

Design an IoT enabled D2C E-Commerce Business Model for the Agricultural Supply Chain

Ashiq MI¹, Raja Krishnamoorthy², Kaarthick Velumani³, Gregory Nannam⁴, Sandeep Padalikal⁵

¹Senior Consultant, Cognizant Technology Solutions, India

²Program Manager, Cognizant Technology Solutions, India

³Senior Technology Architect, Cognizant Technology Solutions, India

^{4,5}Functional Architect, Cognizant Technology Solutions, India

Abstract: Agriculturist face many challenges from producing the food crops until marketing. The conventional agricultural practices need revamping to provide quality food crops with optimized usage of water, bio nutrients and labor. The agriculturist in rural and remote areas lacks better monetary returns, since the local traders and intermediaries decide the prices for the farm produce. To meet the ever-growing demand and improve productivity, few farmers adopt artificial booster and additive usage. This poses a high risk on consumer’s health, since they are not aware of the origin, variety, pesticides and fertilizers used on the farm produce that is available in market. An attempt has been made to digitalize, a conventional agricultural supply chain for gaining better crop yield, cloud marketability, improved profit and provide a robust customer experience.

Keywords: IoT - Internet of Things, D2C - Direct to Consumer, E-Commerce - Electronic Commerce, CPG – Consumer Packaged Goods, API - Application Programming Interface

I. INTRODUCTION

Conventional farming systems share many characteristics like rapid technological innovation, large capital investments in order to apply production and management technology, large-scale farms, single crops/row crops grown continuously over many seasons, uniform high-yield hybrid crops, extensive use of pesticides, fertilizers, and external energy inputs, high labor efficiency and dependency on agribusiness. Philosophical underpinnings of industrial agriculture include assumptions like nature is a competitor to be overcome, progress requires unending evolution of larger farms and depopulation of farm communities, progress is measured primarily by increased material consumption, efficiency is measured by looking at the bottom line and science is an unbiased enterprise driven by natural forces to produce social good. Economic and social problems associated with agriculture are dependent on external economic and social pressures. Potential health hazards are tied to use of pesticide and nitrate contamination of water and food. [1] Farming situations present several respiratory hazards to farm workers. Exposure to these hazards has been linked to excessive coughing and congestion in 20 to 90 percent of farm workers and families. Contact dermatitis is a skin disorder that occurs among agricultural workers. Many agricultural workers are exposed to chemicals on a daily basis. Pesticides can enter the body through many routes, but the

most common ways are through the skin and by inhaling. To prevent dermal (skin) contact and inhalation of pesticides, applicators should wear personal protective clothing and equipment. [2] E-Commerce refers to the buying and selling between parties involved, in case of both services and goods. It also involves payment accomplishment of the goods and services via an online platform (electronic means). E-Commerce presents an advantage to both consumers and sellers. It eliminates most middlemen and inventory reduction which makes it easy for a seller to pass on the benefits to consumers at low prices. For consumers, easy delivery becomes an advantage with low prices while, on the other hand for sellers, cross-boundary selling gives multiple benefits, thereby making it a saviour of search reduction and negotiation costs as well. It has been successfully used by few enterprising people in agricultural marketing as well. For instance, Big Basket, an online grocery portal, books orders from online consumers and delivers sorted and cleaned groceries, vegetables and fruits to them. Giants like Godrej natures Basket and Grofers are also doing the same, while global giants like Amazon are eyeing for the potential in the market. This can be identified as an area with immense potential for agricultural marketing, which is highly suitable for markets of exotic fruits, vegetables, grains, spices and selective organic food. This innovative model can drastically reduce middlemen costs from the supply-chain and can make a good connection between farmers and consumers. It can bring niche products to nationwide markets. [3]



