

## **Adopting Digital Technology to Overcome Challenges of Circular Economy: A Case Study of Platform-based Start-up in India**

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### **ABSTRACT**

Digital transformation is driving growth in a wide range of industries. At the same time, circular economy has gained traction as a means of optimizing resource utilization and augmenting profitability induced by innovations and operational efficiency. Academics, policy analysts and practicing managers have been keenly observing how digital technology relates to circular economy. This article examines how the Indian start-ups are trying to tackle the challenges posed by circular economy through adoption of digital technologies. The article also probes how implementation of digital technology and circular economy practices relate to each other in terms of improving operational efficiency and increasing productivity as well as profitability in the long run. The article is likely to enable the practicing managers to develop a holistic perspective on adopting digital technology with an eye on the gains accruing from circular economy. Academics and researchers can gain fresh insights from this article to carry out studies on implications of combining adoption of digital technology with circular economy.

**KEYWORDS:** Digital Technologies; Sustainability; Circular Economy; Start-ups; India

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## **INTRODUCTION**

Phenomenal increase in population coupled with concomitant urbanization and high incidence of pollution of all sorts have jeopardized the prospects of long-term survival of human civilization. According to some of the reports, accretion of municipal solid waste in the world is likely to increase alarmingly by around 70% to the tune of 3.4 billion metric tons by 2050 due to our current consumption patterns. The scenario is indeed baffling. However, there is a way out if the industries across the globe join hands to adopt a circular economy which is primarily based on the widely acknowledged concepts of 3Rs viz. 'reduce, reuse, and recycle' and thereby capable of mitigating the looming problem of managing solid waste on the earth. Circular economy is a unique business model that fosters a balance between economic development and preservation of natural ecosystems by substituting the linear business model based on the traditional notions of 'take, make, use and dispose' (European Union, 2015). However, a gigantic shift from linear economy to circular economy cannot be possible without appropriate innovations, especially in digital technology. In fact, digital technologies can help in closing the loop in economic systems so that we have less solid waste to deal with while increasing profitability.

All the member nations of the United Nations adopted 17 Sustainable Development Goals (SDGs) in 2015 to be accomplished by 2030 (Salvia et al., 2019) which gave impetus to circular economy across the globe. No wonder, Indian organizations have also demonstrated significant interest in circular economy which is closely aligned with SDGs. Recent studies indicate that the Indian government is encouraging the industries to adopt circular economy. Moreover, concerted efforts made by the government, industry associations and corporate houses towards promoting circular economy have expedited attempts to boost urban and rural economies, fight climate change, improve food and water security, and empower people. It has been observed that the start-ups in plant-based proteins, greenhouse gas reduction, electric vehicle carbon pollution monitoring, and integrated e-waste management may benefit from the net-zero paradigm, ensuring a sustainable future (Jeevitha and Amaleshwari, 2023).

Furthermore, start-ups can leverage the benefits of circular economy in a better way by adopting digital technologies and fostering an ecosystem of innovation. Thus, the start-ups can play a major role in transmuting Indian economy by augmenting national income, expanding employment and livelihood opportunities, and boosting exports of products and services. True, start-ups are growing rapidly in developed as well as emerging economies (Song et al., 2008; Eisenmann, 2021) by combining digital technologies and platform-based business models with the nuances of circular economy. For example, Amazon, Alibaba, and Airbnb have succeeded in creating great fortunes for their shareholders by optimizing platform-based business models that work on digital technologies (Edelman et al., 2014). Thus, it is not at all surprising that the world economy is characterized by high incidence of enterprises which are set-up around digital technologies and platform-based ecosystems.

Under a platform-based business model (PBB), enterprises focus on Business to Business (B2B), Business to Consumers (B2C), or Consumer to Consumer (C2C) marketplaces, thus enabling the expeditious exchange or transaction of goods, expertise, facilities, or provisions (Henry et al., 2020). Scholars have observed a significant growth in peer-to-peer platforms which often function as seamless accelerators to minimize the wastages of resources. Besides, platform-based businesses are characterized by low labour intensity and even lower entry barriers (Ellen MacArthur Foundation, 2015; Ritter and Schanz, 2019). In addition, several research studies indicate a rapid development of digital technologies as a determinant that makes it possible for innovative platform business models to emerge and succeed in the marketplace and leverage their comparative advantages. The innovative platform-based business models act like enablers of commercial transactions while creating immense value for each of the stakeholders in the process (Potting et al. 2017 and Konietzko et al. 2019). Digital technologies like 3-D Printing, Blockchain, Internet of Things, Radio Frequency Identification, Virtual and Augmented Reality, Digital Twins, Robotics, Cloud Computing, Drones, etc. have made it easier for firms to integrate their product and service offerings with circular economy (Bressanelli et al., 2018; Popov et al., 2022).

