



Review Article

A Review on Digitalization of Agriculture and Economic Business Model Strategies in the 21st Century

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Abstract: Firms all over the world today are embracing new and innovative technologies in all facets of the economy including agriculture and business enterprise. These improved technologies enhance work efficiency and improves better performances. Agriculture and economic business digitalization have come to stay owing to the technological era. Nowadays organizations take advantage of these digital technologies in creating values, products and services in return for profits. A digital platform is used to develop unique selling proposition (USP). This indicates that a buyer will pay for goods or services, which is often monetized. Digital agricultural technologies are changing the face of modern agriculture. Wireless connectivity, data analytics, and data-driven genome editing are quickly being employed in agriculture because they give more precision in decision making and practice. These intriguing and novel technologies are being developed to enhance agricultural operations and economic businesses. In the coming years, every sector of the economy will be entirely online, and firms and individuals are expected to embrace these digital technologies to launch the needed revolutions in world agriculture and businesses. In the business world of today, transformation is crucial to remain competitive. Changing from analog to digital operations is taking precedence across the world. Freemium model, subscription model, ad-supported model, ecosystem model, and hidden-revenue model are some of the business models examined. However, reducing information asymmetry, matching buyers and sellers, lowering transaction costs in commercial markets, changing pricing approach, pursuing new markets, adopting new technological advancement and creating new goods or services are approaches in digitalizing agriculture and economic business growth.

Keywords: Digitalization, Agriculture, Digital Business Models, Strategies, 21st Century

1. Introduction

Agriculture digitalization refers to the use of digital tools and systems to enhance agricultural activities and procedures. [1]. Digital agricultural technologies are changing the face of modern agriculture. Wireless connectivity, data analytics, and

data-driven genome editing are quickly being employed in agriculture because they give more precision in decision making and practice. Digital agriculture, also known as smart farming or e-agriculture, refers to agricultural equipment that digitally gathers, store, analyze, and distribute electronic data and/or information [2]. The United Nations Food and Agriculture Organization have dubbed the agricultural

digitization process the "digital agricultural revolution. Before, during, and after on-farm production digital agriculture has an influence on the whole agri-food value chain. Digital agriculture comprises a diverse set of technologies, the majority of which having many uses throughout the agricultural value chain. As a result, digital agriculture includes on-farm technology such as yield mapping, GPS guiding systems, and variable-rate application [3]. Other examples include e-commerce platforms, e-extension services, warehouse receipt systems, block chain-enabled food traceability systems; tractor rental apps, cloud computing/big data analysis tools, artificial intelligence, machine learning, distributed ledger technologies, including blockchain and smart contracts, the Internet of Things, digital communications technologies such as mobile phones, e-pesticides services, e-agro product delivery, agro-advisory apps such as plantix offers detection of crops diseases. However, digital agriculture also includes precision agriculture technologies such as sensors, such as food sensors and soil sensors, GPS, GNSS, RFID, variable-rate input technologies, automatic section control, advanced imaging technologies, such as satellite and drone imagery, to look at temperature gradients, fertility gradients, moisture gradients, and anomalies in a field, as well as automated machinery and agricultural robots [4]. Food is a necessary demand for the living populace and for it to meet the demand of the growing population requires the use of improved technological advancement in agriculture. And for this to be achieved, the digitalization of agriculture is imminent and a necessary end. Digitalization of agriculture has reduced the role of middlemen, provided opportunities for farmers to expand their markets, and improved the linkage between extension and research centers, and productivity and livelihood of small-scale farmers. To achieve a "sustainable food future," the world's food output must be increased through the application of cutting-edge technologies [5]. By making the agricultural value chain more efficient, egalitarian and environmentally sustainable, digital agriculture solves intrinsic food production difficulties. Significance of digital agriculture includes;

1. Efficiency: Economic activity is altered by digital technology because it reduces the expenses of reproducing, transporting, tracking, confirming, and searching for data. Digital technology will boost efficiency throughout the agricultural value chain as costs fall [6].

a. On-farm efficiency: On-farm digital agriculture technologies can reduce the amount of input necessary for a given yield. Variable-rate application (VRA) technology, for example, can apply precise amounts of water, fertilizer, pesticide, herbicide, and so on. Several empirical research have found that VRA enhances input utilization efficiency. Farmers can apply inputs to hyper-localized portions of their farm using VRA and geo-spatial mapping, often down to the individual plant level. Reduced input utilization reduces costs while also reducing negative environmental implications. Additionally, empirical research suggests that digital agriculture technologies can boost yield. Digital agriculture

can enhance physical capital allocative efficiency within and between farms. Equipment-sharing platforms such as Hello Tractor are frequently referred to as "Uber for tractors." We Farm Up, Machinery Link Solutions, TroTro Tractor, and Tringo make it possible for farmers to hire pricey machinery [7]. Digital technology, by creating a market for equipment sharing, guarantees that fewer tractors lie idle and allows owners to earn extra money. Furthermore, farmers who lack the financial wherewithal to make large investments will have easier access to equipment that will increase their productivity. Digital agriculture boosts labor productivity by increasing farmer knowledge. E-extension (the electronic delivery of traditional agricultural extension services) enables the spread of farming knowledge and skills at a low cost. For example, "Digital Green" collaborates with local farmers to make and distribute movies about agricultural best practices in over 50 languages. E-extension services, such as decision-support services on mobile applications or other digital platforms, can help boost agricultural production. Using a variety of information sources — meteorological data, GIS spatial mapping, soil sensor data, satellite/drone images, and so on — e-extension platforms may give farmers with real-time advice. Plantix, Krisikart India, for example, uses machine learning to identify crop diseases, pests, and nutritional deficits based on a smartphone photo [8]. Finally, digital agriculture increases labor productivity by reducing labor requirements. Automation in digital agriculture, from milking robots on dairy farms to greenhouses with automated climate control, can improve crop and livestock management efficiency by lowering labor requirements.