Fig 1.1 Traditional retailer vs direct to consumer

D2C, or Direct to Consumer, is a low barrier-to-entry E-Commerce strategy that allows manufacturers and CPG brands to sell directly to the consumer. It bypasses the conventional method of negotiating with a retailer or reseller to get your product on the market. In D2C, brands sell directly to the consumer through an online medium. Going D2C has many advantages, with competitive pricing being a major benefactor for consumers. Other advantages include having direct contact with consumers to get a better understanding of them, and being able to freely experiment with new product releases and test them with a segment of your consumer-based to gain their feedback. [4] Freewebstore has all the tools needed to run an online business. The simple yet powerful e-commerce solution allows users of all abilities to operate a successful online store for free. The freewebstore API allows linking your store to your new warehouse or your favoured courier or your fully automated picking, packing service. New ideas and technologies are tried and tested like deliveries by drones, robot-powered customer service, mind control product editing or blink activated checkout. [5] Digital business is an increasingly important topic for all companies. However, business and IT lack a common language necessary to discuss, analyze, and design opportunities to take advantage of the digitization of business. A company’s business model is a high-level representation of the specific manner in which the organization generates added value for its customers and sustains itself. The purpose of such representation is to illustrate the company’s core business logic. It has to explain how the company succeeds in satisfying its customers’ needs in comparison to other companies striving for the same goal. One of the most successful business model representations currently used is Alexander Osterwalder’s “Business Model Canvas” which has been widely taken up by practitioners. The business model canvas consists of nine components value proposition, key activities, key resources, key partners, customer relationships, channels, customer segments, cost structure, and revenue streams. A specific adaptation of this canvas is the enterprise view.

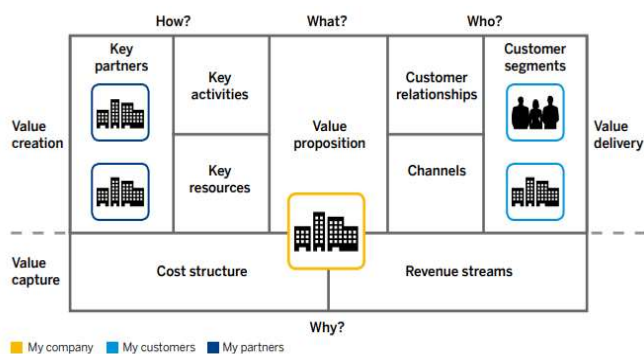


Fig 1.2 Enterprise View

The key component of the enterprise view is the company’s value proposition indicated by “What”, customer focus indicated by “Who”, and the company focus indicated by “How”. The former focus describes the value delivery and includes customer segments describing which customers are

addressed by the value proposition, channels for communication and delivery, customer relationships describing the means by which the connection to the customers is maintained. The latter focus describes the value generation and consists of key activities describing the essential activities in the company that generate value proposition. Key resources, which are the crucial resources to conduct these activities, key partners, which are the collaborating companies, such as suppliers that provide essential resources for the solution that do not come from the company itself. Value creation and value delivery are supplemented by value capturing, which completes the description considering costs and revenues. [6]

II METHODOLOGY

Design thinking as an innovation method is typically used in research and development. Analysis is done whether a short-cycled design thinking method can be developed, so employees outside research and development can be taken out of their daily jobs and innovate, without falling too much behind with their operational work.

2.1 Design Thinking

Design Thinking is a methodology that provides a solution-based approach to solving problems and welcomes the multi-dimensionality of a dynamic process and one has the liberty to juggle the stages in a manner that complies their workflow or turn the thinking process awesome. The process brings out more ideas and refers more choices. The design thinking process is more of a diverging and converging process as against the linear innovation process.

The sequence of five step iterative process in design thinking is summarized as follows,

1. Empathize
2. Define
3. Ideate
4. Prototype
5. Test

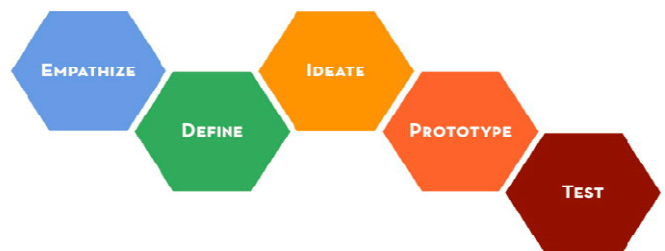


Fig 2.1 Design thinking five step Iterative process

Step 1 - Empathize

Empathy is the centerpiece of a human-centered design process. The Empathize mode is the work done to understand people, within the context of the design challenge. Effort to understand the way user does certain things and why, their physical and emotional needs, how they think about world,

