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Design Thinking and Bricolage for Frugal Innovations during Crisis

Oly Mishra[1]

[1]GITAM Institute of Management, GITAM University, Visakhapatnam, Andhra Pradesh, India | *olymishra@gmail.com*

Abstract

The rapid spread of COVID-19has created resource constraints. This study focuses on applying design thinking in frugal innovations by social entrepreneurs to face the challenges during the COVID-19 pandemic. It discusses the case of an Indian social entrepreneur who essentially provides solutions for menstrual health and hygiene to unprivileged and rural women in India. When faced with the COVID-19 pandemic, the social entrepreneur re-purposed the manufacturing process and implemented bricolage to produce masks which were the need of the hour. The manufacture of masks was a frugal innovation due to the resource constraints during the pandemic. The research paper is qualitative, and it follows an inductive case study approach. The implementation of design thinking in frugally innovating is established through the content analysis of the interviews of the social entrepreneur and her team members. It presents practical implications of design-thinking for frugal innovations by social entrepreneurs in adversity.

Keywords: Design Thinking; Frugal Innovation; Adversity; Bricolage.

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1 Introduction

This paper proposes a theoretical approach that studies the implementation of design thinking for frugal innovations by social entrepreneurs during adversity. The pandemic presented many challenges to the social entrepreneurs, especially the ones in developing countries. Social entrepreneurs create social value and leave an impact on society (Young, 2006). According to Short et al. (2009), in emerging economies like India, social entrepreneurs knowingly locate their operations in unattractive and rural areas to create more social impact. During the COVID-19 pandemic, the challenge became manifold as there were restrictions on the movement of people. It has led to rapid changes in the way social entrepreneurs carried out their business activities. The challenge has become manifold as there are more resource constraints in time, raw material, etc. The pandemic has brought about inequalities among the different sections of society. The most vulnerable section includes the ones who experience poverty or social exclusion. This is evident more in developing countries like India. Such rapid changes and constraints have taught many lessons for the future. This pandemic has taught social entrepreneurs to focus on finding new ways to make their products easily affordable.

However, the global innovation landscape is evolving and moving at a rapid pace. The urgency to innovate is more noticeable now than earlier. There is a worldwide effort to innovatively create new products and services required by the people in the 'new normal'. In this situation, the most suitable type of innovation is frugal innovation due to the lack of availability of resources and

restrictions on movement. Social entrepreneurs have done frugal innovations in other times, but the COVID-19 crisis has increased the difficulty levels for innovating frugally. So, there is a need for a human-centric approach for understanding people's problems and solving them accordingly. To do this, the only way is by implementing design thinking.

Design thinking helps to modify the current situation into the desired position (Simon, 1996). It has a significant role in addressing the unmet needs of poor people who live in limited resource economics (Papanek, 1972). To alleviate poverty and address the needs of poor people, design thinking is needed. It is used for developing and implementing appropriate ideas. It is more critical in a crisis like the current pandemic to support the marginalized communities (Jagtap et al., 2014). In the presence of resource constraints, i.e., time, raw materials, etc., frugal innovation is the only way to address people's problems. It can be said that COVID-19 has become a catalyst of change. The current unprecedented pandemic crisis has prompted a state of urgency for innovation. The innovation is being done by re-purposing the business processes to quickly implement innovative solutions for preventing the virus from spreading further.

This research paper aims to understand the activities of a social entrepreneur who re-purposed her social enterprise's manufacturing process and implemented bricolage to produce masks which were the need of the hour. The paper presents the implementation of the design thinking steps in the frugal innovation done by the social entrepreneur. It attempts to justify the practical applicability of design thinking in frugal innovation in times of crisis. The research paper finds that the social entrepreneur follows design thinking and implements bricolage to make a frugal innovation that will act as a solution during adversity. This is demonstrated with the case study of an Indian social entrepreneur, her design thinking process, implementation of bricolage, and her frugal innovation to meet people's demands during the crisis.

2 Literature Review

The current crisis and lockdowns have led to crucial material shortages due to supply chain disruptions. To help people in such times of need, frugal innovation is imperative.

2.1 Frugal Innovations

The term 'frugal innovation' has been used mainly in the context of emerging markets (Pansera and Owen, 2015; Radjou and Prabhu, 2015; Bhatti, 2014; Prabhu et al. 2017). Frugal innovations consider the needs of the poor as a starting point and then work backward to create an innovation. It is primarily found in environments with scarce resources and innovates the product with the essential features. Moreover, in frugal innovation, the available resources add value and create a new product. The uniqueness of the product is obtained by solving the challenges of the problems faced in an emerging market on a large scale (Bhatti, 2012). This requires the creation of practical solutions that need minimal resources and solve the problem also. Frugal innovations can develop this as it is associated with designing low-cost solutions to make it easily affordable for all (Woolridge, 2010; Radjou and Prabhu, 2015). Despite being low-cost, the quality of the product is not compromised, and it can also be exported to other countries (George et al., 2012).

In addition to this, Bhatti (2014) also found that frugal innovations exhibit superior product quality and performance compared to its alternatives and are inclusive. However, innovative products are generally less advanced in technology than their sophisticated counterparts due to resource constraints. But they are good enough to solve the people's main problem through their core functionality (Radjou, Prabhu, and Ahuja, 2013; Van den Waeyenberg and Hens, 2008).

Apart from the resource constraints, emerging economies like India have advantages like skilled

labor force, low cost of capital, and an indomitable spirit that triggers good quality innovation at a low price (Iyer, La Placa, and Sharma, 2006; Prahalad and Mashelkar, 2010). It is also believed that Indians possess the skills that are more apt to develop frugal innovations (Radjou et al., 2012). Thus, India has a competitive advantage in developing frugal innovations (Porter, 1990). Though frugal innovations' primary trigger point is resource constraints, frugal innovation's fundamental purpose is to address an unmet need. The lack of resources leads to a frugal attitude among people, but it also requires a collaborative approach to design the solution (Sardana, 2011). Entrepreneurs learn to improvise the product and the process when there are constraints. The constraints unleash entrepreneurs' creativity and resilience to design and develop solutions that work by overcoming limitations imposed by social norms or policy (Sheth, 2020).

