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Editorial Note

The November 2024 issue of the *Journal of International Business Disciplines (JIBD)* has been the result of a rigorous process of blind reviews, and in the end, the reviewers recommended four articles for publication in this issue of *JIBD*.

JIBD is committed to maintaining high standard of quality in all of its publications.

Ahmad Tootoonchi, Chief Editor
Journal of International Business Disciplines

THE CHANGING BALANCE OF EFFICIENCY AND RISK OF GLOBAL SUPPLY CHAINS

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ABSTRACT

Improvements in technology combined with an openness to trade, cross border investment and free markets have allowed many firms to reduce labor and other costs by employing globally dispersed operations. Increased trade barriers, growing geopolitical concerns and supply disruptions caused by the pandemic are requiring a greater focus on supply chain and operational resiliency. Some managers are considering moving operations closer to their home markets, foregoing the cost economies and relationships built up over many years. The purpose of this paper is to argue that increases in technology such as artificial intelligence, strategic and operational planning and integrated business planning make it possible for many firms to continue to manage global supply chains and still have resiliency and efficiency.

INTRODUCTION

The growth of globalization of supply, trade and investment have led to huge benefits for much of the world's populace and firms (Zitelmann, 2023; Sundaram et al., 2020; Genereux, 2017). After the financial crisis of 2008-09 the benefits of globalization and free trade began to be challenged and countries' support for both began to decline. Nevertheless, competitive pressures led many firms to continue to expand their global presence in production and sales, especially as China developed rapidly into one of the world's largest markets. Competition between China and the U.S. grew, and firms began facing pressure to shift production closer to home markets. The pandemic resulted in unprecedented procurement and transportation problems for global supply chains and many firms began considering 'reshoring' or 'nearshoring' production and supply even if this meant giving up valuable competitive advantages and losing invested capital and hard-won relationships built up over the years (Kalish & Buckley, 2023).

The purpose of this paper is to support and make a case that with the application of new technologies and integrated planning, global supply chains can be managed without abandoning the many benefits firms received from operating globally. These benefits include cost efficiencies, proximity to local markets, gaining local market knowledge and having diverse suppliers while also creating jobs in developing economies. The next section outlines the growth of global supply

chains, followed by the challenges to globalization from the financial crisis of 2008-09 and the COVID 19 pandemic that ensued. We then discuss balancing the efficiency of operating globally with the need to add resiliency in an era of heightened geopolitical tensions.

GROWTH OF GLOBAL SUPPLY CHAINS

During the two decades prior to the financial crisis of 2008 and 2009 global trade intensity grew as firms utilized low-cost labor in China and elsewhere. Reductions in transportation and communication costs also lowered the cost of moving inventories around the world (Lan et al., 2022). Low trade barriers and the ability to invest in many countries further encouraged firms to operate globally. This growth was made possible by countries' openness to trade and capital flows and the growth of Asian and South American markets. These factors led to the global operations that took many different forms such as outsourcing, joint ventures, acquisitions of foreign firms, and de novo investment.

Managing global supply chains was made easier by technology that allowed better tracking and managing of inventory. For example, in retail trade, Radio Frequency Identification (RFID) tags and smart shelves that employed weight sensors to determine which items customers were picking up and ultimately buying allowed clothing manufacturers to quickly produce more of the product that customers were buying and fewer styles and colors that customers did not want (Smith, 2022). Rapid communication and transportation allowed manufacturing to be located overseas thousands of miles away from retailers in order to exploit significant labor cost advantages. Better inventory management also reduced costs and improved asset efficiency. This in turn improved firms' return on assets (ROA) and return on equity (ROE). Competition led firms to pursue economic advantages offered from outsourcing and globalizing their supply chains.

Firms began to use Just-In-Time (JIT) inventory management to reduce inventory investment even further, with as many as 70% of U.S. manufacturing firms using JIT policies, which in aggregate reduced the inventory to sales ratio by 35% between 1980 and 2018 (Ortiz, 2022). JIT requires relatively low fixed order costs, including transportation and communication costs, and reliable sources of supply. Firms that can employ JIT inventory management are able to reduce their carry cost in inventory and reduce the obsolescence risk of stored inventory. Firms can also better match consumer demand for items without as large an investment in process inventory, which often has very low value and can quickly become obsolete (Lambert & LaLonde, 1976; Ross, et al., 2023). Over time managing these costs can significantly improve cash flow and profitability.

IMPACTS OF THE FINANCIAL CRISIS AND THE PANDEMIC

The financial crisis of 2008-09 reduced demand for goods and services for many firms' products. The crisis also undermined the public's belief in the benefits of globalization as even with the recovery, economic growth remained slow, unemployment stayed high, and U.S. real median incomes declined for years after the crisis was over. The falling popular support for globalization

and the election of President Trump in 2016 led to the U.S. increasing barriers to trade by raising tariffs and withdrawing support for the World Trade Organization that promotes global free trade. Not surprisingly, the crisis resulted in declines in global trade intensity and then the pandemic further reduced trade. Trade peaked at about 61% of output in 2008 and fell to about 57% of output by the time of the pandemic (Hilsenrath & DeBarros, 2023). Growing wages in China, along with the U.S. tariffs, were also reducing that country's cost advantage. Wages in China doubled over the decade before the pandemic and were more than twice the wage costs in Vietnam, Malaysia and other competing countries (Lund et al., 2019).

Increase in Sino-U.S. tensions and the COVID lockdowns in China during the pandemic exposed vulnerabilities in the global supply chain networks, many of which overly relied on production in China. While movements to JIT systems can improve asset efficiency and potentially increase a firm's ROA, it often makes the firm more vulnerable to external supply shocks such as those that occurred during the pandemic (Ortiz, 2022). Potential output losses can be quite large. Even during normal times, the frequency of supply shortages is larger than many realize with shortages lasting for at least one month occurring on average every 3.7 years and shortages lasting 2 months or more occurring every 5 years. In total, Lund et al. (2020) estimate that a firm can expect to lose about 40% of annual profits over a 10-year period due to supply shortages. The pandemic led to even greater losses than normal from shortages. Nikookar and Yanadori (2022) report the financial impact of supply chain issues in 2020 led to between a 5% to 10% drop in global GDP which is quite significant.

Some industries, including the auto industry, were hit particularly hard by pandemic induced shutdowns. With plant closures in 2020 many auto manufacturers canceled JIT orders for semiconductors, which led to manufacturers of semiconductors to produce chips for other uses that had continued chip demand. When automakers began to ramp up production of autos after the stay-at-home orders were lifted, they found they could not obtain the chips needed. This resulted in a shortfall of about 4.5 million autos being produced in 2022. Lack of chip availability and weakening demand for autos in 2023 after the Federal Reserve raised interest rates are likely to have resulted in further declines in the production of automobiles. The shortfall may be as much as 3 million fewer autos produced and sold than expected (Dutt et al., 2023; Gitlin, 2022). The automobile production process is highly globalized with multiple tiers of suppliers used for design, parts, assembly, and production. A shortage of a critical component such as "chips" can sideline a large number of suppliers in multiple countries.

In response a number of countries, including the U.S., Japan and European countries, are attempting to reduce their dependency on global suppliers for what they consider essential industries such as semiconductors. It is important to note that the semiconductor production process is highly specialized and globalized. Design may occur in the U.S. or Europe, while the design implementation may be done by a different firm that does not produce the chips themselves. Using inputs from the U.S. and other countries, fabrication and testing typically occurs in Japan, Taiwan and elsewhere in Asia where specialized factories have been developed that employ highly skilled labor. Assembly of chips into finished goods such as smartphones or 3-D printers may occur in other locations, in China or elsewhere (Varas et al., 2021).

To bring home more of the semiconductor manufacturing process, the U.S. government is offering up to $52.7 billion in subsidies to encourage the production of semiconductors in the U.S. (Sohn, 2023). The estimated cost to build one semiconductor fabrication plant is about $10 billion. The Semiconductor Industry Association (SIA) and the Boston Consulting Group have estimated that if the U.S., Europe and Asia duplicated the full production process in each region rather than allowing the global trade currently in place to produce semiconductors, the capital investment costs would be in excess of $1 trillion dollars. Production costs could be as much as $125 billion more per year resulting in somewhere between a 35% to 65% increase in the cost of semiconductors (Varas et al., 2021).

Aside from any macroeconomic effects on the U.S. economy from all this additional spending, surely the price of automobiles would have to rise substantially. General Motors has been working on reducing the number and type of chips required in its automobiles. Other producers such as Toyota stockpiled inventory of these crucial components. The point is companies can learn how to manage these risks and can do so far more cheaply than relying on the government to provide costly subsidies to foreign chip manufacturers such as TSMC (Sohn, 2023).

Efficiency may argue for working closely with one or only a few suppliers, but doing so may increase supply chain risks, especially if the suppliers are in regions subject to frequent production shutdowns, climate or weather risks and are located in countries with unstable political systems. This does not mean that the alternative is to abandon globalized supply chains. Stockpiling critical inventory may be at least a partial solution. Stockpiling adds to costs, but inventories can serve as a shock absorber from supply disruptions. (Low Technology Institute, 2021; Ortiz, 2022). However, with the increases in interest rates and inflation in 2022 and 2023, capital costs of inventory investment and other carrying costs have increased significantly, so stockpiling may prove to be only a short-term solution. The Hackett Group 2022 Working Capital Survey Midyear Update reports that the largest U.S. nonfinancial firms reduced their first quarter cash cycle by reducing their days sales in inventory and in receivables relative to their first quarter 2021 levels (Hamburger & Blair, 2023). This may be in response to higher capital costs.

Advances in technology such as robotics, artificial intelligence (AI) and the Internet of Things (IoT) are now allowing firms to reduce their labor costs and move to a more capital-intensive business model. These changes have encouraged firms to locate production more regionally or even within their home markets where labor costs are higher. Hence, many firms have begun "re-shoring" or "near-shoring" production. This may make sense for some firms, but we do not believe this is warranted for many or even most firms. For most there is a more balanced approach that firms can take that retains the advantages of global sourcing while reducing supply chain risk.

A THIRD WAY: BALANCING EFFICIENCY AND RESILIENCY

Efficiency in supply chain management is focused on minimizing investments in inventory and other current assets and sourcing supplies and processing in the most cost-effective way regardless of location. Efficiency is critical to provide customers with an affordable product. If your firm is not efficient, customers will eventually switch to a lower cost substitute product. Resiliency is the

ability to handle supply and process disruptions without compromising production or failing to meet customer needs (Alicke et al., 2022; Shih, 2022; McKinsey Business Resilience, 2023). Resiliency can provide a significant competitive advantage to a firm. Imagine if Ford could have continued to produce vehicles to meet demand in 2022 and 2023 when Toyota and General Motors could not. Given that customers often remain loyal to the brand of their most recent purchase, this could have led to a lasting competitive advantage for Ford.

Efficiency and resiliency should not be thought of as an either/or proposition. They are best thought of as a continuum where managers must balance the cost savings of minimizing inventory and selecting suppliers in lower cost locations against the risk of shortages and supply disruptions (See Figure 1). Much has been written of employing risk management practices to identify the cost and risk in managing the supply chain and inventory levels. See for instance El Baz and Ruel (2021), Leibovici and Dunn (2022), Lund et al. (2020) and Nikookar and Yanadori (2022). There are multiple aspects to these tradeoffs.

