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Empowering women agripreneurs through precision agriculture technology adoption: An integrative review of literature

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The use of precision agricultural technology has been shown to increase yields while decreasing the farmer's exposure to risk. Despite women's important involvement in agriculture in many nations, there remains a technological gap between the genders. Particular focus on agriculture's essential role in alleviating poverty and hunger. The literature gap in precision agriculture technology adoption by women agripreneurs needs to be addressed. This study presents an integrative review of the literature aimed at identifying the factors that influence precision agriculture technology adoption among women and proposes recommendations for mitigating the gap. The review highlights precision agriculture technology adoption theories and various factors. Also, it discovered several social and policy implications, as well as training programs, to close the gap. The recommendations given to policymakers are to connect younger, technically-savvy women with older, less technically literate women farmers to address the digital literacy divide. Future research can test the empirical relationship between precision agriculture technology adoption variables on women agripreneurs specifically on various technologies used in agriculture and find the viability. By addressing the gap women agripreneurs will be equipped to adopt precision agriculture technology and digital agriculture, which will ultimately benefit the rural farming community and achieve sustainability.

1. Introduction

"Food and agriculture organization" (FAO) of the United Nations, has framed an agenda to achieve sustainable development goals (SDG) for the year 2030. The SDGs are interconnected to achieve the overall vision of a "better world". According to the FAO (2018, 2011), the access that women farmers have to crucial agricultural resources such as land, credit and capital, information, and other inputs is generally lower than that of men farmers, thereby creating a gender gap in the agricultural sector. The earlier studies state that the digital divide still exists (Galperin & Arcidiacono, 2021; Huber, 2021; Khan et al. 2022). On average, women make up 43% of the agricultural labour force in low- and middle-income countries, yet their access to resources, rights, and services are limited, holding back prosperity for all (CGIAR, Consultative

Group for International Agricultural Research, @ the UN Food Systems Summit +2 Stocktaking Moment - CGIAR, 2023). Women make significant contributions to agriculture around the world, but their work often goes unrecognized and undervalued (Chakma & Ruba, 2021; Multani & Sanghvi, 2017). Women have less control over land and are less likely to own livestock (Beg, 2019; Mendham & Curtis, 2010). The contribution of women in the agriculture sector is highlighted in labour, ownership of land, and livestock. The earlier studies investigated systematic literature reviews on the sociocultural factors influencing the gender digital divide (Acilar & Sæbø, 2021). The societal awareness of agricultural technology adoption among women is not understood and explained as expected toward the positive transformation of women. When women get technology awareness their productivity increases, they act autonomously, make decisions, and increase their standard of living which will lead to women's empowerment (Mobarok et al., 2021). The main objective of this present study is to review the literature on precision agriculture technology, factors involved in adopting the technology, theories on technology adoption, and provide social and policy implications on adopting the technology. The study also provides a research agenda for future researchers. This study shows particular interest in women adopting precision agriculture technology to overcome the problems and implications.

Precision Agriculture and traditional cultivation are substantially different in practice. Farmers in traditional agriculture apply the same unit of pesticides, fertilizers, and irrigation throughout fields at set times and intervals, based on regional recommendations. Even within the same field, there are always variances in biological, physical, and chemical characteristics. Fields are treated uniformly without regard for intrinsic differences, resulting in misuse of inputs in productive areas and underuse in poor regions. This wasteful use of land, water, fuel, fertilizers, and pesticides raises costs and has a negative impact on the environment (Nowak 2021). Precision agriculture uses Variable Rate Application (VRA) to optimize input for farmland variances. VRA requires detailed spatial data from Geographical Information Systems (GIS) and crop lifecycles using Global Positioning System (GPS) and remote sensing across fields and locales. Precision irrigation, yield mapping and monitoring, and information management systems are some of the precision farming tools. Precision agriculture makes data-driven management decisions to create cost-effective, environmentally friendly, sustainable modern farming solutions (Misara et al., 2022).

