power dynamics and disparate sense-making systems between firms and stakeholders [3]. The contextual aspect of CSR evaluation was highlighted, and it was shown as a disputed space where stakeholders and businesses compete to define and implement socially responsible conduct. Their paradigm provided business executives with insights to manage stakeholder participation in CSR discourse by seeing CSR as a political process driven by power distribution.

In order to study corporate leaders' CSR strategies, Aggerholm and Trapp [67] developed a three-generation typology. They used theme analysis to comprehend the CEO's stance while launching CSR projects. This study used their model, which described the creation of strategic CSR programs, to investigate the relationship between CSI funding availability for community development and CSR organizational features. Within the field of CSR theories about social integration, Garriga and Melé [1] emphasized how important it is for businesses to match their CSR initiatives with the requirements of their local communities. This idea is consistent with the findings of qualitative research conducted in 2014 by Bondy and Starkey on multinational companies and how their integrated internationalization plans frequently conflicted with regional CSR values. Their conclusions underlined how important it is to prioritize social investment goals and local community involvement in CSR initiatives [68]. These observations are used in this study to emphasize the value of including local communities in CSR programming and decision-making, as given in **Table 1** below, based on the theoretical grouping.

Table 1. Theoretical grouping.

Societal reality	Theoretical grouping	Description
Economics	Instrumental Theories	Corporation viewed as a wealth creation mechanism: its primary social responsibility. CSR merely a means to achieve greater profits.
Politics	Political Theories	Social power aspect of corporations emphasized. Corporation and society relationship places corporation's responsibility within political sphere
Social Integration	Social Integration Theories	Corporation agrees to accept social duties and rights to participate in specific social cooperation. Business should integrate social demands. Business depends on society for its continual growth and existence.
Ethics	Ethical Theories	Business and society relationship are embedded in ethical values. CSR viewed from an ethical standpoint: therefore, business accepts social responsibilities as ethical obligation, over all else.

Note. Adapted from "Corporate social responsibility theories: Mapping the Territory, by Garriga and Melé [1], Journal of Business Ethics, 53, 51-71.

3. Methodology

There is a lack of research examining the relationship between Organizational Sector and Firm Size and Corporate Social Investment in Asia, making the magnitude of this impact unclear. Furthermore, although the services and non-services industries propel most of Asia's economic expansion, it is still unknown how much of a role they play in CSI. By using a quantitative, correlational-predictive methodology and data analysis from Global Reporting Initiative reports from 2018 to 2022, this study seeks to close this gap. The predictor variables are Firm Size and Organizational Sector, which are classified into MNEs and Non-MNEs in different sectors, respectively. The criteria variable is community service investment. Organizational profiles and sustainability reports that provide details on Firm Size, Organizational Sector, and CSI expenditures are derived from the GRI database. Through the analysis of these variables, the research aims to determine the predictive capacity of Firm Size and Organizational Sector on CSI in Asia, providing insight into the elements affecting the region's corporate social responsibility practices.

In Asia, the study tackles the ambiguity surrounding the predictive ability of Firm Size and Organizational Sector on CSI. With permission, the study used the publicly available GRI database to examine if Firm Size and Organizational Sector independently or together, predict CSI. After retrieving and analyzing data from the GRI database, all entire datasets were kept, and then cleaned datasets were imported into SPSS, version 28, for further analysis. In order to investigate the predictive potential of Firm Size and Organizational Sector on Corporate Social Investment in Asia, this study used a quantitative technique. Since human behavior is assumed to be consistent and predictable, quantitative research makes use of exact measurements and statistical analysis to determine the correlations between variables. Comparatively, qualitative research stresses subjective interpretation and recognizes the dynamic aspects of occurrences. The purpose of quantitative research is to objectively find correlations between variables and characterize current circumstances. By using quantitative analysis to investigate organizational determinants of corporate social responsibility, this study expands on the body of current qualitative research on the topic. Studies by Görg et al. [19] and Wiengarten et al. [36], which examined the

connection between organizational traits and CSR practices or results, are notable instances of this type of research.