b. Off-farm/market efficiency: Aside from optimizing farm output, digital agriculture technologies can improve the efficiency of agricultural markets. Mobile phones, online ICTs, e-commerce platforms, digital payment systems, and other digital agriculture technologies can help to mitigate market failures and lower transaction costs across the value chain. E-commerce, for example, addresses two inefficiencies: the difficulty in matching customers and sellers, particularly in rural areas, and the high transaction costs associated with in-person, cash-based trading. Contribution of off-farm/market efficiency includes;

- 1) Reducing information asymmetry: Price information influences the efficiency of competitive marketplaces by influencing price dispersion, arbitrage, and farmer and consumer welfare. Digital agriculture has the ability to spread price information because the marginal cost of digitally delivering information [9]. Mobile phone coverage in Niger has reduced spatial price dispersion for agri-food products, particularly in distant markets and perishable goods. Similarly, in India, price information provided by Internet kiosks ("e-choupals") increased farmers' net earnings as traders lost monopsony power. MFarm and Esoko are two other price information digital platforms.
- 2) Matching buyers and sellers: E-commerce reduces the expenses associated with matching buyers and suppliers, potentially reducing the value chain. Farmers can sell

directly to consumers rather than going through dozens of intermediaries. Market access services can also help to solve the matching problem without the need for online transactions. Esoko, for example, delivers market information (prices for certain commodities, market locations, and so on) to agents and farmers, allowing them to connect with commodity buyers. All of these matching platforms assist smallholders in coordinating with buyers and gaining access to regional and global value chains. Finally, digital technology can facilitate matching in finance and input marketplaces as well as producer-to-consumer product sales.

- 3) Lowering transaction costs in commercial markets: Digital payments, whether incorporated into e-commerce platforms or mobile money accounts, e-wallets, and so on, lower transaction costs in agricultural markets. The demand for secure, quick monetary transactions is especially acute in rural communities [10]. Furthermore, digital payments can be used to access bank accounts, insurance, and credit. Another option to reduce trust-related transaction costs in commercial marketplaces is to use distributed ledger technology or smart contracts. Many retail and food organizations have collaborated with IBM to develop blockchain pilots for food safety and traceability, and Alibaba is experimenting with blockchain to prevent fraud in agri-food e-commerce between China and Australia/New Zealand.
- 4) Lowering transaction costs in government services: Digital payments can also help the government deliver agricultural subsidies more efficiently. The Nigerian Federal Ministry of Agriculture and Rural Development began issuing fertilizer subsidy vouchers to mobile phone e-wallets in 2011, and by 2013, they had reached 4.3 million smallholders across the country [11]. The e-vouchers reduced prices compared to the previous program — from 2011 to 2013, the cost per smallholder farmer receiving fertilizer decreased from US\$225-300 to US\$22. E-vouchers also reached a greater number of smallholders, increasing from 600,000-800,000 in 2011 to 4.3 million in 2013 [11]. The Nigerian government established the Nigerian Agricultural Payment Initiative (NAPI) in the second phase of the program, which distributed PIN-enabled ID cards containing subsidy information and providing access to loans and grants. Other agricultural subsidy e-wallet/e-voucher systems exist or have been tested in Colombia, Rwanda, Zambia, Mali, Guinea, and Niger. Governments can use digital technology to save time in addition to lowering subsidy costs. When Estonia deployed its e-ID and X-Road systems, the time it took to apply for agricultural subsidies was reduced from 300 minutes to 45 minutes per person [12].

2. Equity: Digital agriculture has the potential to create a more fair agri-food value chain. Because digital technologies minimize transaction costs and information asymmetries, they can boost market access for smallholder farmers in a variety of

ways:

1) Financial inclusion

For a variety of reasons, digital agriculture technologies can help farmers gain access to loans, insurance, and bank accounts. For starters, digital technology aids in the reduction of information asymmetry between farmers and financial institutions. When lenders set a farmer's credit limit or insurance premium, they are frequently unsure of the dangers the farmer poses. The costs of validating farmers' predicted riskiness are reduced by digital technologies. M-Shwari, a Kenyan company, assesses creditworthiness based on clients' phone and mobile money records. FarmDrive and Apollo Agriculture, for example, use satellite imagery, weather forecasts, and remote sensor data to determine loan eligibility for farmers [13]. Drone photography can verify a farmer's physical assets or land use, and RFID technology allows stakeholders to track livestock, making it easier for insurers to assess farmers' risk. Low-cost digital verification reduces lenders' uncertainty in all cases: the questions "will this farmer repay the loan?" and "what risks does this farmer face?" become more obvious. Second, digital technology helps farmers and financial institutions build trust. Trust is built through a variety of methods, including real-time digital communication platforms and blockchain/distributed ledger technology/smart contracts. In Senegal, a digitalized supply-chain tracking system enables farmers to use their rice as collateral to get planting financing. Rice is accepted as collateral by lenders since real-time, digital tracking ensures the product was not lost or destroyed during the post-harvest process.