Precision agriculture (PA) is a road map to attain sustainable development through technology. Precision agriculture in developed countries benefitted from the practical implementation throughout the world. The literature revealed precision agriculture (Balogh et al., 2020; Bandumula, 2017; Dunne et al., 2021; Singh, 2020), Precision Farming (Armenta-medina & Ramirez-delreal, 2020; Azhagesan, 2020; Kendall et al., 2022; Navarro et al., 2020; Rajani et al., 2018; Singh & Elyamani, 2012), Precision livestock (Akter et al., 2017; Linaza et al., 2021; Nyaga et al., 2021) have proven that it increases productivity. Precision agriculture typically relies on technologies such as GPS, drones, sensors, and data analytics software to collect and process data. Precision agriculture has a significant impact on agriculture in many ways.

Research is required to find the inclusive technology diffusion efforts, to determine the characteristics of technology and adoption modality, rights of men and women, and how their empowerment differ (literacy and socioeconomic status) can facilitate women's rights to technology within the household (Theis et al., 2018). The "gender digital gap" reduces their productivity and contributions to agriculture and society. Economic and social developmental goals can also be achieved. Eliminating gender agricultural inequalities would boost agricultural output, reduce poverty and hunger, and boost the economy (FAO 2011). The hypothetical question is does women are adopting precision agriculture. What are the factors that influence the adoption of technologies and the problems faced by women to adopt? This study drags the attention toward women adopting agriculture technology. The main objective of this study is to collect and review the earlier works published in the area of precision agriculture technology and women in agriculture from a global perspective, hence the gap and future research agenda can be attained. The purpose of this study is to find the domain of technologies used in the previous literature like precision agriculture on animal husbandry, precision agriculture on crops, and social media as precision technology to promote agribusiness by women agripreneurs. Data-driven precision agriculture maximizes crop yields and reduces waste.

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It can assist farmers in deciding when to sow, fertilize, harvest, and use water and other resources. It reduces pesticide and fertilizer use, which helps to attain an eco-friendly environment and to attain sustainability. Moreover, it helps to reduce the cost, workload, and saves time for women by automating farming activities. This will indirectly help women to concentrate on other household and family work which leads to empowerment and self-reliance.

2. Review of Literature

2.1 Agripreneurship

Agripreneurship is the profitable combination of agriculture and business. Agripreneurship refers to entrepreneurship in agriculture. It was identified that agriculture entrepreneurship is majorly synced with farm innovations and farm entrepreneurship (Dias et al., 2019; Lans et al., 2013). Agripreneurs must acquire modern skills and agripreneurial competencies that are required for a successful business (Igwe, 2020; Lopez-Garcia & Chin, 2005; Otache, 2017; Ouko et al., 2022). "Agripreneurs may be defined as innovators, create new ideas in doing things in agriculture sectors and drive the change in the economy" (Ndedi & Feussi, 2018). Agripreneur is termed as a business owner and self-employed who seeks out to create wealth in agriculture industry (Aleke et al., 2011; Nagalakshmi & Sudhakar, 2013). The activities of agripreneurship or agriculture-related business were dominated by the male gender in the society even though the contribution of women was restricted to household and agricultural activities (Obosha, 2020; Satpathy & Kumari, 2023).

2.2 Women Agripreneurship

Women agripreneurs should be the key players in rural development (Halim et al., 2020). Women have an important role in income-generating activities in agriculture at present, however, existing technologies have to be provided to farm women for increasing farm productivity and empowerment (Anderson, 2021; Patil & Babus, 2018). Satyavathi et al. (2010) emphasized that women play a crucial role in all farm-related activities starting from land preparation to marketing. Technology-driven strategies in agriculture help farmers to transform economic incentives and growth (Etten, 2022). Digital agricultural practices including geographical flexibility and innovation capacity are important for identifying new opportunities and awareness of technology (Gaihard & Brennen, 2022). Nowadays technology-driven agriculture is adopted in many developed and developing nations, hence study deals with the conceptual research of existing literature review on the area of "Precision agriculture" and "Women Agripreneur" is essential.

2.3 Definition and scope of women agripreneurship

Agripreneurship is defined as a concept linked with the marketing and manufacturing of various agricultural products and inputs. An agripreneur is someone (woman) who starts, organizes, and runs a firm in the agricultural sector. Agri-entrepreneurship, also known as Agripreneurship, adds value to agricultural resources by utilizing rural human resources (Sharma et al., 2019). Women's empowerment of farmers and agripreneurs generates revenue and enables self-sufficiency. Sustainable agribusiness ventures are considered to have the ability to generate job-led economic, social, and environmental benefits. (Buragohain & Deka, 2018; Singh et al., 2022; Mulupi et al., 2023).