Data from 54 Global Reporting Initiative (GRI) reporting organizations working in Asia between 2018 and 2022 were analyzed using a correlational-predictive study approach. The criterion variable was CSI spending, whereas the predictor variables were Firm Size and Organizational Sector. The huge GRI database, which has standardized sustainability reports from organizations all around the world, was used for the study. Organizations have to operate within Asia throughout the designated time and report on all three variables in order to meet the inclusion requirements for the sample. Thorough statistical analysis was made possible by the GRI database's extensive data on Firm Size, Organizational Sector, and CSI spending. Multiple regression analysis was used in the study to forecast the correlation between the predictor variables and CSI. Overall, the research used a methodical approach to gathering and analyzing data, relying on the strong foundation offered by the GRI Standards. The research sought to further knowledge of the variables impacting corporate social responsibility activities in Asia by utilizing quantitative methodologies.

4. Data analysis

The researcher carefully checked the dataset to make sure it was accurate and comprehensive before preparing the study data for analysis. In order to ensure that data for all suggested research variables were present, each case had to be checked. To make data preparation and analysis easier, SPSS was used in combination with the Laerd Statistics application. The researcher converted the Organizational Sector predictor variable into a dichotomous variable that distinguished between mining and non-mining enterprises using dummy codes made using SPSS techniques. Similar to this, a placeholder variable was created for the Firm Size predictor variable, which resulted in the creation of another dichotomous variable by grouping Multinational Enterprises (MNEs) and Non-Multinational Enterprises (NMNEs) into one category. Regression analysis was performed using this code for these variables.

Next, descriptive statistics were looked at to learn more about the characteristics of the sampled population. In order to verify the completeness of the data, produce descriptive statistics, and display the findings using data tables, etc., we used SPSS statistics frequency techniques. In order to determine the most common categories for Firm Size and Organizational Sector, as well as to look into any possible correlations or trends between these variables, summary statistics were put together. Given that Firm Size is a critical organizational element that affects a number of factors, including managerial skill and CSR participation, its link to other predictor variables and organizational demographics has received special attention. The results of the study were influenced by the trends and patterns that this analysis helped to reveal.

4.1. Reliability and validity

The degree to which the data correctly depicts the topic under study is referred to as validity. The legitimacy of CSR reporting has been the subject of several studies, with a particular emphasis on the veracity and applicability of the information

released. In evaluating CSR reporting in a few member states, for example, Lock and Seele [69] discovered that report quality varied, with relevance often outweighing trustworthiness. They underlined the value of using the standardized metrics offered by GRI standards to evaluate report quality as well as the beneficial effects of legislative requirements on report quality. Lock and Seele observed that GRI is widely used as the main instrument for CSR reporting, giving report content legitimacy and highlighting the influence of standards on content [69]. According to Lock and Seele [70], GRI is one of the institutional strategies enhancing the caliber of CSR reporting since it promotes creative reporting techniques above and beyond the requirements of minimum standards. The most widely used CSR reporting instrument, according to Lindgreen et al. [71], is the GRI standards, which include variables pertinent to their planned study. The validity of study findings is improved by the wealth of information included in the GRI database, which includes standardized assessments for CSI and CSR activities. The GRI Standards emphasize stakeholder inclusivity, materiality, and completeness while offering user-friendly reporting principles and standards to assure the legitimacy of sustainability reports. By assisting in the production of precise, understandable, and comparable data, these guidelines help to overcome issues with construct validity. GRI has a strong methodology and established reporting procedures to guarantee data trustworthiness.

The reliability of sustainability reports is increased by testing techniques and reporting standards that guarantee accuracy and consistency in data reporting. The widespread adoption and adherence to GRI standards impart credibility to submitted data even in the absence of cross-checking. All things considered, the extensive framework offered by GRI improves the dependability and validity of CSR reporting.