However, the shift to circular economy and platform-based computing poses significant problems for businesses, including user engagement, market growth, and monetization (Tura, 2018). Even though digital technologies are widely used, not much attention has been paid to how they can be leveraged to solve problems in business activities revolving around circular economy (Nobre & Tavares, 2017). An ever-growing aspect of the contemporary circular economy paradigm is driven by platform-based digital technologies. These platforms serve as interfaces mediating interactions between various stakeholders such as groups of buyers and sellers or complementors and the community of end-users (McIntyre et al., 2020). A rapid and strategic adoption of technological advancements such as the Internet of Things (IoT), which enables speedy processing of data through unified digital devices; artificial intelligence (AI), which substitutes human reasoning while processing the large datasets; virtual reality, which is a relatively new development in user experience management; robotics, which replaces human at the shopfloor; 3-D printing, which has revolutionized customization in industrial production; and blockchain, which links records using cryptography for augmented transparency; amongst others, promise to increase competitive advantages and reduce risks for the firms which are combining technology with circular economy (Peruffo et al., 2017). While it is true that combining platform-based business models with circular economy is advantageous for both the firms and the community, there are several hurdles in the way.

The present paper examines the hurdles or challenges in combining digital technologies and circular economy through case study. This paper has four sections. The first section delves into nuances of circular economy and platform-based business models, and the difficulties that the firms face while integrating the two. The second section highlights the research methodology, while the third section presents the results of the case study. The fourth section discusses the results and provides conclusion.

## **BACKGROUND**

### **Circular Economy and Platform-based Business Paradigms**

Although research and understanding in the field of circular economy are still relatively limited, other schools of thought have contributed to the development of the concept such as cradle-to-cradle (C2C), blue economy, industrial ecology, etc. on a closed-loop. As such, circular economy is "an economic system that is based on business models that replace the end-of-life concept with reducing, alternatively reusing, recycling, and recovering materials in production/distribution and consumption processes" (Kirchherr et al., 2017). Prime objective of circular economy is attainment of sustainability in business processes, which entails a better quality of environment, value creation for all the stakeholders and inclusion of all, including those who are marginalized and struggle for survival at the bottom of the pyramid. Thus, circular value chain alters both production and consumption patterns in sync with sustainable development goals. The emphasis is placed on the effective and judicious utilization of resources, which in due course, contributes to sustainability (Geissdoerfer et al., 2017). Firms are required to make strategic decisions that embrace a variety of practises, including the elimination and conversion of waste, the prioritization of renewable resources, the design of products that are long-lasting and re-usable, and the combination of collective consumption, more typically, via pay-per-use schemes (Stahel, 2013). Within the realm of customer experience, a wide range of platform firms have been established. There are several instances in which digital technologies are used to operate their organization, hence enhancing both the efficacy and ease of the procedure (Hirota et al., 2022).

### **Circular Economy Challenges**

Major challenges faced by the firms while combining digital technologies and circular economy included ownership and sharing of large set of data, competencies of the employees and managers, funding, and transitioning from product-orientation to service-orientation, etc. (Antikainen et al., 2018). Furthermore, scholars have also identified other impediments in the way of combining digital technologies with circular economy such as lack of parameters to measure profitability accruing from digitalization, lack of information, lack of appropriate

supply chain networks, and lack of positive attitude among stakeholders regarding efficacy of circular economy. Besides, there are technical constraints associated with combining digital technologies into production methods (Ritzén & Sandström, 2017). Although digitalization has already accomplished significant headway in terms of accuracy, affordability and access, a lot more is yet to unravel. Currently, issues related to information management such as inadequacy of data, high data cost, etc. are the biggest hurdle in the way of adoption of circular economy (Berg & Wilts, 2018). Technological hurdles pose significant challenges in both production/take-back systems and how that would function and how much it would cost (Ritzén & Sandström, 2017). Also, while examining the scope of digitalization in adopting circular economy, issues related to data integration are generally ignored. It goes without saying that data integration is crucial for taking a plunge from linear economy to circular economy with the aim of improving operational efficiencies for optimum resource utilization with active support of all the stakeholders in the information systems (Pagoropoulos et al., 2017).