There have been several definitions of frugal innovation given by several researchers, the most applicable definition in this study's context is that given by Prabhu (2017). It states that frugal innovation creates faster, better, and cheaper solutions for more people that employ minimal resources. This definition is in sync with the case discussed in the research paper and brings about the real meaning of frugal innovation. The frugal innovations must be made accessible, affordable, and available to the people in backward areas (Prahalad, 2012). Social entrepreneurs can only take such initiatives to create awareness about the frugal innovation among the people in backward areas and improve their lives. Frugal innovation is considered a new and creative form of democracy in which innovation is led by the people, for the people, and with the people" (Radjou et al., 2012). The current case study is an example of one such social entrepreneur and their frugal innovation, which has helped people in backward areas to follow safety norms during the pandemic. It also influences the socio-economic development of the backward regions due to the democratizing effects of frugal innovation (Mishra, 2021). The people living in these regions generally constitute the 'Bottom of the Pyramid'.

2.2 Bottom of the pyramid

The term 'bottom of the pyramid' was first used by Prahalad and Hart (2002). The poor are described as an exciting as well as an invisible opportunity for multi-national companies. This market segment is characterized by the lack of purchasing power and lack of interest in new technology. They are neither value nor brand conscious, and distribution and reaching out to them is complex. However, the reality is that these consumers aspire for a better life and require good quality products at a low price.

Prahalad and Hart (2002) explain that multi-national companies will have to innovate and introduce new products for the BOP segment. The poor aspire to live a better life, and multi-national companies must shape these aspirations of the poor by developing targeted solutions for them. Simanis and Hart (2008) gave a new BOP proposition known as BOP 2.0 where they admit some limitations of "first-generation" BOP strategies. The main difference of BOP 2.0 compared to the first generation is seeing the BOP segment as a business partner, not just as a mere consumer. In other words, multi-national companies should engage in a dialogue and create direct and personal relationships. It should focus on "Business Co-Venturing", as opposed to "Selling to the Poor" (Simanis and Hart, 2008). The core of BOP 2.0 strategies lies in the co-creation of value with the BOP (Simanis and Hart, 2008; London and Hart, 2010; Nahi, 2016).

There are three phases of BOP 2.0 is given by Simanis and Hart (2008), where the corporate partner and the community work side-by-side. The 1st phase deals with creating a new business idea, forming a project team, and nurturing the people's entrepreneurial skills in the community. The 2nd phase refers to the strengthening of the group, its skills, and capabilities. The gaps in the team are identified and rectified through action learning between the corporate and the

community. In the 3rd phase, the community members are made a part of the innovative product. Their capabilities are developed in such a way that they can continue the business. Further, the community's designs are part of the offering, and the supply chain is embedded in the community. This way, the scope of the business is continuously expanded.

Cañeque and Hart (2015) gave the BOP 3.0 by improving partnerships with educational institutions, microfinance institutions, social enterprises, non-governmental organizations, and government agencies. These partnerships will work to improve the areas of innovation and distribution. It will be embedded in the larger innovation ecosystem. The aim is to ensure that the cost of innovating is reduced without compromising the quality of the product and utilizing the resources efficiently. The partnership will also help in resolving the issues regarding distribution channels. They will help create a shared medium that can carry a large variety of products to the rural areas so that the costs can be reduced. The partners need to specialize in some aspects of distribution such that the market access and customer awareness are high in the BOP segment. To solve the problems that the BOP segment faces, companies must think differently. In other words, they need to have a holistic approach to solving the problem, which is possible by 'design thinking'.

2.3 Design Thinking

The term 'design thinking' implies a set of methods for innovation and also a mindset. Companies are involved in innovation-related activities which are based on the direct insights from their consumers or end-users. This approach to innovation by collecting the insights from the end-users are known as design thinking. It requires an open mind filled with curiosity so that the problems of the end-user can be reframed. According to Brown (2009), design thinking is a means to provide innovative solutions. This deals with changing how the problem can be approached and solved. One of the earliest definitions of design thinking was given by Archer (1979). It is a different way of thinking from scientific thinking but is as powerful as scientific and scholarly methods of inquiry when applied to its kinds of problems.

There has been a growing interest in design thinking due to the creativeness and innovation that it adds to an existing process for transforming and creating more knowledge. It helps in the creation and builds a sense of community (Brown and Wyatt, 2010). It brings together people from different walks of life and life experiences to work towards the goal of developing a human-centered solution. It creates a solution by effectively engaging the community through interaction to benefit society (Kummitha, 2019). It is an innovative method and an effective tool to address complex problems (di Russo, 2016).

In the 1990s, the concept of design thinking gained more popularity and acceptance with the design thinking model introduced by IDEO. The model is also known as the 3I's Design Thinking Model. The 3Is of Design Thinking are Inspiration, Ideation, and Implementation. Many other design thinking models were developed later, but mainly three phases are seen in these models(Brown 2008; Luchs 2015; Seidel and Fixson 2013). The main focus of these models has been on fostering a creative process of problem-solving and human-centric innovation. It uses the insights from the end-user (Jaruzelski, Chwalik, and Goehle, 2018). This leads to experiential learning (Kolb, 1984), and the learning takes place through experiences and conceptualization (Beckman and Barry, 2007).