Further, individual women empowerment leads to the increase national sustainable economy. Women comprise about 43% of the agricultural labor force in developing countries, and up to 50% in some regions (Bhandari, 2017; Stapleton, 2023). Agriculture has enormous potential for increasing production and productivity through value addition. It is consequently critical to train the unemployed, with a special emphasis on rural women, in agri-business management (Kaur et al., 2018; Fapohunda, 2023).

2.4 Precision agriculture and women agripreneurship

Empowered women who adopt PA reinvest in their communities, boosting self-reliance, wealth, and food security. The development community should encourage female agricultural entrepreneurs with high-impact PA applied projects (Mamkwe & Lulu Genda, 2023). Urbanization in developing nations is changing agricultural demand. Digitizing value chains make pricing and shipping data more transparent (Balezentis et al. 2023). These food system shifts create opportunities for technology driven agripreneurship, entrepreneurship in agriculture on the farm and be-

yond (Adeyanju et al. 2023). Women have less access to market information, business consulting services, financial assets, and mentors than men (Avnimelech & Rechter, 2023). Women make up nearly half of the agricultural workforce in developing nations, yet females own just one-third of emerging market small- and medium-sized firms and 15% of agricultural extension agents (Welsh et al., 2023). Economic empowerment empowers women to invest in their families and communities, fostering self-reliance, wealth, and food and nutritional security. Hence, this paper focuses on precision agriculture technologies and fosters women's adoption.

3. Review Methodology

According to (Tranfield et al., 2003) systematic literature review methodology we applied inclusion and exclusion criteria. The data was collected from the published articles in Scopus, and Web of Science databases with the search keywords "agripreneur" "precision agriculture technology" and "women agripreneur". The articles were randomly selected based on the keywords "precision agriculture", and "women in agriculture and technology". Initially, in the database Scopus, 47 with English language, Open-source articles, subject area agriculture and bioscience, and business management and accounting were selected. Similarly, in Web of Science, 59 documents with social science citation index and agriculture and business economics papers were selected. In precision agriculture, 24 articles were selected based on the keyword "precision agriculture", from 2018 to 2022 and similarly, "women in agriculture and technology" 18 articles were selected from 2018 to 2022, only 5 years were considered for this study to find the recent trends of the research area. Finally, we studied the complete text of all the collected papers to identify all possible relevant studies that were strictly related to the research topic. Out of 42 articles, Scopus listed articles are 25, and WOS of Science 17 articles were selected for the thorough review. The cumulative papers referred for this study are 42 comprising both precision agriculture and women in technology. The research work was carried out during the month of July 2022. The data collected was reviewed based on the various factors to adopt technologies, and theories deployed.

4. Results

4.1 Precision Agriculture Technology factors to adopt

Precision agriculture adoption of technologies is perceived as complex due to its various attributes such as environmental sustainability, production quality profitability, and efficiency of resource use. Social factors like age and experiences of farmers as drivers and challenges of precision agriculture technology adoption (Lee et al., 2021; Ofori & El-Gayar, 2021). Linaza et al. (2021) found that artificial intelligence technology in agriculture enhanced monitoring conditions, decision support at the farm level, and production optimization. Katke (2019) found that precision agriculture adoption could lead to growth possibilities for Indian agriculture, but the social and financial welfare of the farming network are facing significant challenges. The lower adoption level of smart agriculture technologies was due to a lack of perceived practical usefulness, understanding, information, and awareness (Bukchin & Kerret, 2020; Chuang et al., 2020). Technology adoption helps small farmers to contribute substantially to food security and poverty alleviation. Indian farmers must use unique and current technologies and approaches for food demand and supply stability (Shankarnarayan & Ramakrishna, 2020). Yatribi (2020) called for more relevant treatment and testing of individual factors, organizational factors, technological factors, and institutional factors as covariates or moderating variables for technology adoption.

4.2 Precision agriculture on animal husbandry

Precision agriculture on animal husbandry requires the use of automatic monitoring systems to detect animal illnesses, monitor animal development and behaviour, track milk production, and monitor the physical environment (Monteiro et al., 2021). Technology usage in the agriculture domain has resulted in precision agriculture, digital agriculture, and analytics for yield (Sinyolo, 2020; Upendra et al., 2020). According to Zhang et al. (2019), cleaner production techniques will not be utilized until farmers see the value in that technology.