2) Market inclusion

For a variety of reasons, middlemen frequently demand high rents from farmers when purchasing their produce or livestock. First, isolated smallholders may be unaware of fair market prices. As a result, middlemen (who often have superior knowledge of market circumstances and prices) amass enormous market power and profits. According to a study conducted in Peru's central highlands, farmers who received market price information via mobile phone SMS increased their sales prices by 13-14% compared to farmers who did not have access to the information. Second, because smallholders generate such little harvests in comparison to major farmers, they lack bargaining power with middlemen [14]. Smallholders gain more negotiating power if they can group together or create a cooperative to market their products. Aggregation can be facilitated using online platforms and mobile phones, such as Digital Green's Loop app. Third, connecting producers with final consumers can reduce the monopsony power of intermediaries, increasing producer profits. E-commerce or other market linkage platforms, as described above in the efficiency section, can connect a small farmer directly to consumers all over the world.

3. Environmental Sustainability

According to the World Resource Institute, increasing natural resource efficiency is the single most critical demand for a sustainable food future. As indicated in the section on on-farm efficiency, digital farming, which includes variable

rate fertilizer application, variable rate irrigation, machine guidance, and variable rate planting/seeding, has the potential to reduce agricultural input use for a given output [15]. This has the potential to reduce resource waste as well as negative environmental externalities such as greenhouse gas (GHG) emissions, soil erosion, and fertilizer runoff. Digital agriculture offers the potential to improve environmental monitoring and food system traceability away from the farm. Because of digital technology, the monitoring costs of certifying compliance with environmental, health, or waste regulations are decreasing. Satellite and drone imaging, for example, can measure land usage and/or forest cover; distributed ledger technology can enable trustworthy transactions and data interchange; and food sensors can monitor temperatures to reduce contamination during storage and shipment. Together, these technologies can create digital agricultural traceability systems, allowing stakeholders to track agri-food goods in near-real time. Digital traceability has a number of environmental and other advantages: These includes;

- 1) Reduced food waste: Between on-farm production and customers, 25% of all food calories produced in a year is wasted. Traceability systems help identify supply-side flaws, such as where food is lost downstream of the farm and how much is wasted. Emerging digital solutions, such as milk cartons that track milk from "farm to fridge," have the potential to reduce demand-side waste by giving consumers with more accurate expiration dates.
- 2) Consumer trust: In high-income countries, ensuring food safety, quality, and authenticity has become an important regulatory necessity. The use of RFID tags and blockchain technologies to validate the features of agri-food products could offer customers with near-real-time quality indications.
- 3) Improved producer welfare: Producers who can utilize environmental certification may be able to charge a premium for their products because blockchain technologies may enable increased trust in labels such as "sustainable," "organic," or "fair trade."

1.1. Potential Inequities Resulting From Digital Agriculture

While digital technologies can improve market access and information flow, there is no guarantee that they will not worsen existing disparities. If obstacles prohibit a wide range of farmers from adopting digital agriculture, the advantages may mainly accrue to the privileged [16]. Large farms: When a digital agriculture technology necessitates a significant upfront investment, it is only large farms with substantial assets and financial access that will adopt it. Because of the high expenses, large farms, for example, are more likely to embrace precision agriculture technologies. However, automated mechanization is increasingly focusing on more but smaller autonomous machines, rather than fewer but larger machines, as seen with machines that still require human control [17]. As the upfront expenditure grows more equal in relation to the size of the farm, this trend allows smaller farms

to participate in digital agriculture more evenly with larger farms.

- 1) Digital Divide: Inequitable access to information and communication technologies (ICTs) may result in uneven adoption of, and thus uneven gains from, digital agriculture. When digital technologies necessitate certain abilities, benefits may accrue to digitally literate farmers who are in a position to capitalize on such opportunities.
- 2) Gender: Men appear to be more likely to adopt digital agriculture, notwithstanding gender discrepancies in ICT access and the gender gap in agricultural value chains. As a result, digital technology may prolong gender disparities in the agriculture sector.
- 3) Unskilled labor: On-farm productivity gains, particularly through digitized technology and precision agriculture, may pose a threat to low-skilled jobs. Agriculture will be one of the areas most affected by automation, according to the OECD, and McKinsey Global Institute forecasts that technology will displace 15% of agricultural employees in Mexico and 30% in Germany. Agribusinesses and service providers: The increased reliance on big data could widen the power gap between agribusinesses/information service providers and farmers. Smallholders may lose bargaining leverage if they do not have access to and/or control over their data in comparison to large value chain actors (such as supermarkets) and data collectors.

However, due to a rebound effect, digital agriculture could hasten farms' depletion of natural resources; increased input efficiency does not always result in resource conservation. Furthermore, through altering economic incentives, digital agriculture may reduce the effectiveness of environmental policies: "Precision agriculture can lead to higher marginal abatement costs in the form of forgone profits, decreasing producers' responsiveness to those policies."