Since innovation is the order of the day, many companies have been implementing design thinking in their organizations. Some organizations have modified design thinking to suit their organization, like Google's 3E model. Thus, it can be said that a lot of attention has been given to design thinking from academic and industrial perspectives. Also, a considerable number

of research studies depict the fundamentals of design thinking and its relation as well as an application for different forms of innovation like social innovation. In this study, an attempt has been made to relate design thinking with frugal innovation during a crisis. The design thinking model developed by Stanford design school (2010) has been used for this study. An in-depth research and analysis have been conducted on a social entrepreneur in India who implemented design thinking to innovate frugally to meet the needs of rural people during the COVID-19 crisis.

2.4 COVID-19 crisis

On March 11, 2020, the Coronavirus outbreak was declared a pandemic by the World Health Organization (WHO) (Liguori and Winkler, 2020). People's lives changed suddenly due to movement restrictions, which ultimately led to a reduction in economic activity. It created an emergency kind of a situation that needed to be addressed proactively. According to Doern (2016), a crisis can be perceived as a threat and an opportunity. Governments, institutions, entrepreneurs, and innovators have responded quickly to the challenge posed by the COVID-19 pandemic. Entrepreneurship research has never seen a virus like this (Kuckertz et al. 2020). The COVID-19 pandemic led to new societal challenges and aggravated the social problems existing for several decades.

Kuckertz et al. (2020) predict that those regions that have had high entrepreneurship levels in the pre-crisis period will be able to overcome this jolt. Entrepreneurship is needed in crises, and the links between firms, universities, and governments should be utilized to handle the problem. According to the World Health Organization (2020), social entrepreneurship can help solve some of the most pressing concerns caused by the COVID-19 crisis. This is because social entrepreneurship is a better fit in contextual conditions and can be more responsive to society's needs and incorporate community and non-profit goals. Social entrepreneurship also focuses on the role of communities to implement a collective approach for solving social problems. However, this requires the social entrepreneur to practice design thinking and adjust their entrepreneurial capabilities to suit the new market conditions.

Moreover, a crisis like the COVID-19 pandemic brings along a lot of ambiguity for social entrepreneurs. Social entrepreneurs are proactive and willing to accept change. Crises bring about a lot of uncertainty, which requires new approaches from social entrepreneurs (Weick and Sutcliffe, 2011). Due to the ambiguous nature of events during a crisis, they need to continue with the available resources. This leads to the creation of new knowledge, resulting in long-term learning. This can lead to identifying new solutions by design thinking and implementing them through frugal innovations. Therefore, social entrepreneurs practice design thinking to implement frugal innovations in times of crisis like COVID-19 to provide innovative products and meet society's new needs.

2.5 Bricolage

Any social enterprise's success depends on the resources that the business can organize to carry out its operations. This is even more challenging for the social entrepreneurs during a crisis as there is more uncertainty involved. Social entrepreneurs are not financially influential. They are often resource-constrained (Aldrich, 1999), and during an emergency, there is an immediate need to find a solution, leading to time constraints (Bourgeois and Eisenhardt, 1988). They, therefore, need to exploit the opportunities that are available to them. According to Grossman, Yli-Renko, Janakiraman (2012), the resource environment is highly uncertain, and social entrepreneurs must always search for the critical resources suitable to their requirements. It has been observed that in BOP areas, the required resources are identified and arranged through informal methods (Zoogah,

Peng, and Woldu, 2015). Apart from resources, the social network, planning capabilities, etc., also must be organized informally for bringing a transformation in the lives of the people at the bottom of the pyramid through the social enterprise (Rivera-Santos, Holt, & Littlewood, 2015). This is referred to as 'bricolage'.

The term 'bricolage' was introduced by Levi-Strauss (1966), which refers to the recombination of the available resources to pursue unique opportunities. It has been recognized as an essential strategy to handle resource constraints, especially in poverty-stricken areas (Garud and Karnøe 2003; Stinchfield, Nelson, and Wood 2013; Baker and Nelson 2005; Baker, Miner, and Eesley 2003). According to Baker and Nelson (2005), bricolage is the inclination of companies to 'make do' by combining resources that can be used to solve problems and create new opportunities. Therefore, social entrepreneurs are alert about the available resources and the possibility of addressing using the available resources. Social entrepreneurs shape and pursue opportunities to create value for the people at the bottom of the pyramid. Such social entrepreneurs indulge in bricolage as they do not accept limitations (Molecke and Pinkse, 2017). Bricolage is also considered a type of resource transfer as social entrepreneurs realize a resource's hidden potential and use it accordingly (Clough et al., 2019). It is an approach that supports social entrepreneurs to achieve their goals even in harsh environmental conditions.

Social entrepreneurs have been applying the concept of bricolage in their enterprises and have emphasized community engagement and stakeholder participation (Di Domenico, Haugh, and Tracey, 2010; Gundry, Kickuo, Griffiths, and Bacq, 2011). It is a constraint shattering mechanism to mobilize resources by combining the resources at hand (Senyard, Baker, Steffens, & Davidsson, 2014). It is done with a social mindset (Di Domenico, Haugh, & Tracey, 2010; Linna, 2013). Opportunities can be exploited only when resources are available (Bhawe, Rawhouser, and Pollack 2016). The resources constraint is even more severe in social entrepreneurship as good quality resources are scarce, especially in developing countries (Desa and Basu 2013; Zahra et al. 2008). So, they try to make the most of limited resources (Sunley and Pinch 2012). Therefore, social bricolage is essential in times of crisis for meeting the needs of people at the bottom of the pyramid (Musona, Sjögrén, Puumalainen and Syrjä, 2020).

The ambiguity and uncertainty caused by a crisis force the social entrepreneurs to continue their activities with the available resources. A crisis can also act as an opportunity and lead to new knowledge, which results in long-term learning. This can lead to unique product innovations. Therefore, social entrepreneurs should use design thinking and bricolage to introduce a frugal innovation for people at the bottom of the pyramid in times of crisis, like the COVID-19 pandemic. In the proposed paper, an attempt has been made to study a social entrepreneur who provided innovative products to meet people's immediate needs at the bottom of the pyramid.