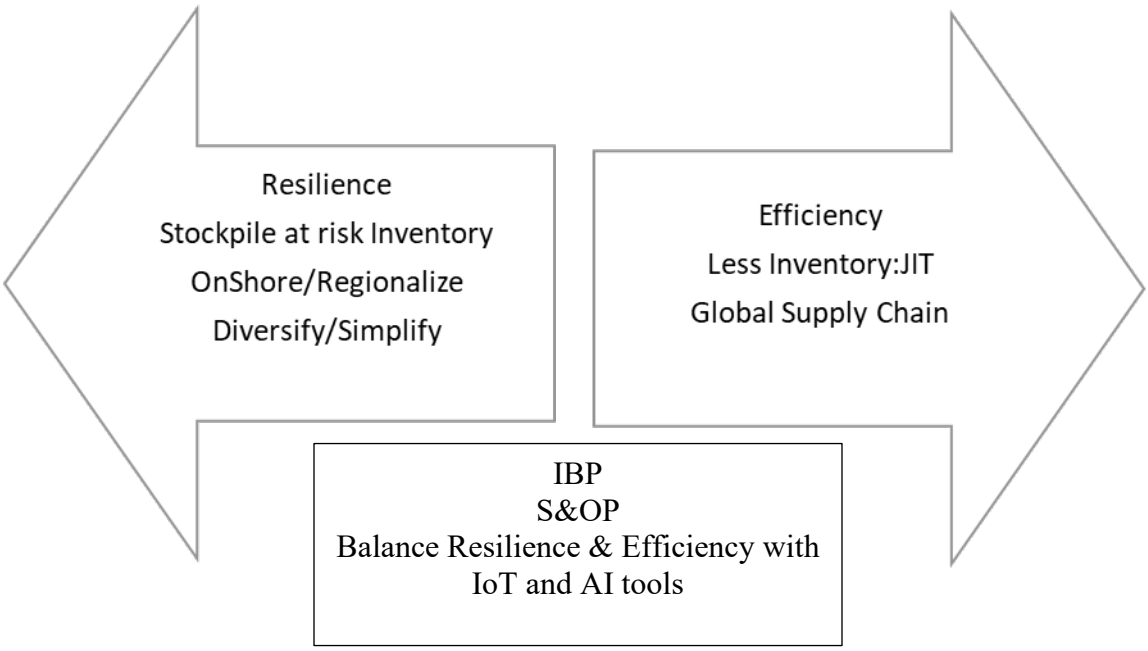

FIGURE 1. MANAGING THE NEW TRADEOFFS BETWEEN RESILIENCE & EFFICIENCY

First, the decision to stockpile inventory adds to the carry cost of the inventory, but reduces the likelihood of shortages, at least in the near term. Second, utilizing globalized supply chains can improve profitability by locating production, distribution and/or assembly in areas with lower labor costs, and/or employing suppliers with specialized R&D, engineering or fabrication skills that would be costly to duplicate otherwise (Sharma et al., 2022). Firms also get exposure to new markets for their product by locating parts of production close to major markets and gain local knowledge by operating in different cultures. The benefits are too large to give up, and the cost to move to autarky solutions would be very significant (Shih, 2020).

Firms have already shown that they are capable of managing global supply risks. The International Monetary Fund estimated that in 2022 firms that actively managed their global value chains and experienced supply disruptions during the pandemic were already learning to adapt by diversifying sources of supply, stockpiling the more critical inventory parts and investing in technology to better understand their critical supply risks (Lan et al., 2022). Firms can manage supply risks on a global scale and the pandemic has created the impetus for them to better understand and manage both demand and supply risks in their production processes. Subsidies such as those offered for semiconductor production in the U.S., Japan and Europe are reminiscent of industrial policy and thus difficult to justify on economic grounds.

Admittedly, the pandemic caused longer and more severe supply disruptions than normal. Some consider the pandemic a one-off event; however, heightened geopolitical, weather and climate risks indicate that supply disruptions are likely to continue to significantly impact businesses. We argue that this does not mean firms (and countries) should seek to eliminate global sources of supply and produce everything in their home country. This would lead to many costly and inefficient redundancies that would unnecessarily raise the cost of goods and services. It could also actually increase the risk of supply shocks. According to the IMF, many Western firms already source over 82% of their intermediate products domestically (Lan et al., 2022). Thus, globalization that diversifies away from predominantly domestic supply sources may in some cases actually increase resiliency. Reshoring production and supply could increase the risk of disruptions from an overconcentration of supply and an overreliance on the domestic market. The better solution is using technology and processes to manage supply chain risks more effectively as we discuss below.

TECH BASED MANAGEMENT OF THE PROCESS: S&OP AND IBP

Firms can develop strategic and operational plans (S&OP) that provide a blueprint for supply chain management to ensure that supply matches demand. Quite a few support firms and products exist to assist in this planning, some of which we list below. The goals of these plans include avoiding excess inventory buildup and shortages and ensuring the firm will have the necessary financial resources to pay for supplies, thereby avoiding business disruptions while still meeting customer demands (Riverlogic, n.d). More firms should employ such plans. These can be especially beneficial for Small and Mid-Sized Enterprises (SMEs).

S&OPs are generally at a transactional level and are often highly detailed plans that are specifically adapted to the firms' needs. Rethinking a firm's supply chain to add resiliency may also require a more strategic focus, particularly with the higher levels of capital investment that may be involved in diversifying supply chains and considering other strategic factors. Post pandemic, the public expects firms to consider other factors in their operations such as adding environmental, social and governance (ESG) considerations to the management of supply chain investments.

USING THE IOT AND AI TO IMPROVE TRANSPARENCY AND RESILIENCY

One of the largest roadblocks to managing supply chains with efficiency and resiliency is ensuring transparency in the supply chain. Transparency requires digitizing the supply chain management process. It requires extensive use of items such as RFID tags and tracking software to trace inventory components through the procurement, processing, and sale processes. Kilcourse and Rowen (2023) argue that these are widely available now and are cost effective for many firms. Retailers in particular can use RFID tracking to improve inventory management as mentioned above and tailor inventory procurement and distribution to markets where supply is needed.

With a growing number of customers resorting to online shopping as a first choice (think Amazon or Google), even if the purchase is completed at a retail store, online sellers want to know what causes customers to respond to their products and why they follow through with a purchase or not. AI can play a crucial role in identifying characteristics of buyers and nonbuyers to improve marketing and tailor production to what is actually selling in real time. The ease of online searching and purchasing along with rapidly changing consumer tastes means that identifying popular products quickly is essential to meeting customer demand in multiple markets simultaneously. This is practically impossible without technology assistance. Firms can use inventory management software such as NetSuite, Fishbowl or Flowtrac among many others, to better track and analyze costs associated with inventory management, including order and transportation costs (Software Advice, n.d.). RFID tracking can also identify supply bottlenecks and thus improve inventory management, identify sources of disproportionate amounts of returns and track lost or stolen inventory.

Planning for product demand has always been an important part of effective supply chain management, but the COVID pandemic and recent increases in geopolitical turmoil makes planning even more important. AI processes such as predictive analytics using real time data can update demand and supply forecasts on a daily basis. This helps reduce disruptions to supply and improves the probability of meeting evolving customer demands in various markets. Machine learning tools readily available now can be used to predict supply chain disruptions, design optimal logistics routes, assess supplier performance and minimize inventory and demand mismatches (Kazancoglu et al., 2022; Aggarwal & Singh, 2019). There are many firms that can assist in supply chain management of this type using advanced AI methodologies including IBM Watson Supply Chain, Oracle SCM Cloud, S&P IBP, and the new Amazon Supply Chain, just to name a few (OpenAI, 2023).

Optimizing a global supply chain also requires input from a strategic financial perspective (Kazancoglu et al., 2022). This can occur by layering on Integrated Business Planning (IBP) onto an S&OP. IBP adds financial goals such as profit growth, improving return on equity or economic value added to the process of managing production. IBP also provides a means of encouraging cross-functional coordination among marketing teams, finance teams and production engineers. Optimizing working capital and production decisions requires digital data from all aspects of the firm's production and sourcing process and cooperation among the functional areas of the firm. The latter is not automatic and requires managers to build in processes that encourage and reward improvements in items such as the percentage of deliveries to customers that are on time and meet

quality standards. Adding resiliency in a cost-effective manner will require identifying critical supply points and building in redundancies that reduce costly supply disruptions while still meeting the firm's financial goals. The IBP process can provide a framework to evaluate these tradeoffs by rewarding decisions that meet financial goals of balancing efficiency and resiliency (Dumitrescu et al., 2022).

RESILIENCY AND COMPLEXITY

Operating global supply chains can add substantial value to a firm, although managing a network of global suppliers is complicated. Suppliers that provide items directly to the main firm are called Tier 1 suppliers. Firms that supply Tier 1 firms are called Tier 2 firms, etc. Many large firms have 3 or more layers of suppliers underlying their production process. Managing multiple Tier 1 suppliers for similar items provides flexibility if one or more suppliers faces its own disruptive event. Encouraging communication between Tier 1 firms can identify cost efficiencies, gain local market knowledge and improve performance (Sharma et al., 2022). Nevertheless, it can be difficult to manage a large geographically dispersed supply chain. Baumgartner et al. (2020) estimate that car makers can have over 200 Tier 1 suppliers and over 10,000 Tier 2 suppliers. That is a large number of relationships and logistics to manage. Aggarwal and Singh (2019) have developed a multiple objective net present value (NPV) based supply chain model that includes third party logistics firms that help manage a global supply chain. Their model incorporates demand uncertainty and presents a means to balance NPV and cost minimization. One of their main results is to recognize the benefits of using third party logistics firms to exploit cost efficiencies in managing global supply chains.

Complexity adds to vulnerabilities that can result in supply disruptions, especially if a firm does not have the capability to understand its suppliers' risks and bottlenecks. However, firms learn much about foreign markets from their contacts with foreign suppliers that they would not learn otherwise. A firm's ability to manage the complexities of global supply chains depends critically on their information processing capabilities (El Baz & Ruel, 2021). Firms invested heavily in 2022 in building transparency among suppliers (Townsend & Bodo, 2022). In 2023 the top priority in investment in supply chain management appeared to be forecasting demand and optimizing inventory, as well as further reducing supply risks to improve resilience. Some firms are focusing on improving vertical integration through the supply chain by encouraging consultations with 1st and 2nd Tier suppliers in product design and eliminating potential supply bottlenecks.

If feasible, firms can design products that can accept a greater variety of inputs from different sources, or firms may standardize components of similar products to reduce the need for specialized inputs that aren't widely available. As noted above, GM is working on reducing the many types of computer chips required in their vehicles down to only 3 types and is contracting with GlobalFoundries to ensure a steady supply of chips in the future (Boudette, 2023). Reducing the amount of product variation can simplify inventory and demand forecasting requirements as well. The cost-benefit of providing many varieties of goods for niche markets may change when the needed supplies may not be readily available (Shih, 2020; Lund et al, 2020).

As firms rethink their supply chains, it may be a good time to integrate ESG considerations into their sourcing decisions. Investors are rewarding firms that can demonstrate they are committed to improving the environment and society along with producing their product. Amazon's new supply chain tool incorporates identifying elements of ESG in the procurement process (https://aws.amazon.com/aws-supply-chain/features/). Demonstrating that a firm is actively considering ESG investments can result in stock price improvements and lower financing costs because stock and bond investors continue to expect companies to be actively involved in improving the lives of stakeholders (Keeley, 2022). Because of this scrutiny, firms may wish to avoid investments in locations that do not have environmental protections or adequate labor standards.

To the extent possible firms may wish to invest in countries with stable political systems while avoiding autocracies that have few human rights protections or those that marginalize women and minorities. Similarly, experiences in the pandemic show that countries with better digital infrastructures that allow remote working and have automated systems to manage inventory and logistics had smaller declines in GDP than otherwise (Lan et al., 2022). As climate risks increase firms should also value suppliers in countries with institutional structures to handle weather and health disruptions. Investing in firms located in countries that value trade and free capital flows is another means of reducing political risk in the supply chain.

CONCLUSION

The purpose of this paper is to argue that firms that operate globally should not be too quick to abandon the efficiencies and relationships they have built from operating globally over the years. This is the case even though the operating environment is less friendly to global trade and climate and political risks have increased. For instance, about 80% of global trade is from or flows through countries with falling political stability (Lund et al., 2020). Firms must consider that the new norm of higher geopolitical risk in much of the world today is not likely to decline anytime soon.

Businesses will have to place greater weight on building in more geographic dispersion of suppliers across different tiers to preserve resiliency. If this is not possible then stockpiling critical inventory may be necessary, even at the risk of incurring higher financing costs and increasing the risk of inventory obsolescence. Managing instability and political risk also means operating in countries with stable political climates that welcome investment and trade can be more valuable in the long run than simply choosing the lowest cost provider at the moment. There will be less political risk and chance of costly tariffs and non-tariff barriers if businesses work with firms that are allies of their own country and with those that have trade agreements (Foroohar & Raju, 2022). Supply chain risks can also be reduced by choosing firms located in countries with a strong digital infrastructure and the ability to respond to health related or weather and climate related events (Lan et al., 2022).

Managing global supply chains in today's environment is more complicated than in the past. Fortunately, rapid improvements in AI and other technologies have given firms the ability to better manage their global supply chain risks through investing in technology and employing S&OP and

IBP software. All firms, and especially SMEs, can use technologies such as the IoT and AI to understand and better manage the desired balance between supply chain efficiency and resiliency without abandoning valuable long-standing relationships with their suppliers. Investing in digital tools will allow firms to successfully navigate the changes and disruptions that will happen in the future and maintain both efficient and resilient supply chains.