1.2. Concept of Economic Digital Models Strategies

The most popular firms in today's marketplace are embracing new technologies, which have allowed them to change the way they conduct business [18]. When it comes to improving the customer experience, emerging technologies like Artificial Intelligence (AI) have the potential to be game changers. Chat bots are powered by AI and can assist website visitors with their questions. Even various variants of the same question can be recognized and answered by AI, and it can be trained to provide prompt responses in your desired tone and voice. This kind of innovation connotes to "digital business model," a way of generating value based on the creation of client advantages through the use of digital technologies. These digital solutions are designed to give clients compelling benefits; they are willing to pay for while also enhancing various parts of businesses. What products or services are being offered by the company or how the company recruits new clients are some examples? The use of technology that not only provides better goods and services but also offer unique and meaningful consumer experiences is a key

component of digital business models [19]. Successful brand building requires a digital strategy. A digital business model is, in essence, a way for a company to generate revenue online, or a way to use the internet to exchange goods and services for a profit. Business models in the digital sphere depend on advancements in technology. Businesses should think about how the internet and contemporary software solutions enable them to create a connection between the needs of the client and their products in order to construct a functional framework. This transition could be as straightforward as a brick-and-mortar store opening an eCommerce site to sell their products online, or it could be as complex as a business creating a whole new service based on its expertise and knowledge of the sector. To create a significant advantage that clients are willing to pay for is the goal of the digital solution [20]. A hotel might, for instance, launch a platform that enables visitors to reserve necessary third-party services in advance, such as guided tours, restaurant reservations, and vehicle rentals. New digital business models are still being developed, though existing ones have been functional and will complement new technologies as demand rises. As a result, the capacity to grow business, modify operations, and make profits is what distinguishes a successful digital business model framework. The need for new business models to reflect the new realities has been fueled by the digital age. Online shopping gives customers rapid and easy access to any good or service, therefore businesses need to be able to provide it if they want to remain competitive. One need a suitable digital business model that addresses the needs of customers whether; the firm is entirely online or an offline.

2. Digital Business Models

A business model that makes use of digital technologies in order to enhance various areas of a company or business is known as a digital business model. It involves everything from the product or service that the business offers to the way it acquires consumers [21]. Digital technology that improves a business model's value is known as a digital business model. It could be likened to a company structure that takes advantage of digital technology's advantages in creating values, products and services in return for profits. A digital business model is the development of consumer's advantages through the use of digital technology in a way of creating proposed values. A digital business model is essentially how a company generates revenue online, or how one use the internet to exchange goods and services for cash [22]. Online business interactions are something we do every day. The commercial nature of some of these transactions is obvious, such as when purchasing goods through an online store, renting storage space from a cloud service provider, or using a ride-hailing service like Uber or Lyft for transportation. In these situations, the customer makes a monetary payment. Other times, it can be more challenging to spot the commercial component. For instances, search engines, several email providers, social media platforms, and some apps are just a few of the businesses that offer services to Internet users for no obvious

financial reward. The main economic resource in this business model is user data, and businesses make the majority of their money by selling consumers, the data on user preferences. These days, if it's not online, it doesn't exist. To adapt to the new reality, the digital era has increased the need for innovative business strategies. Any product or service can be easily accessed by customers online; therefore businesses must be able to meet consumer's needs if they want to remain afloat and competitive. One need an appropriate digital business model that addresses the needs of the customers whether; the business is offline or online. Company attempting digital transformations or online operations must embrace digital technologies coupled with the integration of appropriate business models [23]. However, digital business models have one thing in common despite these distinctions: they are increasingly based on the flow of data. Data, frequently referred to as the "oil of the digital economy," has changed from being a supplementary to a core economic resource in recent years. Data is in high demand among Internet companies and other enterprises, and how well they can compete and survive in the market will depend on it. Notwithstanding, many complex difficulties are brought up by the development of digital business models [23].

2.1. Characteristics of Digital Business Models

What distinguishes a digital business model? To begin with, digital business models are noted for having the following four unique traits [24].

1. Using digital technologies, value is produced. It's known as a digital business model when a service is built on digital technologies. Consider the companies; Facebook, Google, and Amazon. Without the internet, none of these giants would exist.
2. The digital business model is a brand new operation. Using an app (like Uber or Lyft) to request transportation and have a driver match your request is an illustration of this.
3. Using a digital channel is required if you want to purchase something online. Digital platforms that display adverts when you conduct online searches, like Amazon, are frequently the foundation of digital business strategies.
4. A digital platform is used to develop the unique selling proposition (USP). This indicates that a buyer will pay for your goods or services, which is often monetized.

2.2. Creating an Efficient and Effective Digital Business Strategy

The key to success in 2021 and beyond, regardless of your brand, is developing an effective digital business strategy, hence there is need for a "digital transformation" when you leverage on technology to grow your firm. In this technological era, a digital business model is a requirement for one to stay in business and generate revenue [25]. Firms or individuals can take good advantages of so many intriguing and novel technologies that are being developed to enhance

their businesses. This is because, in the coming years, every sector of the economy and every business will be entirely online, firms or individual need to grasp and embrace this in order to revolutionize their business. What is coming at us is bigger than the original internet.

2.3. Important Dimensions for Creating a Digital Business Model

The following are important dimensions for creating a digital business model

1. What are the needs of your target consumer and WHO are they?
2. What is the value proposition and what kinds of items does it produce?
3. How is the value proposition conveyed?
4. What defines profitability for the business model?

2.4. Steps for Developing Business Model Strategy

The identified steps are involved in developing a business model strategy

1. Create a thorough business plan first. Describe your company's mission, your aims and aspirations, and how you intend to carry them out.
2. Identify the People You Want to Reach. Limit your market to two or three buyer personas. Give a brief description of the solutions your organization will provide.
3. Create a compelling value proposition. What will make your business distinct from the competition? Determine how you stand out.
4. Pick important business associates. Choose strategic relationships and important partners that will help you serve your consumers the best [26].