3 Methodological Procedures

This section presents the research design, research setting, research quality criteria, and data collection.

3.1 Research design

This research follows a qualitative approach with descriptive analysis as it helps to achieve the objective of this study, i.e., to understand the activities of a social entrepreneur who has implemented design thinking to frugally innovate a solution that meets society's needs during a crisis. The researcher has adopted an inductive single-case study approach. This is a commonly used approach as it is helpful for research works that aim to obtain a first-hand understanding of

people and events (Yin, 2004). Such a research design allows studying and analyzing an object of inquiry from different perspectives of multiple actors operating within the same setting. It also helps develop an in-depth understanding of how the activities are conducted (Miles and Huberman, 1994). This method was chosen as it is the most appropriate approach to conduct research work that is rigorous and practical at the same time. Such a case analysis offers better insights into a specific context. The theory about social entrepreneurship and frugal innovation in times of adversity is limited in nature. An inductive single-case study was adopted to exhibit a relationship between design thinking, social bricolage, and frugal innovation in times of crisis. It also supports a thorough analysis of a case within its real-life context. This design helps to capture the complexity and richness of the underlying phenomenon. An inductive approach is needed to link this research study's findings with the existing theories about design thinking, social bricolage, and frugal innovation. According to Ozcan and Eisenhardt (2009), the inductive approach helps develop insights in the research area with a limited theory to support it. There is limited research about design thinking, social bricolage, and frugal innovation being implemented by social entrepreneurs for people at the bottom of the pyramid, especially in crises like the COVID-19 pandemic.

In the same manner, Siggelkow (2007) stated that the single case-study approach describes the phenomenon's presence. Case studies can have either a single purpose or a combination of an exploratory, descriptive, or explanatory definition in explaining the phenomenon (Yin, 1994). Moreover, a single case research is well-known for its explanatory power and attention to context. Keeping this in mind, the social enterprise 'Vyomini', was taken up for this study. The social enterprise chosen is an appropriate and typical example of social entrepreneurship that implemented design thinking, social bricolage, and frugal innovation during a crisis. From a methodological point of view, the choice of the social enterprise 'Vyomini' as a single case follows the suggestion given by Seawright and Gerring (2008) and Leoni (2015). In line with the journal's focus, the research paper identifies and highlights the application of design thinking and bricolage by social entrepreneurs for developing a frugal innovation that will meet the demand of critical products for the people at the bottom of the pyramid in emerging economies like India. This research is based on an interpretive paradigm supported by inductive reasoning that contemplates the relationship and the interconnection between the study's theoretical proposition and the evidence presented by the case study (Gehman, Glaser, Eisenhardt, Gioia, Langley, and Corley, 2018).

3.2 Research Setting

India is chosen as the research setting for this study. It is the ideal research setting as the research had to be carried out in an emerging economy. Social entrepreneurs and frugal innovations are primarily found in emerging economies. Social entrepreneurs mostly work to improve society through their frugal innovations. Moreover, the lack of resources in emerging economies like India has made it one of the leading countries in terms of frugal innovations. Indian social entrepreneurs have put more effort into creating solutions for addressing social problems (Silva et al., 2015). The social enterprise has chosen for this research paper, Vyomini, is working on manufacturing and providing sanitary napkins of the best standard to the rural women of North India. The social entrepreneur aimed to remove 'period poverty', so it was decided to manufacture sanitary napkins using locally available fibers. This made it affordable to rural women. Along with providing them with sanitary napkins, the social entrepreneur also trained them in the sanitary napkins' manufacturing process. This way, it was ensured that rural women become independent through entrepreneurship. During the COVID-19 the social enterprise, along with its network of women entrepreneurs, was able to manufacture masks alongside sanitary napkins. This was possible by the implementation of the design thinking process along with bricolage by the social entrepreneur.

It helped her to introduce a frugal innovation for the people at the bottom of the pyramid.

3.3 Research Quality Criteria

Regarding research rigor, the single-case study has been studied in detail as these are considered ideal for revelatory cases where the researcher may have come across a new phenomenon. Single cases may represent a unique case in the recent phenomenon (Yin, 1994). The new phenomenon is applying design thinking and bricolage for implementing a frugal innovation by social entrepreneurs during the crisis for people at the bottom of the pyramid. This kind of crisis was previously inaccessible as COVID-19 has brought new challenges to entrepreneurs, especially social entrepreneurs. The benefit of a single-case study is that they are holistic. Yin (1994) suggested using multiple sources of evidence to ensure construct validity in a single case study. The current study has used multiple sources of evidence, i.e., interviews, social media, newspaper articles, and official documents. This way, the triangulation of data collection techniques, as advocated by Yin (2015), for case studies was followed. The interviews were conducted with the social enterprise's employees at different levels to understand how they implemented design thinking and bricolage for creating a frugal innovation during the crisis.

The selection of the case study is purposive. It is a descriptive case study as it presents a rarely encountered situation that is not ordinarily accessible to researchers. The case of the social enterprise, 'Vyomini', was selected based on the following criteria:

1. The enterprise has been working for a social cause.
2. It has originated and belongs to an emerging economy, i.e., India.
3. It is a typical case to explain the implementation of design thinking and bricolage for making available a frugal innovation.
4. The frugal innovation was implemented to meet the critical needs of society in times of crisis.
5. It has been working with people at the bottom of the pyramid.