and what is meaningful to them. Story mapping is a technique that allows you to organize your user research and breaks down your findings. So there are basically three ways to empathize with user. The first is immerse, meaning become the user and actually live their experiences. Then there is the way of observing user. People-watching is always fun, but observing is about seeing user’s actions and understanding why they are acting in a certain way. And then lastly, actively engage with users –meaning actually talking to them. Engage in conversations, which allows the user to tell stories of their own experience. When moving from gaining empathy to draw conclusions from the research, all the things heard and saw needs to be processed to understand the big picture.

Step 2 - Define

In this phase, a persona, user journey, and point of view is defined based on user research. Personas put a personal human face on otherwise abstract data. When creating persona, characteristics like job, activity, needs and pain points that user is facing needs attention. The next step is to create a User Journey that provides a sequence of actions, touchpoints, mindsets, and feelings the users are involved in as part of their journey. Finally, the last step is the point of view, which is a statement that exists from user, his need and why.

Step 3 – Ideate

Ideate is the mode of the design process in which the designer concentrate on idea generation. Mentally it represents a process of “going wide” in terms of concepts and outcomes. Ideation provides both the fuel and also the source material for building prototypes and getting innovative solutions into the hands of users.

Step 4 - Prototype

Prototyping is the iterative generation of artifacts intended to answer questions that get you closer to your final solution. A prototype is an opportunity to have another, directed conversation with a user. A prototype can be anything that a user can interact with – be it a wall of post-it notes, a gadget put together, a role-playing activity, or even a storyboard. Ideally it is a designer’s bias toward something a user can experience.

Step 5 - Testing

Testing is the mode in which the low-resolution artifacts are put into practice by placing the prototype in the appropriate context, and you solicit feedback from your users to gain empathy for the people you are designing. [7]

III. PROBLEM DESCRIPTION

Agriculturist toil hard to grow the farm produce but during marketing, receive only a trifle amount as profit excluding the overheads and middlemen cost. Field analysis provided an insight on the conventional agricultural practices and the marketing structure used in the current scenario. The existing

business model has been re-designed to integrate IoT with a digital online store.

3.1 Design Thinking

The Design Thinking sequence of steps are as follows,

3.1.1 Empathize:

The user’s daily routine along with his activities were recorded and a few are presented in empathy map.

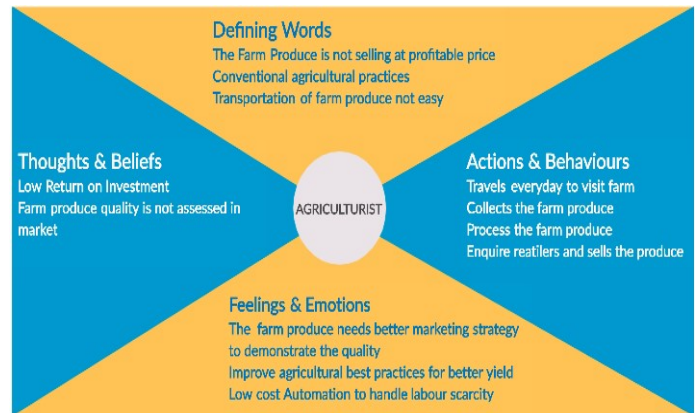


Fig 3.1 Empathy map of user

3.1.2 Define:

Define phase consists of a persona, user journey, and point of view based on user research in Empathy phase.

Persona

The Agriculturist considered for analysis manage thirty acres of land holding, with plantation of spices like coffee, tea, cardamom, pepper, nutmeg and cloves. They would like simple devices to transport the crops and build a digital platform to sell their farm produce and monetize their farming experience through an online consultancy integrating sensors.