### **Digital Technology for the Circular Economy**

Significance of digitalization as a major facilitator of circular economy is well acknowledged. The use of digital technology and associated outcomes have the scope to minimize consumption and encourage circular systems (Moreno & Charnley, 2016). Integrating digital intelligence may distribute information, structure, ownership, and customization, fostering more meaningful and lasting interactions with end-users. Digital intelligence may empower the enterprises based on circular economy business models by way of automation and smart supply chain networks. The digital intelligence can promote decentralised, re-distributed, and circular production and consumption patterns for the benefit of all the stakeholders without compromising on quality (Moreno & Charnley, 2016).

### **RESEARCH METHOD**

Research on the amalgamation of digital technology into circular economy has been making progress in recent years. Nevertheless, there has been a far smaller number of studies

conducted on the process of establishing platform-based circular economy firms. This paper tries to address the following research questions through case study method:

**RQ1:** How is the function and effectiveness of digital technologies in the growth and development of platform-based firms adhering to circular economy norms?

**RQ2:** How can the digitalization technologies be applied to recycle and remanufacture goods in sync with the norms of circular economy?

**THE CASE STUDY**

Beta is a vegetable and food staple distribution company which operates mainly in southern India. The company was established in 2015, and it offers solutions for the delivery of vegetables from farmers to consumers using platform-based business models. It meets the requirements of both the business-to-business (B2B) and business-to-consumer (B2C) markets. They adhere to full-stack technology, which means that they implement technological solutions at every level of the supply chain, beginning with the stages of cultivation and manufacturing and continuing through the stages of distribution and retailing. A full-stack technology-driven supply chain business may include critical components such as advanced data analytics for decision-making, supply chain management software for optimizing logistics, blockchain technology for traceability, and communication platforms for real-time collaboration between stakeholders such as farmers, processors, distributors, and retailers. These components may be used to optimize logistics. Table 1 shows how the farmers use the platform for different agriculture-related know-how. Incorporating technology at every level contributes to developing a supply chain ecosystem that is more accommodating, flexible, and effective.

**Table 1: Mobile Application used by farmers for various agriculture related activities:**

Detection of Insects and Diseases	Intelligent Irrigation Planner
Crop Protection and Information	Spray Management The Prediction of

	Diseases Through Spray Management
Real time Mandi price	Support via Voice and Chat
Monitoring of the Farm's Health Through (NDVI)	Weather

**Source:** Compiled by the Authors

On its sixth anniversary, Beta's annual recurring revenue was INR 1000 Crore, and it was expanding its footprints to Western India and the Middle East. With Beta's "phy-gital" approach to business, data regarding customer tastes and market demand could be quickly sent to producers, wholesalers, and retailers; for example, the farmer sort and grades the food products based on the orders generated by their Master Planning system; once it is delivered to the Distribution centres they are tested for quality for color and size along with the international food safety standards. Once the food passes through the quality check, it is placed in the conveyor for an automatic inverting procedure to avoid unnecessary malpractice, and payment is released within a week. The customers use their platform to know the supply and the available stock, and the order is placed.

The company aims to positively impact the farmers, give them high returns, and lower food wastages using machine learning algorithms that map the customers' needs directly to the farmers on the backend. The business launched Next-gen AI-powered farmer engagement apps in 2022. These six-language applications provide detailed information and personalized solutions. The application helps automate soil testing, crop health, and Real-time mandi price. Farmers using this technology have seen 20%–40% revenue increases. The company has become the fastest-growing agro-tech company in less than five years.

Even though an in-depth scrutiny is essential to evaluate the influence that a platform-based business solution has on the environment and the economy, it is possible to see that Beta can achieve circularity via its platform-based business for a few different reasons. First, the firm has transitioned from a supply-led strategy to a demand-driven approach, which ensures that the



cultivation and processing of the product are in line with the market's current requirements. This helps limit the risk of surplus inventory and minimizes overproduction, which contributes to a more circular and effectual usage of natural resources. The second component of circularity is reduction, which is essential since it lessens the adverse upshot on the atmosphere linked with the disposal of surplus food.

**Digital Technologies to Overcome Circular Economy Challenges**

To deliver its platform-based business, the company gave the associated farmers a tablet each with GPS and other digital products tied to the internet with its apps, which could monitor and manage the customers' needs in real time. The company also leveraged big data with appropriate analytical tools. Such measures enabled Beta to overcome the hurdles of integrating its business model with the norms of circular economy. Table 2 summarizes how different apps helped the company address various challenges.