Since the social enterprise, 'Vyomini fulfilled these criteria', it was selected for the study. The reason for choosing a social enterprise is following Srivastava and Shainesh's (2015) finding that social sectors are vital for the inclusive growth of emerging economies. This is also based on Ratten's (2020) proposition that social entrepreneurship is needed more in times of a crisis due to societal well-being. Moreover, a typical revelatory case is considered a representative case for explaining a new phenomenon that has not been observed earlier. Thus, the researcher has chosen this case so that further studies can better explore the application of design thinking and bricolage for implementing a frugal innovation at BOP in times of crisis.

3.4 Data collection

Following Yin (1994), the data was collected from the following sources:

- Interviews with the social entrepreneur and the employees at different business units.
- Corporate documents
- Newspaper articles
- Social Media posts on platforms like Twitter and LinkedIn

The interviews are the primary source of the data analyzed in this case study. All of them aim to understand the application of design thinking and bricolage for implementing a frugal innovation at BOP to meet the critical needs of the rural people during the COVID-19 pandemic, with specific reference to the period from March 2020 to September 2020. The primary source of information was the interviews with the social entrepreneur and her team members at different production units. The team members included the Founder, Project Manager, Project Officer, Trainer, and

other employees who work along with them in the production process. The required information was gathered through semi-structured interviews on Zoom calls and telephone conversations. Information was also collected through e-mail correspondence with the key resource persons in the social enterprise like the Founder, Team leaders in various business units, Project managers, and Project officers. To better understand the type of informants and give an overview of the interviews, see Table I.

Table 1. Interview Overview and data sources

Source	**Participants Designation**	**Number of Participants**	**Time** (Approximately)	**Information used for analysis**
Primary Sources: Semi-Structured Interviews	Social Entrepreneur *[SE]*	1	45 mins	Understanding the need for frugal innovation, implement design-thinking and bricolage during the crisis.
	Project Manager *[PM 1 and PM2]*	2	40 mins	Understanding the steps undertaken during design-thinking and the preparation required to bricolage and implement the frugal innovation.
	Project Officer *[PO1 to PO4]*	4	30 mins	
	Trainer *[T1 to T4]*	4	35 mins	Understanding how the design thinking and bricolage plan was communicated to the employees.
	Employees *[E1 to E19]*	19	40 mins	Understanding the implementation of frugal innovation.
Secondary Sources	Corporate documents Social Media Newspapers			Gaining knowledge about the social enterprise's activities during the crisis. It helped in triangulation of information.

There were 30 interviews conducted with the people involved in the working of the social enterprise. Each interview lasted for about 30 - 45 minutes. These interviews were recorded and then transcribed. For further clarity, the participants of the study were contacted through e-mails. The secondary information was collected from social media posts of the official page of Vyomini on Twitter, LinkedIn, and press articles in regional newspapers.

The interviews were conducted to understand the social entrepreneur's design thinking process and bricolage for implementing frugal innovation and meeting the people's immediate needs during a crisis. The questions aimed to understand how the social entrepreneur solved the problem of the people at the bottom of the pyramid by using design thinking process.Table II presents the list of the important interview questions that were asked to the 30 participants of the study.

Table 2. Interview Questions

1.	What is your social enterprise mainly producing?
2.	How was your business going before the COVID-19 pandemic, i.e., before March 2020?
3.	Why did you bring a change in your business operations?
4.	How did you plan to bring a change in your business activities?
5.	How did you implement the change?
6.	How did you communicate the change to your employees?
7.	How much time did the whole process of bringing the change take?
8.	What was needed to introduce the proposed change?
9.	How did you manage the materials that were needed for introducing the change in the production process?
10.	How did you train your employees to carry out the new manufacturing process?
11.	What was the response from your suppliers regarding the changed business activities?
12.	How did you ensure that the raw materials and the finished products, reached on time?
13.	What measures did you take to overcome the various limitations imposed during lockdown?
14.	How did you ensure that the masks produced were of the right quality?
15.	Did you connect with other organizations or individuals for support?
16.	How many villages could you reach out to?
17.	What about the production of sanitary napkins? Was it continued?
18.	What were your supply chain measures?
19.	What challenges did you face while introducing this change?
20.	Was there a smooth transformation of the business processes?

Apart from these, some additional questions were also asked based on the participant's information at that moment.

4 Analysis

For this study, a denaturalized transcription technique has been adopted. According to Nascimento and Steinbruch (2019), denaturalized transcription is better suited for performing content analysis. This is because it captures the whole sentence of the interview with the maximum possible details. It aims at presenting the data collected from the interviews naturally as well as accurately. The speech description and the writing are done clearly and in detail (Bucholtz, 2000). The analysis in this research paper also follows an inductive approach (Corley and Gioia, 2004; Glaser and Strauss, 1967). The inductive approach allows to describe the participants' words and develops a proposition to explore the concepts that have not yet been covered in the existing literature (Bryman, 2004). The information obtained from the interviews conducted with the social entrepreneur and her team was coded using an inductive approach (Mair et al., 2012). The data collected was reduced in two steps (Vissa, 2012). As part of the analysis, the portions of the interview relevant to the research study have been listed as the first-order concepts. Then following the Gioia method (Corley and Gioia, 2004), patterns within and across the first-order concepts were searched to filter the overall themes. These themes contained the relevant information following the research study's objective. From the first-order concepts, the second-order themes were extracted in the first step and then categorized into aggregate dimensions in the second step. The aggregate

dimensions have matched with design thinking principles as given by Stanford Design School (2010). The researcher has used NVivo11 software to find out the similarities and group them into aggregate dimensions. It helped in searching for themes that emerged relevant to the objective of the study. Table III presents the inductive process of extracting the aggregate dimensions and the participants' sample codes in the research study.