2.5. Examples of 21st Digital Business Models

When choosing the technology that is ideal for your brand, it is advisable to start by taking your client profile into account. Things like problems, passions, purchasing habits, and demographic traits may be included [27]. With digital becoming the new standard, there are many prospects for success. Before deciding on a digital company model and beginning our entrepreneurial adventure, it is important to identify your destination. Illustrations of a digital business models are shown below;

1. Freemium Model

The most widely used business model for free goods and other subscription-based services is called "freemium." Users can obtain a free version of a product's fundamental functionality using this widely approach. The user has the choice to upgrade and pay for a premium version if they would like more features, even if this version can be slightly restricted. Spotify is a fantastic illustration of this; while it is available without charge, a monthly subscription is required if you want access to its higher-quality content and remove its advertisements. Businesses produce a streamlined version of their product and give it away for free to customers [28].

Businesses can attract a sizable audience and swiftly increase brand awareness with its aid. The biggest problem presented by this strategy is determining the best paywall position to support the business. The paid version should be compelling enough to persuade users to upgrade while the free version should be sufficient to draw users in and demonstrate the product's quality. Slack, Asana, Dropbox, Evernote, and other well-known businesses employ the freemium digital business models.

2. Subscription Model

Companies can offer their goods and services at lower prices to customers; thanks to the subscription-based approach. Both Netflix and Office 365 are well-known examples. The user is granted access to services, updates, and other things on a monthly or annual basis. For software, memberships, and content, subscriptions are especially common [29]. The client has access to the product for a monthly or annual price rather than having to make a substantial commitment to purchase it. Businesses can better plan their spending because they are paid upfront and have consistent revenue. They can also observe client usage patterns and make adjustments. When clients depart, a company could experience significant losses. However, businesses may stop customer from leaving and retain continued growth with the aid of a successful retention strategy in place with the use of clever predictive analytics technologies. This paradigm works well with SaaS products (such as Semrush), online publications (such as The New York Times), and streaming services (such as Netflix) [29].

3. Ad-Supported Model

The customer enjoys free access to the services of the provider under the ad-supported model, as the name implies, but is exposed to unsolicited content from third parties. From ad clicks, the company makes money. The income could grow significantly if the ads are targeted and pertinent. The business may swiftly expand its customer base while offering a high-quality product without cost. The viability of this strategy is in jeopardy as consumers become more and more resistant to advertisements and ad blockers become increasingly popular [30]. Offering an ad-free premium upgrade or taking into consideration a combination with other well-known models as a backup might help businesses prevent losing money. Spotify, Facebook, and Google all employ the ad-supported business model.

4. Ecosystem Model

The ecosystem is among the most interesting types of digital business concepts. One of the most intricate yet durable digital business structures at the moment is digital ecosystems. Alibaba, Amazon, Apple, Google, Tesla, and other ecosystem orchestrators take advantage of the client by providing them with different services across different platforms [31]. They may use their knowledge and data to up sell current customers and draw in new ones because of the "vendor lock-in" effects. In order to offer an all-inclusive experience, the business begins with one primary product and subsequently introduces additional related items. The business can become well-known because of this strategy which offers nearly limitless expansion possibilities. Ecosystems are difficult to

build and manage, which could be a problem. Additionally, the approach involves a substantial financial outlay and carries a high level of risk. Google is a company that has one of the most prosperous ecosystems. Before launching its keyword-focused ad business, the company operated as an investor-funded search engine. Later, they created supplementary goods like their Analytics tools, the Search Console, Google Tag, etc. They've also developed a vast network of consumer products, from owning the video site YouTube and the navigational app Waze to running their own browser, app store, document management program, and so on

5. *Hidden-Revenue Model*

A business model known as "hidden revenue" involves collecting money from third parties rather than charging customers to use a company's products. Sometimes, customers may not be able to immediately perceive how revenue is generated. Data gathering and analysis may lead to the emergence of additional value streams [32]. We are aware that the underlying business structures of platforms and digital services could be disguised. As demonstrated by the Mozilla example, the open-source browser generates revenue from licenses to incorporate other search engines. Clients profit from a free service and businesses earn from partners who pay to get access to the provider's clientele. Similar to previous free models, this one has the benefit of allowing the company to quickly expand its customer base and keep them satisfied while still generating income. The management of personal data is frequently involved in hidden revenue, and there could be potential privacy and ethical problems [32]. (This calls for prudence. Customers can use Google and Facebook for free, but these companies earn money from advertising based on the information collected from those users. The similar business model is used by Mozilla, although it takes precautions to protect users' privacy by getting its money through search engine partnership royalties.

6. *Platform Model*

The platform model, sometimes referred to as peer-to-peer or two-sided marketplace, is a digital business strategy where a provider develops a virtual marketplace to link independent customers and sellers. The availability of a wide range of suppliers and buyers makes both parties satisfied. As a result of sales, subscription fees, and advertising, the company that offers the platform service earns money. The quantifiability of the model is really promising. The platform can also be expanded with new pertinent services if it is successful [33]. Due to the fact that they do not manage or offer any products, the provider also doesn't need to make a big investment. To keep a system viable, demand and supply must be balanced. People will depart if there are many buyers but few sellers, or vice versa. Amazon, Uber, and Airbnb are a few successful examples of platform models. Similarly, the user-generated content model is a particular application of the platform model in which users produce material that is consumed by other users. YouTube, Wikipedia, TikTok, and other websites are examples of the UGC model.