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LIQUID GOLD: JAPAN'S PRODUCTION & EXPORT OF SOY SAUCE AND SAKE

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ABSTRACT

The Japanese agricultural industry and an exceptionally wide variety of Japanese industries are seemingly at a perpetual crossroads. This intersection includes modern manufacturing techniques and a dedicated commitment to the historical and cultural authenticity that each industry and manufacturer represents. The production and exportation of soy sauce and sake are no different. Modern manufacturing techniques have largely superseded tradition in an effort to promote prompt product generation while an increase in profit with the more complex and intricate traditional techniques still are being used in order to create a smaller, almost boutique sub-industry of elite products with prestigious ties to historical authenticity. This paper addresses one of these crossroads with a comparative analysis of soy sauce and sake production in Japan and its status as an export item of value to the Japanese economy (especially the agricultural sector of the Japanese economy).

INTRODUCTION

Japan's agricultural industry relies heavily on two fermented soybean-based liquids: soy sauce and sake. While both are seeing a steady increase in consumption, both also face logistical challenges in meeting this growing market demand. Acknowledging that this is a very specific topic, companies around the world routinely face similar issues with production, logistics, and exports. This paper will review and address these challenges while answering the following research questions:

How can Japan continue to capitalize on soy sauce and sake as valuable trade items, especially in light of Japan's limited agricultural spaces and declining labor pool available in the agricultural industry?

Will international imports of these goods be enough to encourage a development in production practices, or are these two products at a plateau in their production and distribution?

CULTURE AND PRODUCTION CAPITALIZATION

The expansion of the Japanese economy in the 1980s saw a like expansion in the export of Japanese made goods. With the continued export and rise in the importance of pop culture, Japan took position as an important cultural influence on the West. With this new importance comes an emphasis on what constitutes the cultural foundations of a place. Japan emphasizes a melding of traditionalism and an expansion of modern technology (Luo, 2024). This unique combination of cultural emphasis has led to a heightened intercultural competence (Luo, 2024). Organizational success based on this intercultural competence has continued to grow due to a strong heritage as soft power connection to the West and Western markets (Nakano & Zhu, 2020). The differences in cultural and intercultural communication, power distances, tightness of culture, and time orientation lend Japanese culture a uniqueness (Luo, 2024) which is appealing from a Western product/production perspective.

Japanese agricultural practices are directly tied into Japanese economic and energy concerns (Rahman et al., 2022). In demand food products follow seasonal and commercial trends, especially concerning festive food traditions (Daniels, 2020). These conditions set up a scenario in which traditionally manufactured Japanese agricultural products promote a local and global demand.

Soy sauce

Less than 1% of Japanese soy sauce production is done utilizing traditional, multi-year wooden barrel fermentation techniques. These traditional techniques lack additives that mimic the natural aging processes of soybean fermentation, relying instead on large wooden barrels and constant supervision to develop flavors naturally (Figure 1). This, of course, takes up a great deal of time, space, and resources. Barrels must be built by hand to specification, floorspace and employee time is used in order to store barrels during fermentation and to learn and employ specific skillsets (Ito & Matsuyama, 2021), and money must be spent on high quality ingredients and training for employees in lieu of using chemical additives (Figure 2) to compensate for lower quality ingredients and a dearth of attentive and specialized labor.

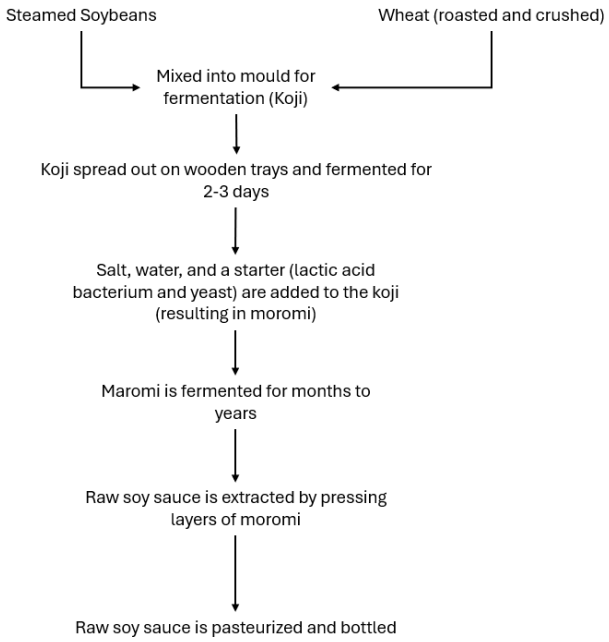
Steamed Soybeans
Wheat (roasted and crushed)
Mixed into mould for fermentation (Koji)
Koji spread out on wooden trays and fermented for 2-3 days
Salt, water, and a starter (lactic acid bacterium and yeast) are added to the koji (resulting in moromi)
Maromi is fermented for months to years
Raw soy sauce is extracted by pressing layers of moromi
Raw soy sauce is pasteurized and bottled

FIGURE 1

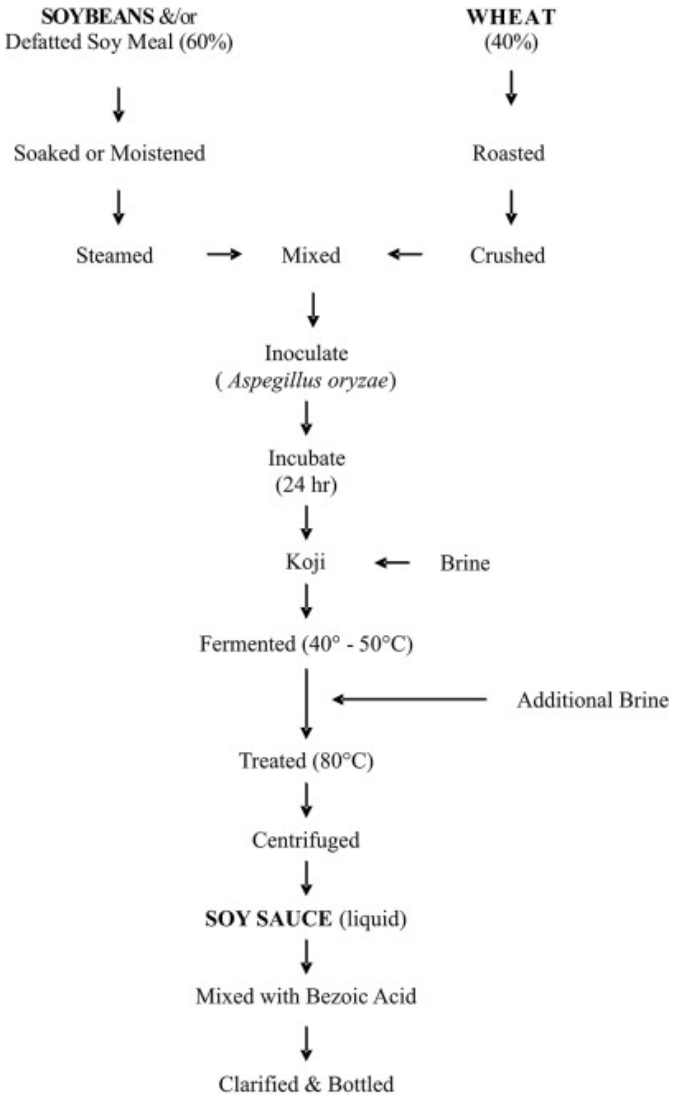

FIGURE 2

Taking the above into account, one can easily see the impetus to make soy sauce quickly and efficiently and to a passable quality. Soy sauce accounts for approximately 9 billion yen (almost 10 billion yen as of 2022, Figure 3) in export value for the Japanese economy, nearly 1% total of all export value annually. There is extreme economic pressure to ensure export demands are met, and further space saving methods are utilized in the production of agricultural products; this is especially true given the limited amount of land space and available human capital in Japan.

According to Hosoe and Akune (2020), "[Japan's food] exports are far smaller than imports and are dominated by food products. This small achievement of Japan's agri-food exportation might be an indication of strong potential for future growth." Japan, in other words, consumes even more soy sauce than it exports, proving this an issue of domestic agriculture as much as it is one of international exports.

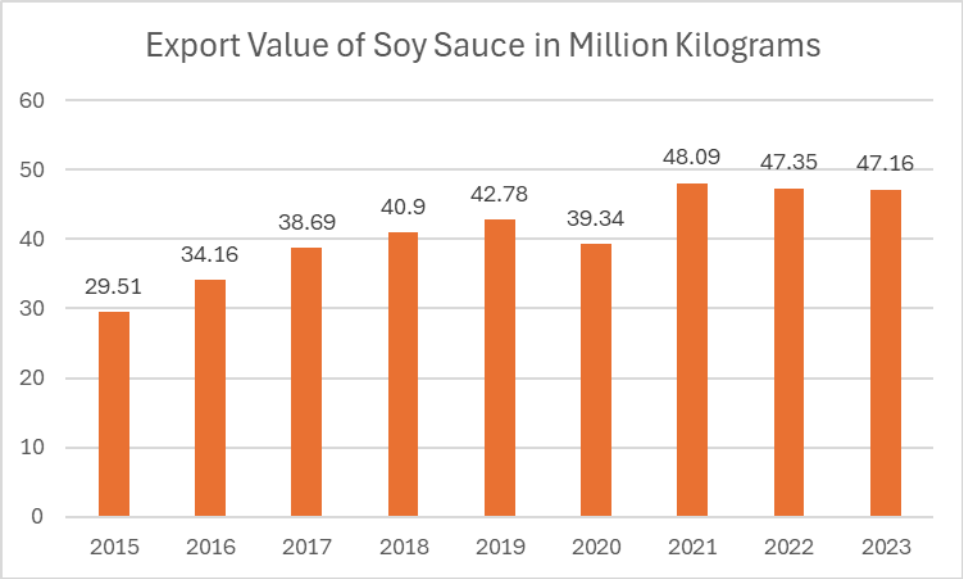

FIGURE 3

Sake

Another of Japan's fermented products lends itself to an in-depth analysis as well. Sake production and export is also a multi-billion yen industry in Japan, one that commands almost 50 billion yen as of 2022. This amount is growing year over year (Figure 4) with the United States being far and away the biggest importer of Japanese sake (Figure 5).

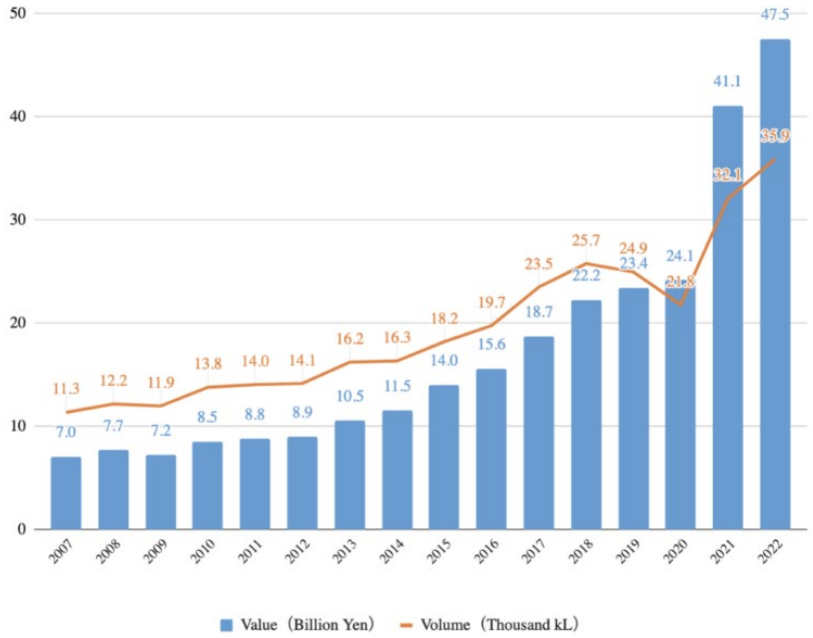

FIGURE 4

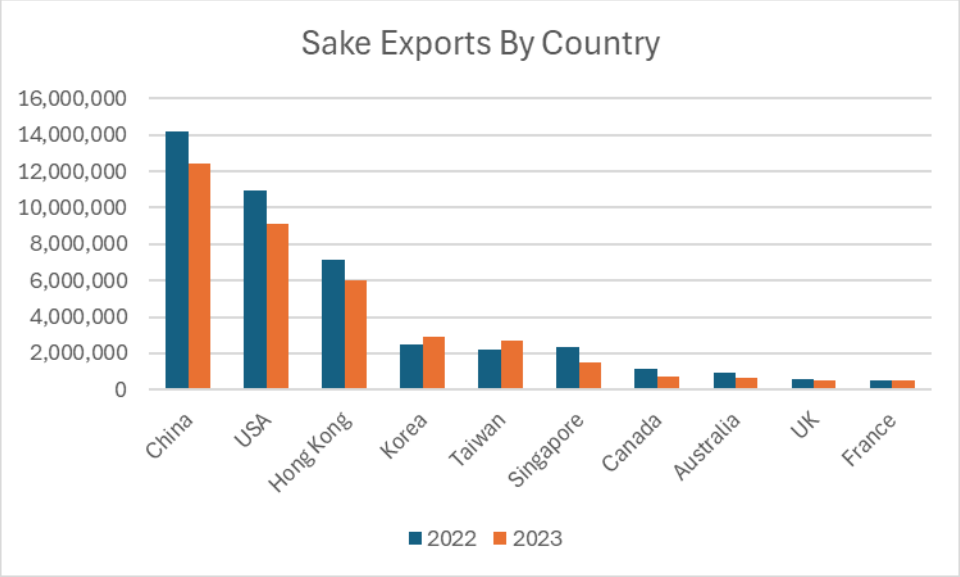

FIGURE 5

While Japanese consumption of sake has been in decline since the 1970s, international import has been growing (as stated above), and this growth has been compounded in recent years through the use of cross-border e-commerce (Ida et al., 2022). Importers and individuals (pursuant to local laws) can order stocks or individual bottles of Japanese sake and have them delivered directly to their stores or front doors. While the same is true for the importation of soy sauce, especially the more expensive and traditionally made brands, sake is more of a specialized item, not available in all grocery stores internationally. The ability to order it online compensates for this comparative lack in general availability as well as the decline in domestic use, an issue not faced by the nearly universal condiment usage of soy sauce within Japan itself.