4.3 Precision agriculture on crops

Agriculture 4.0 enables modern techniques such as

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crop growth monitoring, nutrition, health labelling, and collaboration among different players in the agricultural value chain (Ahmad & Zaman, 2020; Manda et al., 2020: Raj et al., 2021). precision agriculture can help farmers use less water and fertilizer by applying them only where and when they are needed, reducing the risk of runoff and pollution. Technologies such as plant sensors for nutrients, soil, geographical information systems, water management, satellite imagery, and crop-soil simulation models were recognized for site-specific management. Precision agriculture research was crop specific to corn, sugarcane, wheat, cotton, grape, and soybean as the crops that have been researched more often in literature (Cisternas et al., 2020). The impacts of improved seed adoption were not the same among adopters (Sinyolo, 2020). Precision farming technologies related to agriculture resulted in better agricultural production (Helfer et al., 2019; Soma et al., 2019). By using precision agriculture techniques, farmers can improve yields, reduce costs, and minimize the environmental impact of farming operations. It can also help farmers identify and treat crop diseases and pests more effectively, leading to higher yields and healthier crops.

4.4 Social media as precision technology to promote agribusiness

Nurlaela et al. (2020) studied young agripreneurs' use of new media for horticulture promotion, where the majority were using WhatsApp for their daily communications. Female farmers who intend to adopt WeChat-based social media marketing are more likely to be influenced by social factors than male farmers (Han et al., 2021). The integration of social media, digital technologies, and the public's demand for transparent government could lead to a fresh phase of possibilities for rural regions (Foronda-Robles & Galindo-Pérez-de-Azpillaga, 2021). Social media platforms like WeChat (Han et al., 2021), Facebook, Youtube, Twitter, WhatsApp, Instagram, Trip Advisor, Flicker (Madila et al., 2021), and blogs (Arun, 2021) to help farmers or agripreneurs for decisions making from production to marketing the farm produce. Mittal and Mehar (2016) have found that the information provided by animated videos in mobile applications reduces the gap between farmers and technology through updated information and eventually has the potential to increase productivity. Research can also be concentrated on various social media adoptions to improve agribusiness online.

4.5 Women agripreneurs

The relationship between precision agriculture technology adoption and women agripreneurs is important (Dash et al., 2022; DeLay, et al., 2022; Dhanya et al., 2022; Madhumitha et al., 2020). Precision agriculture technology adoption has the potential to increase agricultural productivity, reduce input costs, and improve efficiency and profitability in farming operations (Nowak, 2021; Pathak et al., 2019; Thompson et al., 2019). It can also help farmers manage resources more sustainably, reduce environmental impact, and adapt to changing weather patterns. Increasing the adoption rates among women in agriculture can be achieved by reducing the obstacles they face (Kendall et al., 2022; Remteng et al., 2021; Ruzzante et al., 2021). Women with access to information, training, education, and awareness of climate change and its possible sustainable solutions could enhance their empowerment. The digital divide in South Asian countries like Nepal, India, Bangladesh, and Pakistan is primarily due to factors such as the urban-rural divide, gender disparity, religious and cultural barriers, and social and educational inequalities, including income and access to education (Jamil, 2021). Chuang et al. (2020) found the moderating effects of gender on farmers' knowledge and adoption of smart agriculture technology. The intermediating role of attitude with the relationship between knowledge and practice could be studied further. Ball (2020) suggested that women farmers need separate organizations and programs that reduce inequalities and provide opportunities for education, networking, and government support. Muhammad et al. (2020) argued that there was a lack of opportunities for women to learn about advanced technologies in agriculture for better production of crops, fisheries, and the dairy sector for sustainable development. Female farmers benefit more from precision agriculture adoption than male farmers and the new agricultural technologies and innovative spirit of farmers regarding adoption are required (Shahraki, 2019; Sinyolo, 2020; Yatribi, 2020). Women's perception of agricultural innovative behaviour in Thailand is determined by their perceived possibilities and abilities in the context of existing norms Kawarazuka and Prain (2019). Nepalese women have been given space

to engage in quality agriculture, although their engagement is limited to production and primary processing (Upreti et al., 2018). There are some factors like personal, institutional, and organizational factors that influence agripreneurship. Farmers with information via mobile phones can reduce the information gap and increase productivity, but women still have a long way to go to adopt this information into action (Addo, 2018). The various trends, patterns, and gaps for future research are given in Table 1.