ACTIO NS	Persona visits farm on daily basis	Collects the farm produce and returns home	Perform value addition to the farm produce	Inquires Retail outlets for best price with farm produce samples	Return back home for transferring the farm produce to retail outlet
MINDS ET	Should I waste my time and money coming everyday?	Tired in Transporting farm produce in bulk	How to protect the farm produce during bad weather?	Will my hard work be payed in monetary terms?	Pack the processed produce and transport it to retailer
FEELIN G	Bad ☹️	Bad ☹️	Bad ☹️	Neutral	Bad ☹️
FEELIN G	Good 😊	Good 😊	Good 😊	Neutral	Neutral

TOUCH POINTS	Weekly / monthly visit	Machines to carry farm produce	Process value add for the produce in farm	Provide the farm produce to people next door based on retail price	Try different means of marketing
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Fig 3.2 User Journey Map

3.1.3 Ideate

The data collected is transformed into a business model canvas through the enterprise view.



Fig 3.3 Enterprise View

3.1.4 Prototype

Based on the consideration from the business model canvas, a new online cloud store is designed integrating IoT and drones.

3.1.5 Test

The testing phase involves the persona with hands on prototype to identify, if his thoughts described are visualized and if the prototype fulfils his expectations and requirements.

IV .RESULTS ANALYSIS AND DISCUSSIONS

Design thinking methodology and business model canvas are used to transform the Persona’s thought process into a digital web store. A cloud based D2C application is developed to market their farm produce and their agricultural expertise is transformed into a digital IoT consultancy. The farm is digitally connected with the help of sensors thereby improving their yield. The digital store serves as an advertisement for their products and explains the organic best practices used for their crops. This strategy will attract the end consumers, since the farm produce is free from toxic chemicals and reduces the dependency with retailers for marketing and selling their farm produce. The usage of drones and sensors has reduced the labor dependency and the actual need to scout the farm. The web store products and services are available in the website link provided