DISCUSSION/CONCLUSION

Capitalizing on these high performing exports faces some international competitive issues. Soy sauce isn't produced very often outside of Asia, but international production of sake is on the rise (Okuda, 2019). In response, the Japanese agricultural sector has expanded the breeding and cultivation of sake rice varieties, extending its variety and quantity to wide areas of Japan (Okuda, 2019).

According to Okuda (2019), the properties of rice (starch structure, protein inclusion, water absorption, and susceptibility to grain polishing properties) determines its unique suitability to sake production and to the production of specific types of sake with unique properties, more specifically. This is a unique advantage of the Japanese agricultural industry; the Japanese agricultural sector has the unique experience in cultivating these rice cultivars as well as the agricultural space with unique land and soil features that make the growing of these rice types

possible. As the saying goes, “bubbly wine not grown in Champagne is just sparkling,” and so it is with the unique types of Japanese sake rice.

While the consumption of sake, and alcohol in general, is divisive when it comes to health benefits (especially when consumed in excess), the documented health benefits of soy sauce are well known. Soy sauce possesses antimicrobial activity against bacteria such as staphylococcus and salmonella, contains antihypertensive components, exhibits anticarcinogenic effects (this is especially prevalent in the flavor components of Japanese style, traditionally fermented soy sauce), and exhibits mild antihistamine properties as well (Kataoka, 2005).

The above-described health benefits are leading to its ubiquity in kitchens world-wide (Sassi et al., 2021). The widespread usage of social media, especially video content of varying types, has led to an increase in the spread of cooking techniques and a general increase in knowledge surrounding ingredients. In other words, a “foody culture” has developed and continues to evolve, especially in developed nations with high technology usage and among younger generations further enmeshed in this technology usage and with a greater interest in cultural uniqueness. Home cooks want to be healthier and more diverse in their cooking.

It is the contention of the authors that Japan can continue to capitalize on sake and soy sauce exports by utilizing the above information. The cultural background of the product, and uniqueness in Japanese manufacturing due to its unique rice crops and land and soil features, allows for Sake to be treated as a uniquely Japanese product. Soy sauce can be marketed as a healthy and culturally unique product, one that is necessary in many types of authentic Asian cooking. It is a necessary but health-conscious choice for the modern, diverse kitchen.

Additionally, both soy sauce and sake have niche varieties that appeal to those seeking out the very finest in each product variety. Top-shelf sake and traditionally fermented soy sauces can command large prices, and the luxury aspect of these types of soy sauce and sake can be utilized as a marketing tool, especially in wealthier countries.

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SMART CITIES: CHARACTERISTICS, IMPACT, AND FUTURE WITH GENERATIVE ARTIFICIAL INTELLIGENCE

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ABSTRACT

Smart cities are a growing global trend and include cities like New York, London, and Shanghai. Much of this growth is due to increased urbanization and recent technological advancements. The motivation for many non-smart cities to become a smart city is the ability to improve the lives of its citizens by better managing city services, like traffic congestion, public transportation, and emergency services. With the adoption rate of smart cities increasing, it is important to understand the true nature of smart cities, the full commitment, and risks associated with becoming a smart city before investing the time, money, and resources into becoming one. This article provides insight into the concept, impact, key characteristics, and benefits and challenges for smart cities. This includes a review of some of the globe's top ranked smart cities and highlights the potential impact that generative artificial intelligence can have on the future of smart cities.

INTRODUCTION

Have you ever heard of a smart city? What makes a city smart? Are some cities smarter than others? These are some common questions asked when thinking about smart cities. While many people may have heard of a smart city, the characteristics, realized benefits, and impact of smart cities may not be clear. One of the main reasons that smart cities are a growing trend is that these cities have the potential to improve the lifestyle of their citizens, so there are likely to be more in the future. However, there are some real challenges that must be overcome for a non-smart city to transition into a smart city. This article discusses what a smart city is, some of the critical characteristics and technologies that help to support smart cities, some of the globe's top ranked smart cities, and highlights the potential impact that generative artificial intelligence (GAI) can on the future of smart cities.

PURPOSE

The purpose of this article is to provide insight into the concept and implementation of smart cities, the impact of these types of cities, and highlight the potential impact that GAI can have through a literature review. Given the nature of these types of cities, the literature is relatively recent. As such, the review begins in the early 1990s and includes defining what a smart city is, reviewing some of the key benefits and challenges associated with smart cities, highlighting some of the characteristics and features of smart cities of smart cities and the potential impact smart cities might have in the future. Moreover, this article aims to provide insight into questions like: Will there be more smart cities in the future? What challenges are associated with higher levels of adoption? What is the potential impact of GAI on smart cities?

OVERVIEW OF SMART CITIES

The focus of this literature review is on smart cities and the potential impact that these types of cities can have, and the future with GAI. Specifically, the discussion will define smart cities, provide a historical review, detail the characteristics, highlight the benefits and challenges, and importantly, provide insight into the potential impact that GAI can have on the future of smart cities. To begin this discussion, the following provides an overview of what a smart city is.

Defining Smart Cities

Over the past years, there has been a significant shift in the world's population. Since 1985, the world's urban population has risen from less than 2.0 billion to 4.2 billion in 2018 (Ghosh, 2019) and about 56% of the world's population now lives in cities. Likewise, more than 80% of Global Gross Domestic Product is generated in those cities (World Bank, 2023). In 2009, for the first time, the population of cities equaled the population of rural areas. This rapid growth has put significant demands on the city's ability to provide public services like adequate housing, electricity, water supply, health care, education, employment opportunities (Buhaug et al., 2013) which are allocated to by where people live (Ritchie et al., 2024).

Although the number of smart cities has been increasing, there is still controversy over agreeing on a common definition of a smart city. Mosannenzadeh and Vettorato (2014) created a conceptual framework to define smart cities. They posited that a smart city is a sustainable and efficient city with a high quality of life that aims to address challenges such as improving mobility, optimizing the use of resources, and improving social development by using ICT in its infrastructure and services, collaborating between its key stakeholders, integrating governance, community, and industry, and investing in social capital while Mohanty et al. (2016) postulated that smart cities utilize ICTs to better use resources, improve public services for its citizens and environment. Azizalrahman and Hasyimi (2019) views smart cities from a broader perspective of a sustainable city and develops a model that includes technology, community, economy, and energy, which

facilitates the development of an intelligent city and clearly distinguishes between smart cities and low-carbon and sustainable cities. The National Grid (2020) defines smart cities as using ICT to improve their operations, from street lighting to public transport. They then define characteristics of what makes a city 'smart' in terms of infrastructure that uses connected digital technologies, connected technology to improve environmental and sustainability criteria, progressive city planning, and efficient public transportation and traffic systems.

While there is not complete agreement on the definition of a smart city, there are some similar themes to these perspectives (Azizalrahman & Hasyimi, 2019), including reliance upon technology, improving the lives of the citizens, and sustainability efforts. Mohanty et al. (2016) suggests that the "smartness" of a city describes its ability to bring together all its resources, to effectively operate with maximum possible efficiency to fulfil the purposes it has set itself by effectively using smart components, including smart transportation, smart grid, and smart governance and technologies such as The Internet of Things (IoT) and cyber physical systems

Brief History of Smart Cities

The concept and idea of a smart city is relatively recent and marked by sporadic movement forward. The first significant undertaking towards smart cities can be traced back to the 1970s when Los Angeles created the first urban big data project (GlobalData, 2020). The city managers used IBM mainframes to develop a database of 500 social and physical factors for census tracts throughout the city. The goal was to use the data to inform policy and action to reduce poverty and combat urban decay by providing real-time data to urban policy decision-makers. Next, the 1990s witnessed a global surge in computing technologies, particularly with the onset of the internet. This period marked the rise of city governments utilizing digital technologies to address city problems, including Bangalore in India, San Diego in the U.S., Southampton in the U.K., and Brisbane in Australia, among others. (Hollands, 2008). According to GlobalData (2020), the first smart city was arguably Amsterdam, which created a virtual digital city in 1994, marking the start of the term "smart city. They also established a Digital City, which served as an open network to provide easy access to the internet and improve communication between the government and residents (Bratt, 2022).

Amsterdam created a Smart City platform in 2009 and a partnership among governmental agencies, knowledge institutions, companies, and foundations while IBM improved the knowledge and experience in computing technologies and pioneered a multi-million-dollar "Smarter Cities" marketing initiative. Since 2010, technology firms have reconfigured existing technologies, including sensor networks, communications networks, and automation systems, to modernize existing infrastructure and integrate them into future designs (Pierce et al., 2017). In 2012, Barcelona deployed the Internet of Things (IoT) across urban systems, including public transit, parking, street lighting, and waste management. These innovations helped reduce congestion, lower emissions, and save on water and power (Adler, 2016).

The recent past has seen a transition in the way smart cities are perceived with more focus on people. Trencher (2019) indicates that the concept of smart cities has seen the emergence of its

second generation, the so-called smart city 2.0. The first generation smart city 1.0 was largely techno-economically driven and interested in digital technology diffusion and smart city projects' economic and corporate potential. In contrast, smart city 2.0 has shifted towards a decentralized, anthropocentric approach and ways to foster collaboration and community involvement. Among the critiques, some contest that neoliberal economic interests in smart city planning and strategies prevail at the expense of environmental and social concerns (Cardullo et al., 2019). Carrasco-Saez et al. (2017) note that the top-down tendency of many smart cities is the fundamental cause of many smart city project failures because of a lack of understanding of what the citizens want.

Characteristics of Smart Cities

While there is not a clear definition of a smart city, there are some common characteristics among smart cities. Some of the more important characteristics include the use of technology and the IoT to improve connectivity, data processing, and automation. Bibri (2021) claims that as connected networks and technology become spatially omnipresent across urban environments, cities can become smarter, helping solve environmental problems and responding to socio-economic needs. The National Grid (2020) suggests several defining characteristics for smart cities including having an infrastructure that uses connected digital technologies, using connected technology to improve sustainability efforts, progressive city planning, public transportation and traffic systems that are highly efficient, and hospitable urban space. However, Collier (2020) emphasizes the importance of data and posits that data plays a crucial role in the development and functioning of smart cities, as data is used to make decisions and improve the lives of its citizens. Tull (2023) seems to agree and notes the importance of data and suggests that connectivity allows data to be collected, processed, and analyzed in real-time, which allows for automated decision-making that can enhance and improve quality of life for citizens in the community. Carnis (2018) forwards a similar perspective regarding transit systems and suggests that efficient public transportation and traffic systems can automated with the use of data and algorithms to manage traffic efficiently and are vital components of smart city initiatives that are aimed at improving urban smart cities. As noted by the National Grid (2020), strong, progressive governance is another important characteristic of smart cities. This is primarily due to the need to have strong, knowledgeable leadership to sustain smart city projects. Gil-Garcia et al. (2016) highlights this need and suggests that smart government is necessary to improve citizen engagement, accountability, and interoperability. Becoming a smart city requires that the people making decisions have a clear understanding of the smart city goals, how to achieve these goals, and sustained support to ensure these smart city projects come to fruition.