There is an interrelationship between all the domains mentioned above, in the context of women adopting technology the major drawback in general is literacy and awareness to adopt technology. From the above-detailed review, various factors hinder women from adopting precision agriculture technology are as follows

1. Lack of access to technology: Women, especially in rural areas, may have limited access to technology due to a lack of infrastructure, availability, and affordability of devices such as smartphones, laptops, and internet connectivity (Muhammad et al., 2020).

2. Digital illiteracy: Women may lack the necessary skills and knowledge to effectively use technology (Hay, 2021; Jarial & Sachan, 2021). This includes basic digital literacy, as well as specific skills related to precision agriculture technology.

3. Gender bias: In some cases, women may face discrimination (Drucza & Peveri, 2018) and biases that prevent them from accessing and using technology.

Table 1. The gaps for future research

Results	Trend and patterns	Gap for future researchers
Precision Agriculture Technology factors to adopt	Socioeconomic factors, Technological factors, information resources, farmers' perception, behavioural factors	Age, education, family size, activity experience, ability to collect and interpret information, access to information, perceived profitability with increased use of technology by women farmers, intention to adopt technology by women risk aversion, type of technology adopted on various technologies used separately can be studied further.
Precision agriculture on animal husbandry	This trend has the potential to stimulate additional research into the use of novel biometric sensors, block chain, and big data technology for the joint benefit of livestock farmers, customers, and farm animals.	The three main problems in efficiently monitoring animal welfare are expense, validity, and timing of monitoring findings (technology view). Studies can be on the awareness and adoption level of women on these technologies can be done in the future.
Precision agriculture on crops	The future trend of Precision farming will use machine learning and image analysis extensively. Chatbots, drones, robotics, irrigation systems, and agricultural health monitoring will use machine learning. IoT, big data, differential GPS, and non-contact sensors will impact precision agriculture.	Concerning women in adopting precision agriculture on crops the variation evaluation, crop yield, performance, and nutrient level, can be studied technically. Socioeconomic factors to adopt technology can be studied further.
Social media as precision technology to promote agribusiness	Various social media platforms like Facebook, WhatsApp, Twitter, LinkedIn, and country-wise social media can be included.	Descriptive analysis, content analysis, and sentimental analysis can be studied in the future
Women agripreneurs	Social, economic, and technical factors can be studied	How do all these factors influence the adoption level in particular to the various technologies?

Source: Authors

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This could be due to cultural or societal norms that limit women's roles and opportunities.

4. Time constraints: Women may have multiple roles and responsibilities, including caring for family members and household chores, which can limit the time and energy they have available for learning and using technology (Pierotti et al., 2022).

5. Lack of support networks: Women may lack the necessary support networks, including mentorship and peer networks, to effectively adopt and use technology (Muhammad et al., 2020).

Addressing these challenges will require targeted efforts to increase access to technology, improve digital literacy and skills training for women, and address gender biases and cultural barriers. Additionally, providing support networks and mentorship opportunities can help women overcome the challenges associated with technology adoption, women empowerment and achieve sustainable development goals.

Training programs can help women in various ways to reduce the digital divide and adopt precision technology through training which includes:

1. Building technical skills: Training programs can help women Agripreneurs in developing their technical skills related to precision agriculture technology, digital literacy, and farm management (Ball, 2020).

2. Enhancing decision-making abilities: Training programs can help women improve their decision-making skills related to crop management, market analysis, and financial management (DeLay, et al., 2022, Kendall et al., 2022).

3. Providing networking opportunities: Training programs can help women build networks with other agripreneurs, experts, and policymakers in the agriculture sector, which can lead to collaboration, knowledge sharing, and access to resources (Jamil, 2021).

4. Boosting confidence: Training programs can help women build their confidence and self-esteem, which can lead to more active participation in decision-making and entrepreneurship activities (Sinyolo, 2020; Yatribi, 2020).

5. Improving access to finance: Training programs can help women in understand financial management and access finance for their businesses, which can help in scaling up their operations and generating more income (Nowak, 2021).