4.2. Descriptive statistics

The computation of descriptive statistics came before the study of inferential statistics. In addition to the organizational features, denoted by dummy codes, of the predictor variables Firm Size and Organizational Sector (see **Table 2**), frequencies and percentages were computed for the country of operation of the participating firms (see **Table 2**). Furthermore, organizational characteristics of the study data and predictor variables are shown in **Table 3**. In this research study, data on all three study variables—Firm Size, Organizational Sector, and Corporate Social Investment that were reported to the Global Reporting Initiative by 54 Asian corporations that participated in CSR initiatives between 2018 and 2022 were examined. **Table 3** displays the distribution of these businesses throughout 8 Asian nations, with the bulk (27.77%) being based in Turkey. To be more precise, Turkey had the highest percentage of companies (n = 15), or 27.77% of the total, followed by India, which had the next-highest number of businesses (n = 14), or 25.92%. Others are less than these, as shown in the table below.

Table 2. Demographic statistics, country of operation.

Country	n	%age
Country 1	6	11.11%
Country 2	6	11.11%
Country 3	2	3.70%
Country 4	4	7.40%
Country 5	14	25.92%
Country 6	15	27.77%
Country 7	2	3.70%
Country 8	5	9.25%
$N = 54$		

Table 3. Organizational characteristics of the study data: Predicator variables.

Predicator variables	N	%age
Firm Size		
Multinational Enterprises	19	35.18%
Non- Multinational Enterprises	35	64.81%
Organizational Sector		
Services Sector	40	74.07%
Non-Services Sector	14	25.92%
$N = 54$		

The majority of the businesses were classified as Non-Multinational Enterprises ($n = 35$, 64.81%) when looking at Firm Size. In terms of the Organizational Sector, a sizable fraction of the businesses was engaged in service activities ($n = 40$, 74.6%), as given in the table above.

5. Results

The following analytical techniques were used to investigate each of the three study questions and determine whether to accept or reject the accompanying hypotheses:

First Research Question (RQ1): Does Corporate Social Investment (CSI) have a significant correlation with Firm Size and Organizational Sector?

Null Hypothesis (H10): Corporate Social Investment (CSI) is not substantially predicted by Firm Size or Organizational Sector.

Alternative Hypothesis (H1a): Corporate Social Investment (CSI) is strongly predicted by Firm Size and Organizational Sector.

A multiple linear regression analysis was performed, involving the simultaneous entry of the two variables, Firm Size and Organizational Sector, in order to investigate the null hypothesis for RQ1. **Table 4** shows the results below as the value of $R^2 = 0.079$ and the value of Durbin Watson is 1.70, so 7.9% of the of the variance is explained by Firm Size and Organizational Sector.

Table 4. Variance predicted by Firm Size and Organizational Sector.

R	***R*²**	**Adjusted *R*²**	**SE of the estimates**	**Durbin-Watson**
0.305	0.079	0.70	0.854	1.70
N = 54				

The regression ANOVA table is given in the **Table 5** below. As the given model below is significant ($F = 5.07$, $p = 0.015$). Based on these results of the ANOVA output, the null hypothesis is rejected and H1 accepted. This shows Organizational Sector and Firm Size combined to predict CSI.

Table 5. F- Test: Firm Size and Organizational Sector as predicator of CSI.

Model 1	**Sum of squares**	**df**	**Mean squares**	***F***	***p***
Regression	5.95	2	2.84	5.07	0.015
Residual	53.106	65	0.753		
Total	59.189	67			
N = 54					

RQ2 and RQ3 run through a combined model as given below.

RQ2: Does the CSI predict Firm Size uniquely when Organizational Sector in the model is held constant?

H20: CSI is not predicted by the Firm Size when Organizational Sector held constant in the model.

H2a: CSI predicted by Firm Size when Organizational Sector held constant in the model

RQ3: Is CSI uniquely predicted by the Organizational Sector when Firm Size held constant in the model?