Table 3. Sample codes from interview participants

First-order concepts	Second-order themes	Aggregate dimensions
We observed that the people in rural areas were covering their faces with cloth	Understanding others' problems	**Empathize**
We asked rural people whether they had access to masks	Naïve questioning to know more about the people and problems they are facing	
On interacting with our women entrepreneurs' network, we realized that they were not even aware of the importance of masks	Interrogating about the awareness of the problem	
There was a need to create awareness about social distancing, cleaning hands, not touching the face, and wearing masks among the rural people to protect themselves from COVID	Immersing in the problem	
There were no masks available in the local shops of the nearby villages	Problem scoping	**Define**
People were worried about their work, source of income, etc. and the health of family members	Outlining the challenges	
There was a scarcity of raw materials and restrictions on the movement of people due to the lockdown	Identifying the pain-points	
We decided to manufacture masks and train through our women entrepreneurs' network	Solution development	**Ideate**
We conducted training sessions to create awareness about the pandemic and the safety protocol that needs to be followed	Consider different ways to address the problem identified	
We took into consideration the suggestions given by all team members.	Brainstorming with the team members	
We received help from SIDBI, NABARD, and other such organizations to start producing COVID-19 protection items.	Arrangement of financial resources	
We decided to make 2-layered and 3-layered masks at our manufacturing units	Deciding to make use of existing capabilities	
We were in touch with our women entrepreneurs and encouraged them to continue working.	Communication with team members and grass root level workers	
The already known skill of the women entrepreneurs i.e., stitching, was utilized for making masks.	Arrangement of skills required	**Bricolage**
Available resources were used to start the manufacture of masks	Capabilities matching	

First-order concepts	Second-order themes	Aggregate dimensions
The non-woven sheet used in making sanitary napkins was placed between two layers of cloth to manufacture a 3-layered mask	Utilizing available resources	
Existing raw material that we had with us was enough to make masks as well as sanitary napkins	Capacity matching	
Essential 2-layered cotton masks with tie-ups were manufactured	Sample masks were made	**Prototype**
A non-woven sheet was used in making 3-layered masks	Varieties of masks were made using the existing resources	
The finished product was distributed locally for trial	Improvisation of product	
The difficulties faced by the people after using the masks were taken into consideration.	Understanding the issues with the product.	
The centers in different locations were given the freedom to make decisions on their own about manufacturing	A decentralized approach helped in getting more valuable inputs from the users	
The issues faced by the people were addressed, keeping their concerns in mind.	Iterating the process	
The feedback on the locally distributed masks was collected	A trial of the masks was done, and feedback was used for improving the product	**Test**
The approval and permissions from regulatory bodies were obtained to start manufacturing	The quality of the masks was put to the test	
We tested the masks by wearing them while working	Examining the issues with the product	

5 Findings

When the COVID-19 pandemic struck, almost all countries' governments announced lockdown and had to stop their business operations. However, the social entrepreneur referred to in this research study attempted to connect with her women entrepreneurs' network in the rural areas of north India to find out about their well-being. The social enterprise was manufacturing sanitary napkins, which they continued to manufacture as it was categorized under essential products by the government. The women entrepreneurs' networks communicate to continue making sanitary napkins while following the government's safety protocols. The social entrepreneur was vigilant about the various sanitization and hygiene products required during the pandemic. When enquired about the women who were a part of their women entrepreneurs' network, they informed that they were worried about their income as the lockdown had led to the stoppage of their income from agricultural and other activities.

This led the social entrepreneur to realize that there is a need to respond quickly to the changes in the business environment. The social entrepreneur quickly connected with government bodies, other self-help groups, their women entrepreneurs' networks, etc. The effort of the social

entrepreneur to promptly contact others in her network was well-received in the form of prompt responses. The women entrepreneurs' network members were reached through the Project officers and trainers dedicated to each area (Uttar Pradesh, Haryana, Bihar, etc.). While the primary motive of contacting them was to inform them to continue manufacturing sanitary napkins, it was also felt that there was a need to provide them with masks. The social entrepreneur then implemented the Design thinking steps given by Stanford Design School (2010) to develop frugal innovation. It was also observed that apart from the design thinking principles, bricolage was another key concept that the social entrepreneur implemented to provide the rural people of India with a frugal innovation that met their immediate needs.

To do this, the entrepreneur had to communicate with the rural women entrepreneurs. The aim was to emphasize the importance of following the COVID safety protocols like wearing masks, maintaining social distancing, etc. This was done through video calls on computers or mobile phones. Since India's rural parts are not well-versed with technology, the existing infrastructure facilities that the government of India set up were utilized. For example, Common Service Centres are found in almost every village of India. The government set these up in 2006 to empower rural entrepreneurs digitally at the village level. The trainers and Project managers used these at centers to carry out training sessions for rural women. The training session aimed to explain to the women entrepreneurs about re-purposing their activities and manufacturing items in high demand during the crisis. They were also briefed about WHO's quality standards and medical lab specifications that needed to be followed. The production of masks was then started following social distancing norms and other protocols.

From the inductive single case study analysis, it has been found that the social entrepreneur was successfully able to handle the crisis and manage the production of essential items, i.e., masks and sanitary napkins. This was possible by implementing the design thinking process along with bricolage for making a frugal innovation. This can be understood from the findings of each step followed by the social entrepreneur while carrying out this process.

5.1 Empathize

The social entrepreneur had been working in close coordination with the rural women in her entrepreneurial network. The initial business activity of the social entrepreneur dealt with making sanitary napkins. She understood that only creating awareness in rural areas will not be sufficient. She aimed to provide an affordable solution to rural women for maintaining menstrual hygiene and making them financially independent by getting them involved in the manufacturing process. She aimed at eradicating period poverty. She realized that the distribution of sanitary napkins among rural women would not solve the problem as they were expensive. This made the social entrepreneur empathize with the problem faced by the rural women, and the decision to manufacture a cost-effective and eco-friendly sanitary napkin was taken.