Overall, training programs can empower women agripreneurs and enable them to overcome the barriers related to precision agriculture technology adoption and entrepreneurship in the agriculture sector.

Future research directions on the relationship between precision agriculture technology adoption and empowering women agripreneurs. The future studies can be as follows:

1. Examining the role of social networks and community-based organizations in promoting technology among women agripreneurs.

2. Investigating the impact of precision agriculture technology on the economic empowerment of women agripreneurs, including income generation, job creation, and poverty reduction.

3. Exploring the intersectionality of gender with other factors such as age. education and socio-economic status, and how these factors influence technology adoption and entrepreneurship outcomes.

4. Investigating the barriers and enablers to adopting precision agriculture technology by women agripreneurs, including access to finance, information, and training.

5. Examining the effectiveness of different policy interventions and strategies for promoting precision agriculture technology adoption among women agripreneurs, such as subsidies, tax incentives, and capacity-building programs.

6. Investigating the potential environmental impacts of precision agriculture technology adoption and how this could affect the sustainability of women-led agricultural businesses.

The following table 2. exhibits the theories that can be applied to the study of precision agriculture technology adoption.

Table 2: Theories for accepting technology

Author	Theory	Definition
Davis (1989)	Technology Acceptance Model (TAM)	Users' intention to use technology is determined by their attitude towards the technology, as well as their perceived usefulness and ease of use.
Rodgers (2010)	Diffusion Innovation Theory	The adoption of innovation is influenced by factors such as the innovation's characteristics, the adopter, the communication channels used to promote the innovation, and the social system in which the innovation is being adopted.
Bandura's (1989)	Social Cognitive Theory	The adoption of technology is influenced by social and environmental factors, as well as personal factors such as self-efficacy and outcome expectations, due to the human ability to learn through observing others and adjusting their behaviour accordingly.
Fishbein and Ajzen's (1977)	Theory of Reasoned Action	An individual's behavioural intentions are a result of their attitudes towards the behaviour, as well as their beliefs about how others will perceive their behaviour.
Ajzen's (1991)	Theory of Planned Behaviour	An individual's intention is influenced not only by their attitudes and subjective norms but also by their perceived behaviour control.
Taylor and Todd's (1995)	CTAM-TPB	CTAM-TPB is a combination of the Technology Acceptance Model (TAM) and the Theory of Planned Behaviour (TPB).
Ram and Sheth's (1989)	Innovation Resistance Theory	Factors such as uncertainty, habit, and tradition can cause innovation resistance and propose strategies to overcome such resistance.
Venkatesh et al.'s (2003)	Unified Theory of Technology and Use of Technology	Technology acceptance and use are influenced by factors such as performance expectancy, effort expectancy, social influence, and facilitating conditions.

Source: Authors

These theories can provide a framework for understanding the factors that influence the adoption of precision agriculture technology in the context of women agripreneurs.

5. Discussion

Technology adoption is one of the pathways to sustainable agriculture holding the promise and grip for a sustainable future. The objective of the present study to explore the various factors used in the previous studies, theories, and precision agriculture technologies are mentioned and attained. The review on precision agriculture technology adoption for women found that there were Technology acceptance model (Arun, 2021; Pierpaoli et al., 2013), Unified theory of acceptance use of technology (UTAUT1) (Dehghani, 2018; O'Neill Somers & Stapleton, 2020), Unified theory of acceptance use of technology (UTAUT2) (An et al., 2016; Gansser & Reich, 2021), Internet on things (IoT) (Demestichas et al., 2020; Naresh et al., 2021; Shafi et al., 2019), Geographical information system (Mendes et al., 2020; Shafi et al., 2019), Global positioning system (Demestichas et al., 2020; Grogan, 2012), Remote sensing data acquisition (Naresh et al., 2021; Mendes et al., 2020), Decision support system (Demestichas et al., 2020; Yaseen et al., 2018), Sensor-controlled automation (Mendes et al., 2020; Navarro et al., 2020; Raju & Vijayaraghavan, 2020), and Variable rate technology (VRT) (Naresh et al., 2021), and many more are being used as a technology to improve agriculture.

5.1 Gender Inequalities

Men have greater and more satisfying access to technology than women in agriculture (Peterman, 2014, Achandi et al., 2018). Women have less access to ICT in the agricultural sector and have less information on climate-smart agriculture compared to men (Chuang et al.,2020) Gumucio et al., 2020; Tsige et al., 2020).