7. *Sharing Model*

The access-over-ownership approach and the sharing model are both terms for the same concept. In a professional sense, "sharing" is the key word. This strategy lets you to pay for a good, service, or offer for a predetermined period of time without actually owning it. A few examples include renting a vehicle (like with Zipcar), a residence (like with Airbnb), or even equipment for business use. This model dwells on ownership and the potential revenues it could generate. An automobile might start generating income rather than just adding costs. Customers that use the model can use a product without purchasing it. In most cases, these are frequently items that people might not ordinarily be able to afford or might not want to acquire because they only need them temporarily [34]. Upon exceeding the investment's payback period, a corporation that owns the products may earn an endless amount of money. The supplier makes money when they merely serve as a middleman by charging usage fees to both the buyer and the seller. The initial investment for companies that own the items may be one of the few drawbacks to the sharing model, which is generally a terrific one. Incorporating the sharing economy, Airbnb, Uber, Zipcar, and Lyft are some of the most prosperous businesses.

8. *On-Demand Model*

The analog framework, in which customers had to follow the schedule and format of the source in order to use a service, was replaced by the on-demand model, which is particularly popular with media and content providers. The model refers to a digital good or service, such as a time-limited subscription to a video on an online video platform like Apple TV or Amazon Prime Video. The freelance and gig economy portal Fiverr is another example of this concept. On this platform, you may hire people and pay them according to the projects they do. Customers have unrestricted access to the company's digital services, allowing them to access and consume information whenever and however they want. The ability to provide its clients with a range of options is this model's greatest benefit. Companies that manage to supply content that answers their customers' needs can increase demand and grow their business [35]. To encourage engagement, companies need an advanced algorithm that makes accurate content suggestions, and those can be very expensive. The most successful on-demand services that the public knows and loves are Spotify and Netflix.

9. *eCommerce Model*

A popular business strategy on the internet today is eCommerce. It's simple to adopt for both firms that go online from beginning and for offline enterprises looking to embrace a digital transformation. This digital business model of selling real goods online was initially used by Amazon; one of the most well-known and successful firms [36]. A basic one-brand store can be an eCommerce model, or it can be integrated with a platform or marketplace approach to create a larger business. In order to serve their customers' digital requirements and reach new markets, businesses can now do so with the help of online retailers. Companies may expand their business and boost revenue with the correct plan. Business owners who lack technical expertise may have

trouble running their online store and developing a successful digital marketing plan. As a result, the user experience may suffer, and growth may be inhibited. Customers from all over the world shop at Amazon, which is the most popular eCommerce site. Sellers should think about the social commerce model as an alternative to eCommerce. The ability for users to make in-app purchases on social media networks is a recent development. The advantage is that companies can offer their goods without the requirement of a stand-alone internet store.

10. Custom Made Model

The best digital business model for any company is the custom-made one. Any business can benefit from a tailored digital business model. Firms must find the intersections between their product's distinctive features and the pertinent needs of the target market in order to create a custom model. The framework might consist of several tried-and-true models combined with a new twist, or it might take the form of an entirely original configuration that will provide the market a cutting-edge service or solution [37]. A customized digital business model can be created in three different ways: Combining several models to meet your business needs, incorporating current technology in your company in creative ways, and investing in the research and development of new technologies are all good ideas. To determine which model is best, businesses can test out various options. As such, they will be able to respond to their customers' digital needs as their company expands. It could be challenging to decide on the appropriate option if the firms have no digital knowledge and experience.

11. Cloud Services Model

A new method of delivering IT services over the Internet, such as data storage, computer processing power, and software, is known as cloud computing. This results in lower hardware and software expenses because data and programs are no longer kept on personal or business computers, but rather are kept on remote servers that can be accessed online. In a society that has become more globalized and prioritizes outsourcing and cross-disciplinary work, cloud services have become essential. They provide teams with the tools they need to collaborate effectively or to carry out difficult operations that some businesses choose to contract out, like data analytics, trend detection, data mining, calculations, and other jobs that demand a lot of processing power.

3. Digital Transformations

The process of enhancing business practices, customer experiences, and operations through the use of cutting-edge technologies is known as "digital transformation." With the move, the company saves money on operating costs, boosts employee performance, and boosts productivity across the board [38]. The phrase "digital transformation" has become extremely common and can be used to represent anything from cloud computing to AI and machine learning. Digital technology is the integration of high-end tech tools or solutions across all areas of a corporation or business,

changing how you do business and deliver value to customers. How a company defines and implements digital transformation depends on the particular objectives and business goals being pursued. However, reforms are now required in order to preserve business competitiveness in this modern economy. Converting an analog company to digital company has been the practice in this 21st century; firms and individuals are engaged in changing their operational services using digital technologies. The last ten years have seen a widespread adoption of enterprise technological advancements. The way that businesses choose individuals and assess their performance has changed as a result. Global spending on digital transformation tools and services is expected to reach \$2.3 trillion in 2023 [11]. This shows the extent and length of digital transformation across the globe. Digital transformation encourages a culture shift that forces businesses to innovate, tolerate failure, and question the status quo. Businesses are making good use of digitization, in creating enormous value for the business and customers alike for instances, in designing successful business strategies, manage massive amounts of electronic data, and upgrading of their business models. Digital transformation and digitalization are frequently used synonymously in the context of rapidly developing technology [23]. The automation of processes and activities through the use of digital technologies is known as digitalization, whereas transformation is a more general term that encompasses both digitalization and other changes. Numerous organizations have benefited from digital transformations in designing new and innovative products and services, enhanced customer experience, streamlined operations and increased revenue.