At the onset of the pandemic, the social entrepreneur was worried about the health and well-being of rural women. She contacted them and tried to determine if they were aware of the pandemic and the safety measures to be followed. On interacting with them, she realized that they were more worried about their income and the lockdown that the government imposed. It was observed that the rural women were covering their mouths with their clothes like saree or dupatta, and the rural men would cover their mouth with a handkerchief or towel. They were tensed about their future and the ways to meet their day-to-day expenses. From the following quotes by the social entrepreneur (SE), project trainer (PT), and project officer (PO), it is understood that the social entrepreneur empathized with the rural women.

We observed that the people in rural areas were covering their faces with cloth. [SE]

We realized that they were not even aware of the importance of masks. [PT1]
There was a need to create awareness about social distancing, cleaning hands, not touching the face, and wearing masks among the rural people to protect themselves from COVID-19. [PO1]

The social entrepreneur informed them about the safety precautions that need to be followed and explained the pandemic. The reason for the lockdown was also explained to them, which helped reduce their fears to a certain extent. The worry about the source of income was mainly because the men in most rural households had migrated to the nearby cities to work as laborers. They were now forced to come back to their villages due to a lack of work and money. The social entrepreneur asked the women to continue the manufacturing activity of sanitary napkins like they were doing earlier. She also assured them of their payment on time as sanitary napkins were listed as essential items. This assured them of income and reduced their fears to a certain extent. Thus, it can be observed that the social entrepreneur heard their problems and worries with compassion and decided to address them at the earliest.

5.2 Define

The social entrepreneur then immersed herself in defining the problem and working to achieve a suitable solution. The problem could be defined as the dual concern of the rural women about the health and well-being of their families and a source of steady income. The fear and worry about the uncertainty of health and income had to be addressed. From the following quotes by the social entrepreneur (SE), project trainer (PT), and project officer (PO), it can be understood that the social entrepreneur was able to define the problem faced by the rural women correctly.

People were worried about their work, source of income, etc. and about the health of family members [SE]
There were no masks available in the local shops of the nearby villages [PT1]
There was a scarcity of raw materials and restrictions on the movement of people due to lockdown [PO2]

The social entrepreneur and her team were able to define the problem after the communicating with the rural women. They were asked several questions to understand their condition better. They were counselled accordingly so that their worries could be put to rest.

5.3 Ideate

Once the problem was defined, the social entrepreneur then started working with her team members to generate different ideas to address the issue. The idea was to provide an affordable solution to rural women to maintain their health and get them involved in the manufacturing process. The social entrepreneur realized that the participation of the rural women in the manufacturing activity was necessary to utilize their time correctly and earn more for their families. There were brainstorming sessions among the team members of the social enterprise to find out a suitable solution to the problem. The recommendations of all the team members were taken into account, and it was decided that the women entrepreneurs would be making masks for protecting the people in the nearby villages from the corona virus. Thus, she started the research on how masks can be manufactured while following the safety protocols given by the government. From the following quotes by the social entrepreneur (SE), project trainer (PT), and project officer (PO), it can be understood that the social entrepreneur and her team generated the right ideas to solve the problem faced by the rural women.

We decided to manufacture masks and train through our women entrepreneurs' network.

[SE]
We conducted training sessions to create awareness about the pandemic and the safety protocol that needs to be followed. [PT1]
We took into consideration the suggestions given by all team members. [SE]
We were in touch with our women entrepreneurs and encouraged them to continue working. [PO2]

The social entrepreneur attempted to solve the problem with the idea of manufacturing masks. The idea appeared to be the best possible solution as masks were the need of the hour. The villagers were not aware of the need for and importance of masks. Moreover, they did not have access to masks. The idea of manufacturing masks would help the villagers by giving them access to masks. It would act as an additional source of income for the women entrepreneurs during the pandemic. The idea was to manufacture masks and sanitary napkins as both were hygiene-related products and listed among the essential products.

5.4 Bricolage

The concept of bricolage refers to creating a product from whatever is available. The social entrepreneur had earlier followed the principle of using the locally available raw materials, i.e., natural fibers, in making sanitary napkins. A similar method was applied for making masks also. The suppliers of the social enterprise were contacted, and they were asked to continue supply. These materials were used for making sanitary napkins as well as masks. The experience of making sanitary napkins was useful for making another hygiene-related product, i.e., masks.

There was also support from the local government officials and leaders to manufacture and supply masks and sanitary napkins. This way, the existing resources were made use of in the best possible manner, and the social entrepreneur ensured that the COVID-19 protection items could be manufactured along with sanitary napkins. From the following quotes by the social entrepreneur (SE), project trainer (PT), and project officer (PO), it can be observed that the social entrepreneur and her team implemented bricolage in network, skills, and raw materials to carry out the manufacture of masks.

The already known skill of the women entrepreneurs, i.e., stitching, was utilized for making masks. [PT2]
Available resources were used to start the manufacture of masks. [SE]
The non-woven sheet used in making sanitary napkins was placed between two layers of cloth to manufacture a 3-layered mask. [E2]
The existing raw material that we had with us was enough to make masks as well as sanitary napkins. [PO4]

To address the problem defined earlier by the social entrepreneur, she researched various websites like World Health Organization (WHO), Indian Medical Association (IMA), etc to find the most suitable materials for making masks. She found that the surgical masks were made up of non-woven cloth, which was the same material used to make sanitary napkins. She realized that the women entrepreneurs in her network could easily manufacture these masks as they already had this material. Similarly, she found that WHO also approved cloth masks. She asked the rural women entrepreneurs to use the stitching skill they already knew to make two-layered cloth masks. For the cloth masks also, they used the cotton cloth that was available with them. In this manner, almost all the necessary materials for making masks were obtained from the sanitary napkin manufacturing materials. Thus, the idea of making masks as well as sanitary napkins was implemented practically through bricolage.