H30: CSI does not predict by Organizational Sector the when Firm Size held constant in the model.

H3a: CSI predicted by Organizational Sector the when Firm Size held constant in the model

As shown in **Table 6**, CSI was not predicted by Firm Size, so the null hypothesis was rejected for RQ2, but Organizational Sector did significantly predict corporate social investment, so the null hypothesis for RQ3 was rejected.

Multiple regression analysis was run using archival data from GRI reports and showed that Organizational Sector emerged as a significant predictor ($b = 0.275$, $p = 0.005$), indicating that manufacturing and fertilizing companies contributed more to CSI than other companies, while Firm Size did not significantly predict CSI spending ($b = -0.089$, $p = 0.259$), as given in the table below.

Table 6. Regression coefficient table: Firm Size, Organizational Sector as individual predicators.

Model 1	**Unstandardized B**	**Coefficient standard error**	**Standardized coefficient B**	***t***	***p***	**95% CI lower**	**95% CI upper**
(Constant)	4.98	0.089		47.69	<0.001	4.98	5.01
Firm Size	−0.312	0.325	−0.089	−0.897	0.259	−0.599	0.321
Organizational Sector	0.657	0.201	0.275	0.278	0.005	0.201	0.898

Note: Log transformation, corporate social investment.

6. Research findings

The survey included 54 companies from 8 Asian countries; most of them (27.77%) were based in Turkey and India (25.92%), which is consistent with previous studies on corporate social responsibility in other countries that focused on these regions. It's interesting to note that, in contrast to research that focuses mostly on multinational enterprises, the majority of firms (64.81%) were classified as non-multinational enterprises. Furthermore, 25.92% of companies did not operate in the services industry, which is in contrast to previous research that suggests the services industry is the primary topic of conversation when it comes to CSR. The study's findings demonstrated a broad range of Corporate Social Investment spending, underscoring regional and national differences and the absence of standardized CSR procedures.

The question of whether Firm Size and Organizational Sector predict CSI was investigated using multiple linear regression analysis. Based on the investigation, 7.9% of the variation in CSI spending could be explained by these factors taken together. It was impossible to determine the relative importance of each predictor, though. This was addressed in later analyses by looking at Organizational Sector and Firm Size independently. The analysis for Research Question 2 (RQ2) revealed that, while Organizational Sector was held constant, Firm Size did not independently predict CSI. This finding expanded the CSR literature beyond the traditional focus on MNEs to include small and medium enterprises, which play a significant role in local socioeconomic development in Asia.

In response to the research question, the null hypothesis was rejected by the analysis, which showed that Organizational Sector strongly predicted CSI spending. This emphasizes how crucial it is to take Organizational Sector into account when evaluating the social development contributions made by firms in Asia, especially in the extractive industry, which is important to CSR practices but also highly complicated. Furthermore, compared to non-services organizations, service corporations provide a substantial contribution to CSI, highlighting the sector's role in Asian social development—albeit one marked by inequities and concentrated advantages, as previously shown in the study.

7. Conclusion

With an emphasis on Firm Size and Organizational Sector, this study has shed important light on the organizational traits that determine Corporate Social Investment in Asia. The results help extend the idea of CSR in this setting and provide insight into the state of CSR in Asia.

The study found that although Organizational Sector and Firm Size together accounted for 7.9% of the variation in CSI expenditure, Firm Size by itself was not a reliable indicator of CSI spending when Organizational Sector was controlled for. Organizational Sector, on the other hand, strongly predicted CSI spending, suggesting that it plays a crucial role in influencing CSR activities in Asian businesses. Moreover, the study's inclusion of small and medium-sized enterprises in addition to multinational enterprises emphasizes how crucial it is for CSR research to take into account businesses of all sizes. The prevalence of non-multinationals and businesses

outside of the services industry threatens preconceived ideas about corporate social responsibility in Asia and emphasizes the need for a more comprehensive approach. The research also emphasizes the value of CSI as a stand-in measure of social performance and how well it can be used to evaluate the results of corporately supported social development programs. Furthermore, service firms have made significant contributions to social development in Asia; this highlights the need to comprehend industry-specific corporate social responsibility policies. Practically speaking, stakeholders may utilize the results to create regulations that support ethical business practices, pinpoint opportunities for cooperation, and get a deeper understanding of the CSR environment in Asia. Through the utilization of this information, businesses may increase program efficacy, strengthen their strategic positioning, and make more meaningful contributions to the social development of their local communities.