5.2 Social Implication:

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1. Promoting technology adoption among women can help to reduce gender inequalities in agriculture. Women mark up a significant proportion of the agricultural workforce in many developing countries, yet they often have limited access to resources, education, and technology. Promoting technology adoption among women agripreneurs can minimize the gender digital gap and promote sustainable agricultural practices (Anyoha et al., 2018; Jarial & Sachan, 2021; Shahraki, 2019; Sinyolo, 2020; Yatribi, 2020).

2. Technology adoption can help improve the livelihoods of women agripreneurs and their families (Chinelo et al., 2022). Precision agricultural technology can increase agricultural productivity, reduce inputs cost, and improve efficiency (Balafoutiset al., 2017), which can help improve the income and food security of women agripreneurs and their households.

3. Promoting technology adoption can help promote sustainable agricultural practices (Li et al., 2022; Takahashi et al., 2019, Muhammad et al. 2020). Precision agriculture technology can help reduce the use of pesticides and fertilizers, promote soil conservation, and reduce water consumption; hence it enhances environmentally friendly farming practices.

5.3 Policy Implications on precision agriculture technology adoption and Women agripreneur

1. Gender-sensitive policies that recognize the specific needs and challenges faced by women agripreneurs and safeguard women's rights and empowerment (Jabeena et al., 2022). This will give equal opportunities for women to access technology and utilize precision agriculture technology and can help to reduce gender inequalities (Singh et al., 2022).

2. Capacity-building programs that provide women agripreneurs with the necessary skills and knowledge to effectively adopt and use precision agriculture technology. The training may include digital literacy, precision agriculture technology, and business management skills.

3. Policymakers need to create mechanisms that provide easy access to finance and credit facilities which in turn expand their business (Abbasi et al., 2017; William et al., 2020).

4. Infrastructure development policies to support precision agriculture technology will enable reliable electricity, internet connectivity, and other necessary infrastructure for effective adoption and utilization (Hundal et al., 2023).

5. Research and development to invest to improve the effectiveness and affordability of precision agriculture technology (DeLay et al., 2022). This can support research institutions and private sector organizations to develop innovative technologies that are tailored to the specific needs of women agripreneurs.

6. Limitations

This study is limited to PA technology adoption concerning women agripreneurs. This study grabbed the articles from databases like Web of Science, Science Direct, Scopus, and Emerald. Only a limited period is being considered based on the availability of the data and for finding the current gap and trends in this research area. The various review methods like Systematic literature review using PRISMA tools, Bibliometric using the R program, Biblioshiny, and VOS viewers, Meta-analysis, and Thematic analysis are suggested for further scientific literature reviews. Future research can test the empirical relationship between precision agriculture technology adoption variables on women agripreneurs specifically on various technologies, and theories used in this study to find the viability. By addressing the gap women agripreneurs will be equipped to adopt precision agriculture technology and digital agriculture, which will ultimately benefit the rural farming women community and achieve sustainability.

7. Conclusion

The present research study concludes that the literature revealed on Precision Agriculture, precision farming, and precision livestock are identified to increase productivity, socio, and economic growth and reduce the risk faced by the women agripreneurs. Most of the developed and developing countries have adopted precision agriculture however digital literacy among women is the major gap found in the review. Age, education, family size, activity experience, ability to collect and interpret information, access to infor-

mation, perceived profitability with increased use of technology by women farmers, risk aversion, and type of technology adopted on various technologies used separately can be studied further. The three main issues in efficiently monitoring animal welfare are cost, validity, and timing of monitoring findings (from a technological standpoint). In the future, investigations on women's awareness and acceptance of these technologies may be conducted. To reduce the digital divide, the young technically updated agripreneurs should collaborate with the experienced farmers without technical knowledge so that both age groups can be empowered by sharing their knowledge. It is recommended to the policymakers and the government institutions that they should conduct awareness and training sessions with hands-on experience and technical know-how programs for the agripreneurs on technology especially in rural areas so that they can be part of precision agriculture and digital agriculture. By providing these training women agripreneurs can be empowered and self-reliant. This study will be benefit the women agripreneurs, researchers, practitioners, and policymakers.

Conflict of interest

The authors declare no conflict of interest.

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