**Table 2 Role of Digital Technologies in Overcoming Circular Economy Challenges**

<b>Digital Technology</b>	<b>How Beta overcome the challenges</b>
Mobile Computing/Apps	Provides real time data enhancing supply chain visibility for collaborative decision making. Overcomes the operational challenge
Analytics & Big Data	Crop cultivation by understanding the market trends, Efficient use of resources to reduce wastage, Identify the supply chain bottlenecks. Helps with Predictive analysis.
Cloud Computing	With more than 169,000 customer networks, 100+ Procurement location and 412 distribution points, Large volume of data is stored. Overcome the scalability challenges.
Internet of Things	Satellite and AI-enabled Smart-Farm resource management solution

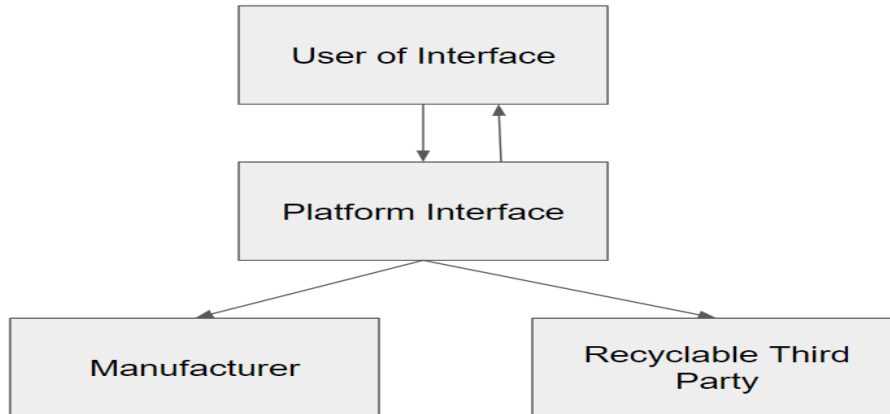
	gives farmers precise water and weather data. Helps to overcome Infrequent rainfall, temperature variations, and disease outbreaks reduce harvesting and yields.
Blockchain	Reduce counterfeit products while handing in Distribution Center or during at any point of supply chain.

**Source:** Compiled by the Authors

### DISCUSSION

The case of Beta has indicated that digital technologies can be used for overcoming the hurdles of integrating platform-based business units with circular economy. As reflected in Table 2, tools such as mobile computing, big data and analytics, cloud computing, Internet of Things, and blockchain proved quite handy in providing real time solutions to the issues in circular value creation. The company successfully executed its plan of action regarding mitigation of operational risks, reduction of food wastages and increase in the income levels of the associated farmers.

Secondly, Beta has successfully applied digital technologies for recycling and reproducing goods. The case study has indicated that platform-based business units can have additional features to recover their recyclable material from the user. For example, Decathlon in India swaps their used products for Decathlon credit. Older and used Bicycle can be taken to nearest store, after the experts check the usability the buyback price is estimated, and a gift card is offered to shop at their store.



**Figure 1: Digital Interface for Circular Economy (prepared by the Authors)**

Figure 1 elucidates that it is possible for the platform-based businesses to make use of their digital interfaces to educate consumers and provide them with incentives to learn about recycling programmes. It is possible for companies to promote a greater rate of participation by implementing user-friendly elements such as incentive systems or discounts for returning recyclables. Furthermore, these platforms have the capability to use technology to monitor and trace recyclable materials, so making the process more responsible and transparent. Platform-based businesses have the ability to build relationships with recycling facilities or third-party suppliers to guarantee the correct processing of returned products. These capabilities may be achieved via the implementation of efficient logistics and collecting systems. Platform-based firms can integrate with circular economy paradigm by using a mix of technical engagement, user incentives, and strategic collaborations. This not only helps these businesses become more environmentally responsible, but it also helps their customer base develop a feeling of shared responsibility.

## **CONCLUSION**

Beta's case study has indicated that it is possible to mitigate the challenges of integrating platform-based businesses with the circular economy paradigm by the efficient use of digital technologies. Beta has successfully educated the consumers on their recycling responsibilities and reclaimed old products from them. Thus, the company has been able to recycle and

reproduce useable goods, a characteristic feature of the circular economy. However, it would be premature to generalize the role of digital technologies in enabling platform-based business units to integrate with the circular economy paradigm. Taking cues from the present paper, it is imperative that the scholars can take up more empirical studies on the theme.

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