8. Study contribution and limitations

The organizational traits of corporate social responsibility that forecast corporate social investment in Asia are well explained by this research study. The study advances the understanding of corporate social responsibility in Asia by looking at Firm Size and Organizational Sector as possible CSR factors. The results not only pinpoint CSI predictors but also employ CSI as a stand-in for evaluating an organization's involvement in corporate social responsibility initiatives. These findings have important ramifications for future CSR growth in Asia, providing a chance for stakeholders to target marginalized groups, close resource gaps, and foster socioeconomic development.

The study broadens the existing focus on leadership as the key predictor of CSR by including Organizational Sector as a theoretical factor of CSR, especially considering CSI expenditure in Asia. Furthermore, it emphasizes CSI as a crucial CSR success metric, enhancing previous studies that primarily focus on financial performance results. Furthermore, by including small and medium enterprises in the research, the theoretical understanding of Corporate Social Responsibility in relation to globalization and sustainable development is broadened.

Limitations include the use of self-reported data and possible reporting biases. By putting in place more stringent data gathering techniques and confirming data accuracy throughout the recruiting phase, future research might overcome these shortcomings. With the use of the data, stakeholders may make well-informed decisions on CSR practices by learning more about the prevalent organizational traits and CSI expenditure patterns in Asia. Business executives may utilize this data to better design policies, distribute resources, and evaluate the CSR posture of their companies. Governments in the host nation may use the CSR landscape study to map gaps in social development and create pertinent legislation, while social development players can use it to find possible collaborations and areas to target for action. The Global Reporting Initiative provides access to a varied dataset and a strong theoretical background, both of which are beneficial to the study.

The paper makes recommendations for future research directions to validate its conclusions and deepen our knowledge of CSR dynamics in Asia. In order to improve

the thoroughness of the CSR landscape study and look into how CSI investment affects social development results, future research might look into other nations. Case studies on certain sectors of the economy, such as mining, and the CSR projects they support would improve the body of knowledge on the relationship between social performance and CSR results.

9. Future research directions

To further enhance our grasp of the CSR landscape in Asia, future research endeavors should strive to incorporate more Asian nations than the eight examined in this study. This extension will facilitate the targeted delivery of services in places where social development initiatives are desperately needed by helping to close geographic gaps and offer more thorough resource mapping. It is advised to look into Firm Size and Organizational Sector, the two organizational factors this study looked at, in more detail. The theoretical framework in the Asian context would be strengthened by further convincing data on the role of Organizational Sector in determining CSR, particularly in relation to CSI within Asia, and the conclusion that Firm Size does not predict CSI spending.

More investigation is necessary to validate CSI as a surrogate measure of social performance. The credibility of CSI as a CSR outcome indicator would be increased if a clear connection was made between it and the results of social development initiatives. This may be done by looking at the relationship between the effect evaluations of the social development projects that these investments finance and the expenditure levels of the CSI. More research should be done on CSI expenditure patterns, especially the noteworthy contribution mining firms make to social development in Asia. The literature on corporate social responsibility would benefit from case studies that highlight service firms' social development activities and offer insights into how CSR affects social performance. Further research on small and medium enterprises and their contributions to social development is also necessary. Studies in this field may improve knowledge of the functions played by SMEs and may strengthen their standing in obtaining recognition, respect, and cooperation from other stakeholders. Long-term community benefits might result from more meaningful and durable social development initiatives as a result of this kind of cooperation.

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