D2B online web store link: <https://herbarium.onlineweb.shop/>

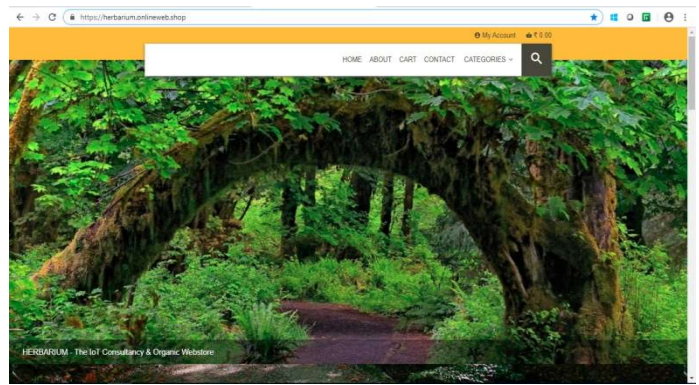


Fig 4.1 Application Main Page

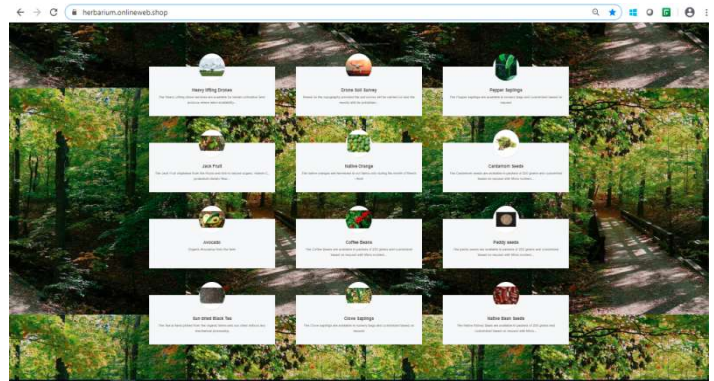


Fig 4.2 Featured Products

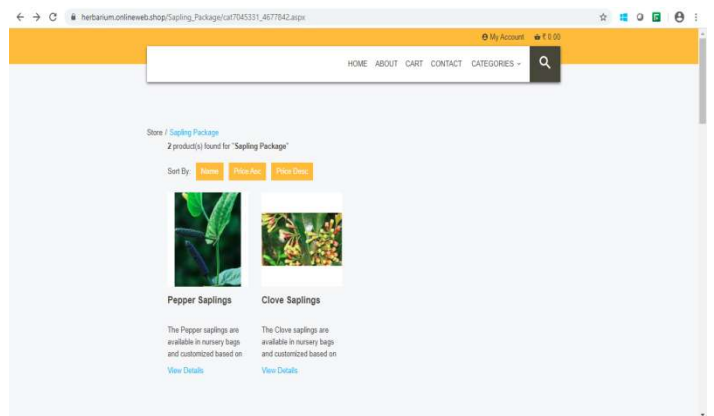


Fig 4.3 Categories – Sapling package

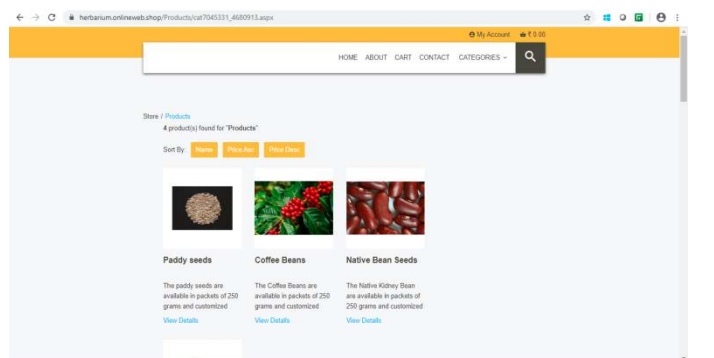


Fig 4.4 Categories – Products

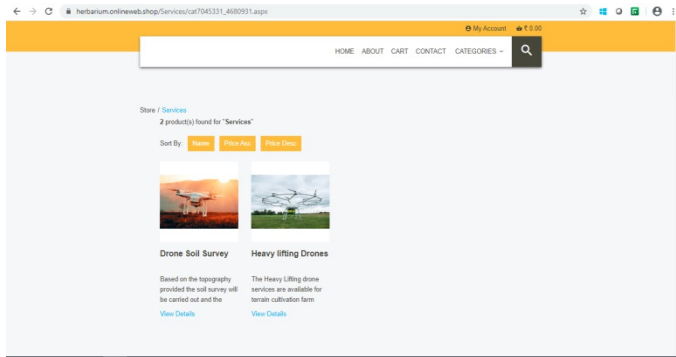


Fig 4.5 Categories – Services

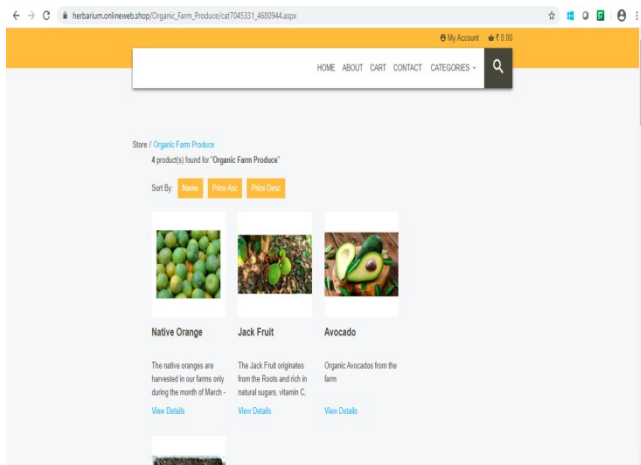


Fig 4.6 Categories – Organic Farm Produce

V. CONCLUSION

This paper emphasizes on the transformation of persona’s agricultural best practices, experience gained over years in farming, farm products and services into a cloud based marketing business model. The cloud based online store makes it easy for consumers to buy products directly from the farm website and delivered to their household. The website maintenance, listing new products, integration of carts with payment provider and customer login is simple and can easily be administered. The digital shift in the agricultural line of business will improve the profit for both the supplier and consumer, since wholesalers, distributors and retailers are not a part of the value chain. The addition of IoT and drones is a boon for agriculturist facing labor scarcity in remote areas and paves way for smart farming practices.

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