Impact of Top Smart Cities

There are about 140 smart cities worldwide, and the number is increasing and many of the top smart cites like Zurich, London, Amsterdam, and Shanghai are having a positive impact. Smart cities have traditionally been studied from a technocentric perspective. However, such technological conceptualizations of smart cities have changed to a human-centric smart cities

perspective (McBride et al., 2022). Scholars (Lara et al., 2016; Almeida et al., 2018) and city leaders have begun to explore smart cities from this new perspective. According to Zurich's Bruno Lanvin, President of the Smart City Observatory, Zurich's leading position as a smart city includes demonstrating its ability to be "a livable city with strong human-centric policies." At the same time, "Giving priority to inclusion and diversity helps make a city more vibrant for citizens and enterprises" (Wray, 2023). Canberra has implemented several intelligent city solutions to improve the well-being of its residents. According to Thinger.io (2023), the city has introduced an innovative ticketing system for public transport, which makes commuting more accessible and more convenient. Canberra has also updated its lighting systems, improving its people's visibility and safety. Tekin et al. (2024) found that London's smart city initiative indicated that spatial inclusion is the primary focus where inclusive housing, transport, and health management systems are promoted. In Singapore, the government launched a "Smart Nation, Smart Towns" program that encouraged citizens to develop creative ideas to make their communities more livable and efficient. They also have over 100,000 cameras that surveillance public spaces to ensure public safety (Goyal et. al., 2023).

Sustainability is also gaining importance for the success of smart cities. Several cities worldwide pursue selective strategies to attract talent and investments through net-zero enterprises. Zurich has implemented initiatives in public transport greenhouse gas emissions to transform itself into a smart city. It has decreased its transportation related GHG per person in the city by implementing new operational and design measures, such as limiting the expansion of the car traffic network and parking (Menendez & Ambuhi, 2022). Zurich is working towards a net zero emissions goal to become climate-neutral by 2040 (IMD Report, 2023). Oslo has the most electric, hybrid, and alternative fuel vehicles of any other city worldwide and plans to reduce emissions by 95 percent by 2030 (Locke, 2023). Toh (2022) notes that the Tokyo Metropolitan Government launched a city decarbonization effort to achieve zero emissions in Tokyo by 2050. The government recommended fundamental energy, urban infrastructure, and land use changes to reduce carbon emissions. Walbank et al. (2023) reported that London has 346 IOT companies, the highest number of electric vehicles charging stations, and green-certified buildings in Europe and America. Shanghai has implemented intelligent grid systems, smart traffic management, and smart street lighting, resulting in savings from reduced energy use and emissions (Arumugam, 2022).

Smart mobility plays a crucial role in smart cities by providing efficient and sustainable transportation solutions that reduce congestion, improve air quality, and enhance quality of life (Wolniak, 2023). Santilli (2023) posits that Singapore has implemented an extensive intelligent transportation system that includes real-time adaptative traffic signals and data to optimize traffic flow and reduce congestion, while Goyal (2023) maintains that Singapore has one of the world's most extensive mass rapid transit systems, known for its reliability and efficiency. In London, people check into buses and underground trains with their phones, use curb-side electric vehicle charging, and use mobile apps to promote healthy walking routes around the city (Puttkamer, 2023). Shanghai provides full 5G coverage in the downtown area and fiber coverage across 99 percent of the city (Arumugam, 2022). Topos Magazine (2022) reports that Hamburg provides smart traffic management, smart parking, and a car-sharing app that allows users to book their tickets after seeing the fastest route from all available means of transport.

The focus of this section has been on providing an overview of smart cities, their relative history, and the impact that some smart cities are currently having. The following discussion focuses on the benefits and challenges of smart cities, which helps to provide a better perspective on why some non-smart cities are more likely to transition into becoming smart cities than others.

OVERVIEW OF BENEFITS AND CHALLENGES FOR SMART CITIES

Smart cities are intriguing and growing globally. Much of this is due to increased urbanization and the impactful benefits associated with smart cities, like an improved lifestyle for its citizens and more sustainable environment. However, there are also some challenges with establishing and maintaining a smart city, like the heavy investment in technology and the need for progressive governance. Figure 1 provides an overview of some of the main benefits and challenges for smart cities, which is followed by a more detailed discussion that provides further insight.

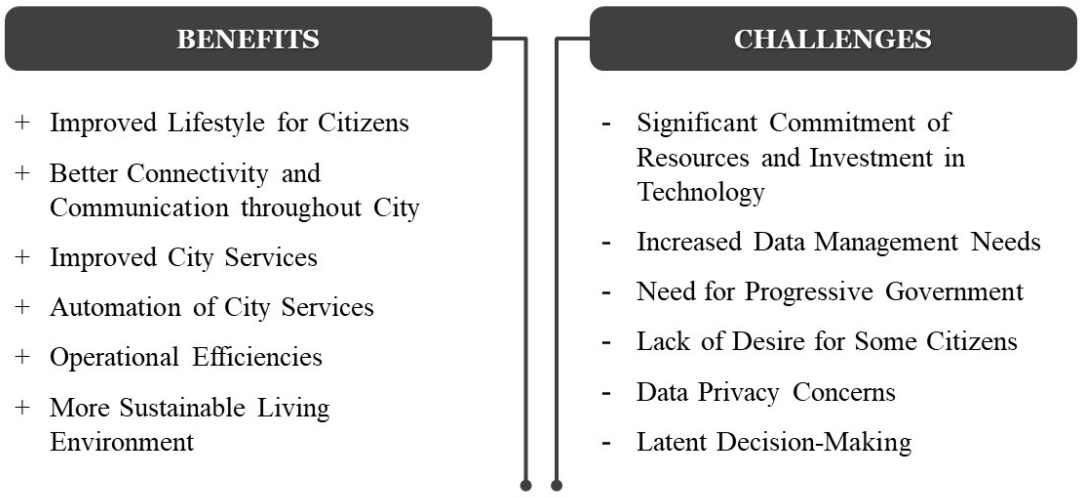

FIGURE 1. DIAGRAM OF BENEFITS & CHALLENGES FOR SMART CITIES

Benefits of Smart Cities

There are several benefits associated with smart cities. Many of these benefits are so impactful that they serve as motivation for more non-smart cities to transition into smart cities. One of the most impactful and important benefits is the improved lifestyle for the citizens in the community. Woetzel et al. (2018) highlight lessons learned from municipal leaders who are realizing that smart city strategies should start with people, as it is not just about improving city operations, but also about using technology to make better decisions and deliver an improved quality of life for the citizens in the community. Zhao and Zhang (2020) agree and posit that all citizens in the community can benefit and experience the convenience brought by smart cities to their lives. Much of the improved lifestyle is due to smart cities offering technology based innovative solutions to

improve the quality of life of urban communities in a sustainable and equitable manner (Ramírez-Moreno et al., 2021).

Another key benefit for smart cities is the increased technology, which leads to better connectivity and communication throughout the community. As noted earlier, Mosannenzadeh and Vettorato (2014) discuss how one of the key aspects of a smart city is the use of the IoT and technology to lead to an upgraded lifestyle for its citizens due to things like enhanced mobility, optimized use of resources, and integrated community services. The National Grid (2020) suggests that smart cities can improve every facet of city living for their residents including faster and public Wi-Fi and improved community engagement. This is an important benefit that can directly benefit the community. Having free and reliable WIFI with ample access points throughout the community is a particular motivator for many citizens.

The increased use of technology not only benefits the citizens, but it is the foundation for helping the city to deliver on providing improved services. Wang and Zhou (2023) posit that smart cities can help to improve the services like public safety, medical services, daily commutes, and environmental quality through smart solutions. This can include things like crime reduction due to faster and better response times from public safety, decreased commute times with better traffic systems, better public health with systems that are able to identify health problems and trends, and more sustainable environments. For example, a strategy used by many smart-cites to improve public safety is to have ample webcams throughout the city that are connected directly to fire and police departments. This helps with faster responses from public safety, easier tracking and identification of crimes, and improved evidence for prosecuting criminals. Furthermore, smart cities typically have better responses to natural disasters, as city services can be better directed and used more efficiently during a crisis or times with limited resources.

Automation is another key feature associated with smart cities. That is because smart cities have advanced systems that can handle more data and process data in real-time, which can lead to automated decision-making. Meijer and Bolívar (2015) note that smart cities are not only smart in terms of how they can automate routine functions, but also in how the technology enables them to improve decision-making (Meijer & Bolívar, 2015). With recent technological advancements in artificial intelligence (AI) and GAI are helping technologies like self-driving cars, robots and city brains to transition some aspects of smart city life from automated to autonomous (Cugurullo, 2020).

Efficiency is another benefit that smart cities. These efficiencies are driven by the city's use of technology and connectivity to better process data and integrate operations that can help the city to use less energy and operate more efficiently. Meijer and Bolívar (2015) note that they can automate tasks to better serve citizens, maintain buildings, and manage traffic systems to improve the efficiency, equity and quality of life for its citizens in real time. For cities, these efficiencies often lead to a reduction in operating costs, which can be reinvested in other city operations.

Finally, many smart cities are more sustainable than non-smart cities. As discussed earlier, the National Grid (2020) emphasized sustainability as a key characteristic of smart cities and notes that these cities use technology to improve environmental and sustainability efforts. In addition, some smart cities focus on reducing the use of traditional gas and electric energy and increasing

the use of alternative energy sources like wind and solar energy (Krishna, 2016). For example, many smart building spaces seek to achieve net-zero energy consumption to improve sustainability efforts, which can help lower a city's carbon footprint and improve sustainability. With more efficient use of the city's resources and less use of energy, many smart cities are more sustainable and have lower carbon footprints than non-smart cities.

CHALLENGES WITH SMART CITIES

With all the benefits associated with smart cities, there may be a question of why are there not more of them? While there is a lot of growth in smart cities, there are also some challenges that must be dealt with to become a well-functioning smart city. Unfortunately, some of these challenges are quite significant and serve as barriers that hinder adoption for many non-smart cities seeking to become smart cities.

One of the main challenges is the commitment and significant amount of time, energy, and resources necessary for a city to transform into a smart city. Zhao and Zhang (2020) propose that the design and construction process of a smart city is quite complex, involving many departments, regions, and data cross types. The design can also vary greatly from city to city based on things like size, current state of readiness, and willingness of the community. Fundamentally, smart cities rely heavily upon technology so it can be challenging to transition into a smart city because current operations may need to be restructured in order to incorporate the different types of technologies, software, and data types. This can be a real barrier, as different departments can be at different levels of readiness.

Another barrier to non-smart cities transitioning to having more smart elements is the necessary long-term investment in technology. Puron-Cid and Gil-Garcia (2022) conducted research on smart cities and the long-term financial sustainability of smart cities and found that for some cities smart city projects are too expensive and not financially sustainable for some city governments. That is because smart city project investments typically include things like financial support, reorganization, labor, and time, as becoming a smart city often requires a significant shift from how the city is currently operating. This can includes upgrading a significant number of operations to shift to be technology based, like new computers, rewiring, installing cameras, sensors, etc. It is important to note that there is more than the initial investment to consider, as technologies change regularly and need to be updated in order to continue to maximize the benefits of being a smart city.

Another important aspect of being a smart city is ensuring that the proper systems are in place to manage data. Zhao and Zhang (2020) clarify the importance of data processing and suggest that if there is no data transmission, then there is no data processing, no data storage, or data reprocessing. Smart cities generate a tremendous amount of data, which is processed by the technological systems that are in place. With the appropriate systems, smart cities are able to use technology to process lots of data quickly, reliably, and intelligently. This is important, as the most critical aspects of being a smart city are based on processing data.

Another complex challenge is the need for coordination between the city's governance and its citizens. The is necessary because the main beneficiary of transitioning into a smart city is the community. Therefore, it is important for city governance to ensure that there is not only buy-in to becoming a smart city, but also ongoing efforts to ensure that the community is part of the decision-making process. Meijer and Bolívar (2015) note successful efforts at smart city government in Amsterdam where there was a unique partnership between businesses, authorities, research institutions and the citizens to develop the Amsterdam Metropolitan Area into a smart city with a focus on the themes living, working, mobility, public facilities and open data.

However, this can sometimes be a challenge because with the heavy use of technology and data, there are people who do not desire to live in a smart city. Some of this is attributable to the benefits not being equally accessible for all citizens, as the primary beneficiaries are citizens that already have access to technology. Kharas and Remes (2018) highlight this concern and note that there is a risk of deepening inequality unless governments recognize that technology solutions are as important to the poor as they are to the affluent.