3.1. COVID-19's Effects on Digital Transformation

A huge shock to the world economy was caused by the COVID-19 epidemic. According to studies firms are now three times more likely than they were in the pre-pandemic era to say that at least 80% of their consumer interactions are now digital [7]. Sad to say that businesses suffered losses; resulting from the pandemic which undoubtedly triggered massive digital transformations across businesses. Online shopping and the use of digital services have significantly increased as a result of the dramatic impact that digital transformation has had on consumer behavior. Businesses are now investing quickly in developing digital infrastructures and related capabilities as a result of this. Additionally, there has been a sharp rise in the use of digital tools for collaboration and remote working, which has prompted businesses to spend money on cloud-based services and software to allow their staff to work from anywhere. In this post-Covid era, organizations have all embraced digital transformations in order to remain in business and compete favorably with other striving businesses using digitization [18].

3.2. Challenges Faced in Digital Transformation

The biggest obstacles that most companies encounter trying to build and expand their digital operations often have

little to do with technological innovations [10]. The success of digital transformation depends on tackling these identified issues head-on, and this includes;

1. Poor decision makings: Poor decision-makings affect all aspect of a successful digital transformation, including strategy formulation, innovations, funding, and implementation, making it most difficult for firms and company to move forward. Poor decision makings exist in governments, ministries, private and corporate sectors.
2. High cost of digital tools and services: High cost of digital tools and services makes it extremely difficult to embrace digital transformation. Thus it is capital intensive to install modern scientific technologies coupled with their manpower services.
3. Digital Skills Shortages: This restricts and limits businesses and firms from embracing digital transformations. Where manpower services are scarce and inadequate; causes companies to renege their zeal and interest in changing their operational procedures.
4. Cultural deficits: This has to do with changing the mindset and business attitude of firms, individuals, organizations, etc that is changing their mindset from analog to digitization principles. Some firms believe in maintaining status quo which could hinder digital transformations.
5. Poor network services: This is the most serious challenge and problems of digital transformations across the globe. Slow and fluctuating networks kills rapid growth of digitization and overall transformations across firms, businesses, industries, governments, etc.

4. Approach to Digital Transformation

Cross-functional communication is supported by digital imperatives, which give technology first priority. The initiatives resulting from this requirement result in a modular, flexible technology that can successfully support the digital transformation and strategic values [29]. Thus, this includes

1. Diverseness: Organizations should be able to have diverse capacities to adjust business operations at any point in time without persuasions.
2. Developing broad digital strategy: With this approach, the aim is to create an immediate, comprehensive strategy. An effective long-term strategy is required. Rapid innovation uptake and culture change are the two main objectives of the comprehensive digital transformation plan.
3. Availability of digital skills: Digital skills must be readily available to support digital transformation plans. Companies, firms, organizations should embrace intensive training of staffs and employees on digital technologies use and applications.
4. Prompt decisions and implementations: Companies, firms, organizations, governments, private and corporate sectors etc, should be more proactive and efficient in decision makings and digital transformation executions

without fail.

5. Business focus: Business minded and directions are expected from firms, organizations, and governments, private and corporate sectors etc, in adopting business digitization and transformations across board.

4.1. Main Areas of Digital Transformation

Digital transformation can be defined as the process of employing digital technologies to develop new or updated business processes, business modules, and consumer experiences. Anything and everything is included in the broad definition. Digital transformation primarily focuses on four areas, each of which has unique potentials and problems [39].

4.1.1. Change in Process

There is no one method that works for all cases of business process change. Instead, the greatest strategy to decide how to convert your business procedure is to comprehend the objectives you're attempting to attain and customize the transformation to meet your particular wants. A few important considerations for business process change include:

- a. Establish your goals. Knowing what you hope to accomplish with the transformation can help you decide which processes need to be changed and how.
- b. Evaluate the methods you use now. You must comprehend the existing operation of your processes before you can change them. You'll be able to tell when improvements can be made using this.
- c. Track down the best answer: For the purpose of changing business processes, several different tools and methods can be applied. Find the one that most closely matches your requirements and goals. Transformation strategies should be shared with all stakeholders, along with the appropriate assistance and training, because change can be challenging.
- d. Track results, then make adjustments: After modifications are made, it's crucial to keep track of them. Don't be scared to make changes if the new process isn't performing as expected.

4.1.2. Transformation of the Business Model

In the business world of today, transformation is crucial for remaining competitive. Changing from analog to digital is known as transformation. This implies that to be relevant in business, you must constantly innovate and change. Changing your business model can be done in a variety of ways. Changing your pricing approach, pursuing new markets, or creating new goods or services are a few examples. The objective is always to be on the cutting edge and keep your business expanding. Consequently, understanding your goals is the first step toward transformation. By changing your business model, for instance, what do you hope to accomplish? Once you know your goals, you can start to develop a plan of action [39].

4.1.3. Domain Transformation

A move to the cloud is being sought after by organizations trying to change their operations. But what exactly does that

mean? The process of shifting your company's processes and data to the cloud is known as domain transformation. Cost savings, increased scalability, and more agility are a few reasons to consider doing this. Selecting workloads and apps that can run in the cloud is the first step in domain transformation. Having completed that, you may start moving your data and workloads. However, when you're going through domain transition, there are a few factors to keep in mind.