While other citizens are concerned with data privacy, security, and misuse. In this case, data breaches and security threats are managed by the city. In many cases citizens are not aware of or confident in the protocols in place to secure their data. This is a major concern for many citizens, as they desire to understand what type of data is being collected and be sure that the data will not be misused or subject to data security problems. Handley (2023) emphasizes one of the main concerns with data privacy and smart cities is whether the data gathered is going to be used by the government for surveillance and unintended purposes. Smart cities tend to collect a lot of data on their citizens via sensors, cameras, and tracking devices. This is concerning to some people as they believe that it gives the government too much access to people's personal lives with the potential to use the data in a manner in which it was not intended.

Finally, the reliance upon technology and its processes can lead to latent decision-making. This can happen because newer technologies can not only gather data but also be automated to process and make decisions. For example, traffic lights can be automated to adjust based on traffic flow, which makes their process efficient and citizens happier. However, there is still a need for human interaction to maintain the systems, make adjustments, and ensure that the systems are running correctly. Without human interaction, there can be a risk of systems going array.

ARTIFICIAL INTELLIGENCE, GENERATIVE ARTIFICIAL INTELLIGENCE AND SMART CITIES

In recent years, AI has been used in intelligent city studies and practices and is becoming an increasingly significant aspect of smart cities. For smart cities, the power of AI helped cities to achieve many of the benefits discussed above. According to Ullah et al. (2021), AI has become a critical intelligent city technology that helps cities increase efficiencies including automation to deliver urban infrastructures, services, and amenities. AI has resulted in opportunities for cities to increase infrastructural efficiencies, predictive analytic capabilities, and quality of life in cities (Yigitcanlar et al., 2021). AI has been utilized for effective traffic management (Ramírez-Moreno

et al., 2021), traffic monitoring (Englund, 2020), and transportation network services (Englund et al., 2021). AI powered adaptive traffic management can adjust signal timings based on real-time traffic patterns, incidents, and weather conditions, reducing greenhouse gas (GHG) emissions and improving emergency response times (Lockhart, 2024). AI based vehicle traffic prediction, driving, and routing applications have been discussed in articles such as Ge et al. (2020)'s proposal using deep learning algorithms to predict urban traffic speeds.

The IoT started as a vision of all digital objects being connected and acting intelligently and has been evolving since 2000 (Chae, 2019). It was developed to collect data from all areas, as much data must be collected to make cities more efficient, and it allows various objects on the internet to communicate with each other. Real-time problems are tracked through constant communication, and possible solutions are identified (He et al., 2021; Li et al., 2022). Whitmore et al. (2015) reviewed IoT by identifying categories, including technology, applications, challenges, and business models. AI is being used for smart city technologies like the IoT and sensors. IoT uses AI to analyze vast amounts of data generated by these devices. The estimate is that about 30% of smart city applications are now integrating AI to enhance urban sustainability, resilience, social welfare, and vitality, including urban transportation solutions (Alahi, 2023). For example, Syed et al. (2021) highlights that the IoT facilitates collecting data and performing data analysis to extract information for decision and policymaking. However, the large amount of data generated by IoT sensors can be overwhelming for people to analyze and interpret. AI can analyze enormous amounts of data (Kaufmann et al., 2021) and detect patterns and trends that humans might not be able to detect. For example, AI can enhance IoT in smart cities' predictive maintenance by analyzing data from IoT sensors to predict when maintenance is needed for bridges and buildings before a failure occurs (Alahi et al., 2023).

Generative AI is enabling the creation of more efficient and sustainable smart cities. It is a type of machine learning that crafts new data instances reflecting its training set. Generative AI can generate a model of how a city might evolve, such as creating a city layout that prioritizes a city and reducing its carbon footprint. According to Chiancone (2023), GAI could scrutinize data on a city's current energy consumption and transportation patterns and then generate a model of a city layout that minimizes energy use. Amsterdam has used GAI to optimize its public transport routes, while Singapore uses it to simulate various urban scenarios and predict the impact of different planning strategies. Generative AI can also analyze vast amounts of data collected from IoT devices, sensors, and cameras to identify patterns and trends humans cannot easily detect. This information can then optimize city infrastructure, transportation systems, energy consumption, public safety, and other vital areas (Asri, 2023). For example, Generative AI already impacts cities using predictive maintenance for urban infrastructures. Generative AI enables more intelligent energy use, improved air and water quality monitoring, and more efficient waste management (Lockhart, 2024).

Generative AI is shown to have many uses and benefits, but it has some challenges, including data privacy and security and ensuring that Generative AI systems are ethically sound. Skilled professionals will be needed to develop and implement generative AI systems (Asri, 2023), including data governance and coding fluency (Papandeaou, 2024). Generative AI will be increasingly important in the government's ability to personalize government service delivery. It can create compelling summaries of dense data such as city council notes, complaint records, and

policing (Descant, 2023). Cities like Copenhagen and Amsterdam are leveraging AI to optimize building and district energy use, Oslo embraces AI to predict and optimize waste collection routes, and Barcelona, Dubai, and Tel-Aviv utilize AI for sustainable energy management (Papandreou, 2024). Singapore has a comprehensive AI policy for all its services, training, and investments; Tokyo tackles traffic, disasters, and personalized public transport with AI, while Beijing utilizes it for air quality, building energy optimization, and smart city infrastructure. Seoul, Melbourne, Sydney, and Brisbane utilize AI for traffic management, public safety, demand prediction, and route optimization (Papandreou, 2024).

FINDINGS AND CONCLUSIONS

Smart cities are not cities of the future, they are here today. While there are limited numbers of smart cities across the globe, there is a growing trend toward more non-smart cities transitioning into smart cities. Technologies are becoming more accessible and user-friendly. This can help a city's endeavors, as these technologies enable easier connection, data collection, and data processing, which makes transitioning into a smart city more achievable than in the past. Also, advancements in AI and GAI will help drive more adoption in too. However, the advancements in technology do not address or overcome some of the other challenges associated with smart cities. This includes acquiring the necessary resources for transitioning into a smart city, having progressive governance that can garner citizen support for smart city projects, and addressing citizens' concerns regarding data privacy and security. In most cases, cities will still be challenged with accessing the funds necessary for the investment into upgrading operations and infrastructure. Also, now more than ever, there will be a need to ensure adequate coordination and collaboration between the city governance and its citizens. While technology will continue to evolve, the need to ensure that these advancements will work to benefit the citizens and the environment is necessary to ensure a smart city's long-term success.

For many cities, being a smart city or transitioning into one is well worth the effort because the primary beneficiaries of smart cities are its citizens. Smart cities help to provide an upgraded lifestyle for its citizens with things like better connectivity, enhanced public services, and public WI-FI. While these benefits help to make life more enjoyable, it also requires the same citizens to actively engage in generating funds for the investment in technology, ensuring that there is an active and progressive city government, and supporting the coordination between the city government and its citizens to ensure the long-term future of being a smart city.

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AN OVERVIEW OF SUSTAINABLE ENTREPRENEURSHIP AND FUTURE RESEARCH DIRECTIONS

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ABSTRACT

This paper provides an insightful overview of current research on sustainable entrepreneurship, exploring diverse perspectives, key themes, and future research directions. It reviews various conceptualizations of sustainable entrepreneurship and discusses pivotal topics such as ethical considerations, stakeholder dynamics, accountability, and the triple bottom line. Additionally, the paper highlights promising aspects of sustainable entrepreneurship, including its role in fostering innovation, driving social wealth generation, transforming unsustainable practices, promoting job creation, establishing eco-friendly businesses, and addressing issues like climate change, energy consumption, greenwashing, and digital sustainability. Lastly, the paper raises thought-provoking questions for further investigation, serving as avenues for future research and inquiry.

INTRODUCTION

In recent decades, the concept of sustainable entrepreneurship has emerged as a focal point in both academic discourse and practical business endeavors. (Halberstadt et al., 2024; Sharma et al., 2021; Anand et al., 2021; Certo & Certo, 2019; Kraus et al., 2018). Defined broadly as the pursuit of economic growth while concurrently addressing social and environmental concerns, sustainable entrepreneurship represents a fundamental shift in the way businesses conceptualize their role within society. This paper aims to provide a review of sustainable entrepreneurship research, exploring diverse perspectives, defining key themes, and identifying future directions for inquiry. Sustainable entrepreneurship is significant in integrating economic, social, and environmental value creation for future well-being (Muñoz & Cohen, 2018; Hockerts & Wüstenhagen, 2010, O'Neill et al., 2009) and balancing economic, environmental, and social objectives, serving as models for creating social and environmental wealth (Tilley & Young, 2009).

The term "sustainable entrepreneurship" has garnered increasing attention and importance in response to mounting global challenges, such as climate change, resource depletion, and social inequality (Halberstadt et al., 2024). Recognizing the interconnectedness of economic, social, and environmental systems, scholars and practitioners alike have sought to develop innovative approaches to business that prioritize long-term sustainability over short-term profit maximization.

However, defining sustainable entrepreneurship presents a complex challenge, as the concept encompasses a broad range of perspectives and interpretations (Gu et al., 2022). Scholars have

proposed various definitions, highlighting elements such as market success, environmental stewardship, societal impact, and ethical considerations (Schaltegger & Wagner, 2011; Cohen & Winn, 2007). Despite this diversity of definitions, a common thread emerges sustainable entrepreneurship entails more than just financial success; it involves a holistic approach to business that considers the well-being of people, planet, and profit (O'Neill et al., 2009).

Theoretical foundations of sustainable entrepreneurship further illuminate its multifaceted nature. Some scholars emphasize the role of market failures in motivating entrepreneurial action, suggesting that opportunities for sustainable innovation arise from gaps in traditional market mechanisms (Dean & McMullen, 2007). Others focus on ethical dimensions, exploring how sustainable entrepreneurs navigate complex moral dilemmas and integrate sustainability principles into their decision-making processes (Muñoz & Cohen, 2018).

Stakeholder dynamics also play a crucial role in sustainable entrepreneurship, as businesses interact with a diverse array of actors, including government agencies, non-governmental organizations (NGOs), consumers, and competitors (Muñoz & Cohen, 2018). Understanding these interactions and their implications for sustainable business practices is essential for fostering collaboration and driving positive social and environmental change.

Sustainable entrepreneurship is significant in integrating economic, social, and environmental value creation for future well-being (Hockerts & Wüstenhagen, 2010) and balancing economic, environmental, and social objectives, serving as models for creating social and environmental wealth (Tilley & Young, 2009).

PERSPECTIVES ON SUSTAINABLE ENTREPRENEURSHIP

Definitions and Conceptualizations

The conceptualization of sustainable entrepreneurship is multifaceted, reflecting the diverse perspectives and approaches adopted by scholars and practitioners in the field. One prevailing view characterizes sustainable entrepreneurship as the pursuit of economic growth while simultaneously addressing social and environmental concerns (Halberstadt et al., 2024). This definition emphasizes the integration of sustainability principles into entrepreneurial endeavors, recognizing the interconnectedness of economic, social, and environmental systems. Sustainable entrepreneurship thus entails a holistic approach to business that seeks to create value not only for shareholders but also for society and the environment. Scholars have proposed several nuanced definitions of sustainable entrepreneurship, each emphasizing different aspects of the concept. Sustainable entrepreneurship was defined as the extension of market success to instigate societal change, underscoring the role of entrepreneurs in driving innovation and social progress (Schaltegger & Wagner, 2011). In this view, sustainable entrepreneurship entails not only economic success but also the promotion of broader societal goals, such as environmental protection and social equity.

Dean and McMullen (2007) define sustainable entrepreneurship as spotting and seizing economic opportunities in areas where market failures threaten sustainability. They highlight how these failures can actually be opportunities for sustainable entrepreneurs to tackle sustainability issues, especially those with environmental impacts. Ploum et al. (2019) stress the need to include moral competencies in entrepreneurship education to connect entrepreneurial ambition with sustainability. Their research proposes a framework that connects moral competencies with recognizing opportunities and sustainable entrepreneurship, highlighting ethics' role in guiding actions toward sustainability. Halberstadt et al. (2024) address the link between moral skills and entrepreneurial actions, proposing a model that connects these skills to sustainable entrepreneurship. They highlight the importance of ethics in tackling challenges within sustainable entrepreneurship, advancing the understanding of ethical decision-making in this area.

Moreover, extant research provides several typologies aimed at better understanding sustainable entrepreneurs: for example, their motivations (Nhemachena & Murimbika, 2018) and entrepreneurial capabilities (Obrecht, 2011). Identifying, developing, and utilizing opportunities to introduce future goods and services with environmental and social benefits are crucial in sustainability entrepreneurship (Bacq & Jansen, 2011; Cohen & Winn, 2007). This perspective underscores the importance of technological advancement and disruptive innovation in driving sustainable entrepreneurship forward. By harnessing new technologies and business models, sustainable entrepreneurs can create solutions that address pressing social and environmental challenges. Patzelt and Shepherd (2011) offer a broader definition of sustainable entrepreneurship, emphasizing the creation of goods and services that sustain both the natural and communal environment. They argue that sustainable entrepreneurship involves not only economic value creation but also the preservation of ecosystems and communities. By integrating environmental and social considerations into business activities, sustainable entrepreneurs can generate positive outcomes for both people and the planet. Binder and Belz (2015) presented a different view of sustainable entrepreneurship, focusing on the concept of "recognition." They described it as the scholarly study of identifying, developing, and utilizing opportunities for future goods and services, considering their economic, social, and ecological impacts. They stressed that recognition is vital because it enables the identification and creation of opportunities.

In addition to these conceptualizations, sustainable entrepreneurship is often linked with the notion of the triple bottom line, which encompasses economic, social, and environmental dimensions (Certo & Certo, 2019; Rajesekaran, 2013). This framework highlights the importance of balancing financial profitability with social responsibility and environmental stewardship, emphasizing a holistic approach to business practices. By considering the triple bottom line, sustainable entrepreneurs can create value that extends beyond monetary gains, benefiting society and the environment. The triple-bottom-line perspective plays an increasingly important role in SE research (Majid & Koe, 2012), emphasizing the interconnectedness of economic health, social equity, and environmental resilience (Kuckertz & Wagner, 2010). In this context, the integration of the triple-bottom-line is sequential rather than simultaneous (Belz & Binder, 2017). Environmental entrepreneurs may develop into sustainable entrepreneurs over time. Furthermore, it's worth noting that the triple-bottom-line performance and wider societal impacts of SE activity are difficult to capture and to evaluate (Aguinis & Glavas, 2012). For instance, there are challenges in measuring and comparing social and ecological aspects in the triple bottom line approach (Slaper & Hall, 2011), while Norman and MacDonald (2004) question its substantive sustainability

framework status, suggesting it might be more of a marketing strategy due to issues like data applicability and comparability.

Overall, the various definitions and conceptualizations of sustainable entrepreneurship underscore its complex and multifaceted nature. From integrating sustainability principles into business practices to addressing market failures and promoting innovation, sustainable entrepreneurship encompasses a wide range of activities and approaches. By exploring these perspectives, scholars can gain a better understanding of sustainable entrepreneurship and its potential to bring about positive changes in society and the environment.

Ethical Considerations

Ethical considerations are fundamental to sustainable entrepreneurship, guiding entrepreneurs' actions and decisions as they navigate complex economic, social, and environmental challenges. Within this ethical landscape, sustainable entrepreneurs often encounter various dilemmas, requiring them to balance economic goals with social and environmental responsibilities. This balancing act extends to engaging with stakeholders and being accountable for the social and environmental impacts of business activities.

Sustainable entrepreneurship operates within a complex ethical landscape, necessitating careful consideration of moral principles and values in entrepreneurial decision-making (Dean & McMullen, 2007). Entrepreneurs often encounter ethical dilemmas when balancing economic goals with social and environmental responsibilities (Dean & McMullen, 2007). These dilemmas require entrepreneurs to prioritize actions that maximize social and environmental benefits while minimizing harm, reflecting a commitment to ethical decision-making in pursuit of sustainability objectives (Dean & McMullen, 2007).

Ethical entrepreneurship entails active engagement with stakeholders and accountability for the social and environmental impacts of business activities (Schaltegger & Wagner, 2011). Sustainable entrepreneurs are accountable to a broad range of stakeholders, including shareholders, employees, customers, and the community (Schaltegger & Wagner, 2011). By considering stakeholder interests in decision-making processes, entrepreneurs can build trust, foster collaboration, and enhance organizational legitimacy, reflecting ethical principles of transparency, fairness, and inclusivity (Schaltegger & Wagner, 2011).

By adopting a Triple Bottom Line (TBL) approach, sustainable entrepreneurs integrate ethical considerations into their business models and decision-making processes, striving to create economic, social, and environmental value. The TBL approach provides a framework for integrating ethical considerations into business models and decision-making (Elkington, 2000). Sustainable entrepreneurs aim to create economic, social, and environmental value through ethical business practices that promote long-term sustainability and stakeholder well-being (Elkington, 2000). By adopting TBL principles, entrepreneurs can balance profit motives with social and environmental responsibilities, reflecting a commitment to ethical leadership and corporate citizenship (Elkington, 2000).

Corporate Social Responsibility and Sustainable Development

Corporate Social Responsibility plays a crucial role in promoting ethical business practices and sustainable development (Cohen & Winn, 2007). Sustainable entrepreneurs aim to create value for society while minimizing negative impacts on the environment through CSR initiatives that prioritize social and environmental well-being (Cohen &Winn, 2007). By embracing CSR principles and integrating sustainability into core business strategies, entrepreneurs can contribute to positive social change and environmental conservation, reflecting ethical imperatives of social justice, environmental stewardship, and community engagement (Cohen & Winn, 2007).

Environmental Stewardship and Ethical Innovation

Ethical entrepreneurship entails a commitment to environmental stewardship and responsible innovation (Fellnhofer et al., 2014). Sustainable entrepreneurs prioritize environmental conservation and seek to minimize ecological footprints through ethical innovation that promotes sustainable technologies, products, and processes (Fellnhofer et al., 2014). By developing and implementing sustainable solutions, entrepreneurs can mitigate environmental degradation and promote responsible consumption patterns, reflecting ethical imperatives of environmental integrity and intergenerational equity (Fellnhofer et al., 2014).

Stakeholder Dynamics

Stakeholder dynamics within the realm of sustainable entrepreneurship play a crucial role in driving sustainable development practices (Schaltegger & Wagner, 2011). Understanding the interactions and behaviors of various stakeholders is essential for comprehending the broader impact of sustainable entrepreneurial endeavors. Sustainable entrepreneurship aims to address environmental degradation and social injustice by providing market-oriented solutions for sustainable development (Belz & Binder, 2017; Binder, 2017).

Schaltegger and Wagner (2011) emphasize the importance of stakeholders in driving sustainable development practices. They argue that sustainable entrepreneurs address the needs of a broad range of stakeholders, whose interests extend beyond mere financial gains for shareholders. These stakeholders actively support sustainable development practices, which are essential for sustainable entrepreneurship. Often, market failures prompt entrepreneurial efforts aimed at enhancing societal and environmental well-being (Schaltegger & Wagner, 2011).

Moreover, stakeholders such as local government, competitors, suppliers, and NGOs play significant roles in influencing and shaping the behavior of sustainable entrepreneurship (Muñoz & Cohen, 2018; Schaltegger et al., 2012). Understanding the dynamics of these interactions is crucial for sustainable entrepreneurship ventures to navigate complex regulatory environments, access necessary resources, and gain social legitimacy.

Local governments, in particular, can impact sustainable entrepreneurship through policy frameworks, incentives, and support mechanisms (Muñoz & Cohen, 2018). By fostering an enabling environment for sustainable businesses, governments can encourage entrepreneurial initiatives that contribute positively to societal and environmental well-being.

Competitors also influence sustainable entrepreneurship by setting industry standards, driving innovation, and shaping market dynamics (Muñoz & Cohen, 2018). Sustainable entrepreneurs must carefully analyze competitor behavior and market trends to identify opportunities for differentiation and competitive advantage.

Suppliers play a vital role in sustainable entrepreneurship by providing access to sustainable inputs, materials, and technologies (Muñoz & Cohen, 2018). Collaborating with suppliers who share similar values and sustainability goals can enhance the sustainability performance of entrepreneurial ventures throughout the supply chain.

Non-governmental organizations (NGOs) often act as advocates for sustainability and can provide valuable support, resources, and networks for sustainable entrepreneurs (Muñoz & Cohen, 2018). Partnering with NGOs can amplify the impact of sustainable entrepreneurship initiatives and foster positive relationships with communities and stakeholders.

Government policies are increasingly pushing businesses to adopt more environmentally friendly practices. As a result, businesses are actively implementing various corporate environmental and sustainability initiatives, programs, and management systems (Cohen & Winn, 2007). These efforts extend beyond mere compliance with regulations and have the potential to address environmental issues such as pollution, while also enhancing overall business performance. This concept, often referred to as the triple bottom line, underscores the importance of considering the three dimensions of people, profit, and planet in sustainability entrepreneurship research. By embracing this approach, businesses can contribute to improving community well-being by creating cleaner living environments and protecting vulnerable ecosystems (Cohen & Winn 2007).

Impact on Society and Environment

Sustainable entrepreneurship initiatives have garnered attention for their potential to yield significant positive impacts on both society and the environment (Gast et al., 2017; Muñoz & Cohen, 2018; Sarango-Lalangui et al., 2018). By strategically addressing pressing social and environmental challenges, sustainable entrepreneurs not only contribute to the well-being of communities and ecosystems but also foster economic development (Muñoz & Cohen, 2018).

Sustainable entrepreneurs prioritize long-term goals and strive to achieve more with fewer resources, actively working towards improving ecosystems and societal well-being (Gast et al., 2017). Additionally, sustainable entrepreneurs are expected to play a significant role in inspiring future generations to embrace and promote sustainability (Burch, 2018). By integrating sustainability principles into their business models, sustainable entrepreneurs aim to create value

that extends beyond financial gains to encompass social and environmental benefits (Bocken et al., 2014).

One of the paramount societal impacts of sustainable entrepreneurship lies in the creation of job opportunities, particularly within local communities (Sarango-Lalangui et al., 2018). Sustainable ventures often prioritize local hiring practices and may invest in training programs aimed at enhancing the employability of community members, thereby facilitating poverty reduction and socioeconomic development (Sarango-Lalangui et al., 2018).

Moreover, sustainable entrepreneurship initiatives have demonstrated the potential to lead to improvements in public health and overall quality of life (Muñoz & Cohen, 2018). By championing clean energy solutions and sustainable agricultural practices, these initiatives effectively mitigate air and water pollution, consequently reducing the prevalence of respiratory diseases and enhancing community well-being (Muñoz & Cohen, 2018).

From an environmental standpoint, sustainable entrepreneurship plays a pivotal role in natural resource conservation and climate change mitigation efforts (Muñoz & Cohen, 2018). Through prioritizing resource efficiency, waste reduction, and the development of renewable energy technologies, sustainable ventures significantly minimize their ecological footprint and contribute to the transition towards a low-carbon economy (Muñoz & Cohen, 2018).

Moreover, sustainable entrepreneurship ventures often prioritize stakeholder engagement and collaboration, fostering positive relationships with local communities, governments, and non-governmental organizations (NGOs) (Schaltegger & Wagner, 2011). By incorporating stakeholder perspectives into decision-making processes, sustainable entrepreneurs can ensure that their initiatives align with community needs and aspirations, leading to more inclusive and sustainable outcomes.

FUTURE RESEARCH IN SUSTAINABLE ENTREPRENEURSHIP

Sustainable entrepreneurship is an emerging field that holds promise for addressing contemporary challenges while fostering economic growth and environmental stewardship (Orth et al., 2020). However, despite its growing importance, there are numerous unanswered questions and research gaps in this field that necessitate further exploration. Here are some promising areas for future research:

Understanding Factors Influencing Sustainable Entrepreneurship

Research in sustainable entrepreneurship aims to understand the factors influencing entrepreneurial behavior and outcomes. Cohen & Winn (2007) emphasize the importance of investigating demographics, nationality, and prior work experience in shaping entrepreneurs' capacity to recognize sustainable business opportunities. This inquiry seeks to clarify the

contextual conditions fostering sustainable entrepreneurship (Dean & McMullen, 2007). Understanding these factors can provide valuable insights into the mechanisms driving sustainable entrepreneurial behavior. Additionally, analyzing the alignment of the TBL framework with sustainable entrepreneurship and its effectiveness in guiding entrepreneurial practices (Muñoz & Cohen, 2018; Dixon & Clifford, 2007) can further enhance our understanding of the field.