- a. You must first make sure that your data is safe and secure
- b. Then select the best cloud service to suit your demands.
- c. Finally, you must have a detailed plan for moving your workloads and data.

4.1.4. Cultural Transition

Attempting to modify an organization's culture can be challenging. The alignment between the company's objectives and its employees' behavior is frequently impossible for leadership to achieve. This means that any attempt at transformation typically encounters opposition and ultimately fails. Achieving cultural transformation is difficult for a number of major reasons.

- a. First and foremost, culture refers to a system of unwritten and unrecognized shared ideals, precepts, and conventions. When there is a problem, it is frequently just brought up.
- b. Second, the organization's culture is hard-wired into the fabric of the organization and is resistant to change. Because of this, it may be exceedingly challenging to convince staff to alter the way they typically do things.
- c. Thirdly, the leadership must be devoted to bringing about a transformation in the culture. They must be able to articulate the desired culture and serve as examples of the new conduct.
- d. The final requirement is to allow transformational endeavors the time and funding to succeed. In order to change an organization's culture, it is important for them to be aware of these difficulties. They need to set clear objectives, be patient, and invest resources. They must wait to see the needed change [40].

4.2. Assessing Rapid Success in Digital Transformation Strategy

The results of company's digital transformation will be greatly influenced by how digital transformation strategy is implemented. The methods and tools chosen will always affect the final results. The development of long-term strategies to scale the digital transformation and accomplish new objectives as firm grows, however, must take into account preliminary results. The ability to examine the results and make the required adjustments calls for flexibility from team members or stakeholders [41]. The capacity to move swiftly will determine how successful one's digital transformation approach is. Naturally, sticking to your plan is the first step, but you must also be prepared to make changes if it doesn't work out as you had anticipated.

5. Strengthening Digital Transformations and Overcoming Associated Challenges

Companies and firms using digital technologies must make up their minds to embrace the challenges that come with it. Thus proactive efforts and steadfastness are major prerequisites for staying in business in this digital era [42]. Therefore, businesses could be improved by;

1. Cultivating desired digitization plans: Firms should cultivate the habit of changing from old operational patterns to entirely new ones and keep tracks of failures and successes recorded in the business environment, this will chart a path way for total technological transformations desired.
2. Prioritizing change and goals: Change is needed to shift to the digital era. Specific digital goals must be kept in mind and seriously adhered to without fail. Firm must recognized and know when to change outdated business models and embrace recent ones for effective service delivery and competitiveness.
3. Deconstruct Data Silos: To create a successful digital strategy, businesses need to have a comprehensive plan that includes all of their employees, departments, and subdivisions. Data silos occur when a company's divisions use incompatible software or refuse to share data with one another. Deconstructing data silos is very essential and formidable for businesses looking to adapt digitally [43].
4. Finding the correct technology and making investments in it: Digital transformation is not simply updating a single piece of software that powers the core functions of a company. For a seamless shift, which is also difficult, selecting the correct technology and utilizing it is very essential. When making a technological purchase, courtesy demands to find or select the right and appropriate technology that fit for that purpose and thus investing hugely in it.
5. Culture-specific Modifications: In this era, employers have trouble finding workers who are open to using modern equipment and efficiency techniques. Lack of an adaptive culture causes the entire transformation process to stall. Corporate executives ought to promote a culture that embraces cutting-edge technological advancements. Employees need to be encouraged to share information on newly adopted technologies, and the workplace culture should support this development.

6. Conclusion and Recommendation

Farmers and various organizations are embracing new digital technologies, which has remained relevant as decades evolve. These innovation predicates to digital agriculture and business models, used in enhancing agricultural operations and business activities across the world. Digital agriculture comprises a diverse set of technologies, the majority of which

having many uses throughout the agricultural value chain. As a result, digital agriculture includes on-farm technology such as yield mapping, GPS guiding systems, and variable-rate application. Other examples include e-commerce platforms, e-extension services, warehouse receipt systems, block chain-enabled food traceability systems; tractor rental apps, cloud computing/big data analysis tools, artificial intelligence, machine learning, distributed ledger technologies, including blockchain and smart contracts, the Internet of Things, digital communications technologies such as mobile phones, e-pesticides services, e-agro product delivery, agro-advisory apps such as plantix offers detection of crops diseases. Every organization nowadays needs an effective digital business plan and an online business strategy. Days of analog operations are changing rapidly paving out ways for digital business operations and procedures. Digital businesses follow a completely different set of guidelines; and have requirements that conventional models (analog) are unable to satisfy. As a result offline businesses are now being converted to online operations in order for the owners to remain in business and compete effectively. Companies now can find new methods to satisfy their clients and increase income via the use of digital techniques. Modern technology transformation is enabling businesses to change and go through digital transformations, which boosts their productivity and competitiveness in the market. Restructuring organizational structures will enable business owners, agriculture stakeholders, firms to fully benefit from imports of digitalization, which will result in improved operations and services, increased revenue, workers' efficiency, organizational growth and developments, opportunities for collaboration, more service options, and an efficient approach in maintaining good customer relationships. However, farmers and agriculture stakeholders and firms as well as individuals should look inward and embrace real digital transformation to achieve overall efficiency.

Conflicts of Interest

The authors declare no conflicts of interest.

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