Implications of New Venture Creation for Social Wealth

Key variables contributing to social wealth creation through sustainable entrepreneurship endeavors need identification (Nhemachena & Murimbika, 2018; Obrecht, 2011; Majid & Koe, 2012). Although acknowledging the significance of new venture creation for generating social wealth, comprehensive research on these contributing variables is lacking (Cohen & Winn, 2007). Understanding these variables is crucial for assessing the broader socio-economic impact.

Business Models for Sustainable Entrepreneurship

Understanding innovative business models and their role in sustainable entrepreneurship is crucial for comprehending how sustainable ventures operate within economic frameworks (Neumeyer & Santos, 2018; Bocken et al., 2014). Additionally, investigating the diffusion rates of sustainable innovations, both with and without business models, can shed light on the effectiveness of different entrepreneurial strategies (Hockerts, 2017; Boons & Lüdeke-Freund, 2013). Furthermore, exploring how sustainable entrepreneurs utilize their business models to navigate public policy and mitigate risk remains an important area for investigation (Tekala et al., 2024). Despite acknowledging the diversity of sustainability entrepreneurs and the significance of business models in sustainable entrepreneurship, further exploration of innovative business models is necessary (Neumeyer & Santos, 2018; Bocken et al., 2014; Schaltegger et al., 2012).

Transformation of Unsustainable Practices through Sustainable Technologies and Innovation

Exploring the complexities of sustainable entrepreneurship is essential, particularly in understanding how it facilitates the transformation of unsustainable practices through the introduction of sustainable technologies. This research aims to uncover how sustainable entrepreneurship drives innovation and replaces unsustainable practices with environmentally and socially responsible alternatives. Further studies are needed to examine how sustainable entrepreneurs establish successful businesses with innovations (Lüdeke-Freund, 2020) and transition existing businesses into sustainable or eco-friendly enterprises (Hoogendoorn et al., 2017). By investigating these aspects, researchers can gain insights into how sustainable entrepreneurship promotes the adoption of sustainable technologies and advances more sustainable business practices. Despite recognizing its potential, more research is needed to understand how

this process fosters innovation and replaces unsustainable practices with eco-friendly alternatives (Sreenivasan & Suresh, 2023).

Relationship Between New Ventures and the Triple Bottom Line (TBL)

Further analysis is needed to assess how well the Triple Bottom Line (TBL) framework aligns with sustainable entrepreneurship and guides entrepreneurial practices (Muñoz & Cohen, 2018; Dixon & Clifford, 2007). While the TBL concept is recognized in sustainable entrepreneurship, additional critical examination is necessary to determine its compatibility with the complexities of the field and its effectiveness in guiding entrepreneurial actions (Dhahri & Omri, 2018; Dixon & Clifford, 2007; Hall et al., 2010). Moreover, more research is required to understand the intricate relationship between new ventures and their impacts on financial prosperity, social well-being, and environmental sustainability (Muñoz & Cohen, 2018).

Identification of Key Areas for Future Research

Future research should focus on investigating climate change (Ye et al., 2020), energy consumption (Aghelie et al., 2016), greenwashing (Ik & Azeez, 2019) within sustainable entrepreneurship, and digital sustainability and entrepreneurship (George et al., 2021). Exploring these areas, along with social entrepreneurship, innovation, impact investing, and the intersection of the plastic industry with the triple bottom line, holds promise for funding and grant success (Ploum et al., 2019). It's crucial to develop comprehensive typologies that empirically capture the diversity of sustainability entrepreneurs, considering various criteria to avoid oversimplification and stereotyping.

Understanding Decision-Making Processes and Moral Competencies

Research should explore how moral competencies influence sustainable entrepreneurial actions and decision-making processes (Halberstadt et al., 2024). Understanding how sustainable entrepreneurs make decisions can inform the development of theories about their personality traits. This research is crucial for refining educational programs to meet society's increasing expectations from entrepreneurs, especially with the rise of eco-friendly businesses. It's important for entrepreneurs to understand how to meet societal needs, drive economic growth, and create innovative products/processes that reduce environmental impact. The research highlights gaps in understanding sustainability entrepreneurship, particularly regarding typologies and the process of idea development. Although the concept of "innovative" behavior is introduced, quantitative evidence supporting its prevalence and characteristics is lacking (Halberstadt et al., 2024).

Clarification of Sustainable Entrepreneurship Concepts and Processes

Further research is needed to address several unclear aspects of sustainable entrepreneurship. For instance, there is a gap in distinguishing between regular entrepreneurs and sustainable entrepreneurs (Kraus et al., 2018). Additionally, empirical validation is required to confirm the prevalence and characteristics of "innovative" behavior in sustainable entrepreneurship (Muñoz et al., 2018). Quantitative studies are necessary to investigate the sequential integration of triple-bottom-line goals in idea development within sustainability entrepreneurship. Moreover, exploring concepts like "innovative" behavior and the sequential integration of triple-bottom-line goals in idea development within sustainability entrepreneurship requires further investigation (Muñoz et al., 2018; Ploum et al., 2019). Another area requiring research is cost containment issues in sustainable entrepreneurship (Saebi, 2018). As innovations progress, their costs typically increase, posing challenges for widespread adoption. Research should focus on determining the types and quantities of materials to use in innovations to prevent excessive costs due to material factors, ultimately benefiting society. Additionally, research on cost control for sustainable businesses is needed to ensure innovations are affordable for customers yet lucrative enough to sustain business operations (Jimenez, 2019).

Exploration of Hotly Debated Topics

There is a need to delve into hotly debated topics within sustainable entrepreneurship, such as supply chain management, sustainable business practices, and entrepreneurial marketing for small and medium-sized enterprises (Sreenivasan & Suresh, 2023). Focused inquiry into these areas can contribute valuable insights and scholarly contributions to the field, addressing pressing challenges and opportunities in sustainable entrepreneurship.

Addressing Data Limitations and Understanding Sustainable Firm Impacts

The main challenge in sustainable entrepreneurship research is the limited size of available data samples (Hockerts, 2017; Gast et al., 2017; Kolk & Pinkse, 2008). To enhance the reliability of findings and avoid drawing incorrect conclusions, it's essential to utilize larger data sets in future research (Reynolds & Holt, 2021; Fors & Lennerfors, 2019; Hockerts, 2017; Gast et al., 2017). From these expanded data sets, it's crucial to determine the impact of sustainable firms on communities and society, as well as compare the success rates of individuals who have undergone sustainable entrepreneurship programs versus those who haven't (Gast et al., 2017).

Tailoring Learning Approaches and Education

Future research should prioritize developing better theories and educational approaches tailored to the distinct competencies and characteristics inherent in sustainability entrepreneurs, enriching sustainability entrepreneurship education (Halberstadt et al., 2024). Moral competencies, such as normative and strategic action competence, emerge as pivotal in steering individuals towards sustainable practices and fostering investment in sustainability. Integrating these competencies into entrepreneurship education is paramount, heralding a shift towards embracing the triple bottom line ethos. However, to comprehensively understand how moral competencies shape entrepreneurial actions, empirical studies correlating output measures to actual behavior are imperative (Halberstadt et al., 2024). This underscores the urgent need for further exploration of sustainability entrepreneurship through rigorous empirical investigations that offer both scientific insights and practical implications (Pinna, 2020).

Exploring Ethical Considerations and Moral Reasoning

Research has relatively overlooked the ethical considerations and moral reasoning of sustainable entrepreneurs (Muñoz & Cohen, 2018). This gap is notable considering that sustainable entrepreneurship aims to enhance the world's well-being. Given the significant global challenges such as climate change, famine, disease outbreaks, and environmental degradation, it's crucial to investigate how sustainable entrepreneurs address these issues. By examining the solutions devised by sustainable entrepreneurs during such world-changing events, researchers can gain insights into their complex decision-making processes and ethical considerations (Muñoz & Cohen, 2018).

Analyzing Stakeholder Interactions, Regional Dynamics, and Understanding Sustainable Firm Impacts

Various stakeholders interact with sustainable entrepreneurs and their ventures. These include local government, competitors, suppliers, and NGOs (Muñoz & Cohen, 2018). Studying these interactions can enhance society's understanding of actions and behaviors that contribute positively to improving the world. It's crucial for influential individuals not to obstruct initiatives aimed at bettering the world (Muñoz & Cohen, 2018). Additionally, research should explore how different locations impact sustainable entrepreneurs. Variances in markets, territories, and social systems can influence the process of sustainable entrepreneurship (Muñoz & Cohen, 2018). By comprehending these regional differences, society can better support sustainable entrepreneurs and their efforts to enact positive change (Muñoz & Cohen, 2018).

Empirical Validation and Structural Models in Sustainable Entrepreneurship

Conducting empirical studies to validate theories and utilizing structural models are essential components of advancing research in sustainable entrepreneurship (Halberstadt et al., 2024; Reuther et al., 2023). Empirical validation provides a robust foundation for theoretical frameworks (Halberstadt et al., 2024), enhancing the reliability of findings and gaining deeper insights into sustainable entrepreneurial actions. Additionally, structural models offer a systematic approach to understanding the complex interactions within sustainable entrepreneurial ecosystems (Reuther et al., 2023). By employing both empirical validation and structural modeling techniques, researchers can develop more accurate and comprehensive understandings of sustainable entrepreneurship dynamics, contributing to both theoretical advancement and practical applications in the field.

Expansion of Research Beyond Educational Contexts

Expanding research beyond educational contexts will capture the full spectrum of sustainable entrepreneurship (Halberstadt et al., 2024), informing policy and practice to promote sustainability and address societal and environmental challenges effectively.

Exploring Economic Impacts and Market Dynamics

Experts must gain a better understanding of how sustainable entrepreneurs influence economies to address critical market issues (Hall et al., 2010). Conducting detailed research in this field can enhance effectiveness in promoting sustainable innovation in business, benefiting society, the economy, and the environment.

Advancing Theoretical Frameworks in Sustainable Entrepreneurship

Future research should focus on developing better theories explaining the motivations and actions of sustainable entrepreneurs (Reuther et al., 2023). This includes exploring alternative perspectives on value creation beyond the triple bottom line theory (Muñoz & Cohen, 2018), such as the triple-embedded view proposed by Muñoz & Cohen (2018), which emphasizes the interconnectedness of sustainable entrepreneurs with social and natural systems.

Addressing Business Challenges

Understanding the challenges encountered by startups and large corporations in pursuing sustainability efforts and exploring the strategies used to overcome them is crucial (Hockerts &

Wüstenhagen, 2010). This understanding is essential for both startups and large corporations, commonly referred to as 'Davids' and 'Goliaths' respectively, to effectively achieve their sustainability goals.

Exploring Job Creation Potential

Understanding the job creation potential of sustainable entrepreneurship is crucial for comprehending its broader socio-economic impact and contribution to addressing unemployment challenges (Sarango-Lalangui et al., 2018; Rajesekaran, 2013; Certo & Certo, 2019). Research in this area needs a deep understanding of how entrepreneurial activities create jobs, showing how sustainable entrepreneurship boosts the economy while meeting societal and environmental needs.

Key Research Questions and Future Directions in Sustainable Entrepreneurship

The exploration of sustainable entrepreneurship raises several thought-provoking questions that warrant further investigation. Understanding these questions can deepen our comprehension of the complexities and implications of sustainable entrepreneurship on economic, social, and environmental dimensions. The following questions serve as avenues for future research and inquiry:

- Under what circumstances do entrepreneurial ventures, rather than established firms, tend to offer sustainable products and services?
- To what extent do the complexities arising from sustainability considerations worsen issues of limited rationality, potentially placing new ventures at a disadvantage?
- How much do entrepreneurs feel motivated to pursue sustainable ventures, and are there obstacles preventing sustainable ventures from capturing economic rents?
- Do entrepreneurs focused on sustainability differ from conventional entrepreneurs, and what characteristics are solely specific to sustainable entrepreneurs?
- How strongly are entrepreneurs driven by non-financial incentives such as social norms or personal values?
- Do sustainability-focused entrepreneurs exhibit different risk preferences or opportunity costs compared to traditional entrepreneurs?
- Under what circumstances can entrepreneurship promote both economic growth and social/environmental goals simultaneously?
- When is entrepreneurship beneficial rather than harmful to welfare, especially when considering all external factors?
- Under what conditions does public policy have a positive impact on promoting sustainable entrepreneurship?
- To what extent can entrepreneurs create sustainable economies, and what are the characteristics that only sustainable entrepreneurs have?
- How might new products and services in sustainable entrepreneurship create new social and environmental challenges?

As we delve into sustainable entrepreneurship, it's clear that there's much more to explore. Building on our discussion of current research, the following section outlines key areas where more investigation is needed to advance our understanding and practice in sustainable entrepreneurship.

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