5.5 Prototype

The implementation of the idea of the social entrepreneur was possible by the iteration of the process of manufacturing the masks. The aim of the whole process was to design a mask that could be manufactured from the materials already available with the women entrepreneurs and provide a human-centric solution to their problem. To achieve this aim, the social enterprise worked continuously to improve the mask that they made. This was done by carrying out the manufacturing process at the various manufacturing units. There were 15 manufacturing units of the social enterprise spread across the states of North India. They were given the freedom to decide the type of mask they would like to manufacture so that the mask could be made as per the demand of the people nearby that area. Before the units started large manufacturing of the masks, prototyping was done by the social entrepreneur along with her team members. This was explained to the rural women entrepreneurs to try out these prototypes in their manufacturing unit and nearby areas. From the following quotes by the social entrepreneur (SE), project trainers (PT), and women entrepreneurs (WE), it can be understood that the social entrepreneur and her team created prototypes to provide the best possible product to the people.

> *Essential 2-layered cotton masks with tie-ups were manufactured. [WE2]*
> *The non-woven sheet was used in making 3-layered masks. [WE8]*
> *The difficulties faced by the people after using the masks were taken into consideration. [PT2]*
> *The finished product was distributed locally for trial. [SE]*
> *The issues faced by the people were addressed, keeping their concerns in mind. [WE3]*

Prototyping helped the rural women entrepreneurs get more clarity about the design of the masks and save time spent and cost incurred by them. Some units initially started manufacturing the 2-layered cloth mask with ear loops, according to the initial discussion. This was used by the rural women themselves while working to identify the areas of improvement. They felt that instead of the ear loops, tie-ups could be used. Tie-ups let the user adjust the mask as per their need. Some units manufactured the single-layered surgical masks; this was not so well-accepted by the villagers as they felt it was loose. So, changes were made following the needs of the people so that they accept and use the product. The purpose of prototyping was to initiate a conversation with the local people around the masks, followed by exploring and evaluating them. This purpose was achieved, and it also paved the way for having conversations about the importance of using masks.

5.6 Test

Once the different prototypes of the product have been created, they are put to testing. Testing aims to improve user satisfaction. Since the social entrepreneur wanted to develop a human-centric solution for rural women entrepreneurs', the user's satisfaction with the product was important. By gathering first-hand user feedback, the social entrepreneur and her women entrepreneur network could introduce a variety of good quality masks at affordable prices. The quality of the masks was also ensured by getting appropriate tests done by the regulatory bodies and by following the guidelines given by World Health Organization and Indian Medical Association. From the following quotes by the social entrepreneur (SE), and women entrepreneurs (WE), it can be understood that they tested their products effectively before starting large-scale production.

> *The feedback on the locally distributed masks was collected. [WE7]*
> *The approval and permissions from regulatory bodies were obtained to start manufacturing. [SE]*

We tested the masks by wearing them while working [WE5]

The social entrepreneur and her team emphasized that they would manufacture a good quality product affordable. The mask was thus, tested first by the team members themselves. They wore the masks made by them while carrying out their daily activities. This helped them to get a first-hand experience of the product that they were making. They did a lot of the product testing on themselves, their family members, and other near and dear ones. The various prototypes of masks made by them would be worn by the women entrepreneurs throughout the day while working. This helped them in finding out the problems with each prototype and thus, improving it. This also constituted a form of testing as the women entrepreneurs tested the masks themselves and created the best possible product.

6 Discussion

Based on the findings presented above, it is clear that social entrepreneurs need to be proactive, agile, and quick in solving people's problems in times of crisis. They should be able to take calculated risks and also innovate quickly. Social entrepreneurs should identify the problem, arrange for resources to solve the problem, and innovate frugally. During a crisis, there ought to be resource scarcity, but it has been observed that resource scarcity tends to drive the creation of social entrepreneurs. This is because they have been dealing with many such challenges and addressing them through innovation (Alarifi et al., 2019). They are also required to be proactive as it involves thinking about different ways in which the resource constraints can be overcome (Corsini et al., 2018; Turpin and Shier, 2020). In resource-constrained situations, social entrepreneurs carry out frugal innovation as it is the most feasible form of innovation and helps bring about a transformation along with regional development (Zahra, 2021). Thus, a social entrepreneur has to solve the problem by reducing the cost incurred and making a good quality product rapidly by using the existing skills, knowledge, competencies, and resources. In other words, they have to achieve more with limited resources in an unpredictable business environment (Kuckertz et al., 2020).

According to Smith and Riley (2012), a crisis can be handled only when business organizations take immediate decisions and implement them. This is true irrespective of the size and type of the organization. There is a need to study how a crisis is managed in social enterprises to bring a change at the bottom of the pyramid. Branicki et al. (2018) suggest that handling a crisis is more challenging for a social enterprise when compared to other enterprises. Still, they are flexible and adapt to the changes in the crisis environment quickly. The research study on social enterprise found that frugal innovation was the only way to address the problem. It also found that the social entrepreneurs feel the pain as their own when they try to solve it. In this regard, it has been observed that the social entrepreneur's steps are those of the design thinking process. While design thinking is an iterative process used to tackle problems, the social entrepreneur, in the given case, follows more of 'design feeling' than just design thinking.

Design thinking is believed to work based on logic and reasoning. It helps to attain the best possible solution to the problem. However, in the given case, the need was to design the best possible solution within certain limitations, i.e., resource constraints. In other words, the problem had to be addressed, keeping the resource constraints in mind. So the problem had to be addressed, keeping human emotion at the center of the design thinking process. This is essentially the crux of design feeling. The social entrepreneur felt that the problem faced by the rural women entrepreneurs and their family members was her problem. When human emotion and intuition become a part of the design thinking process, the solution finally becomes more human-centric.

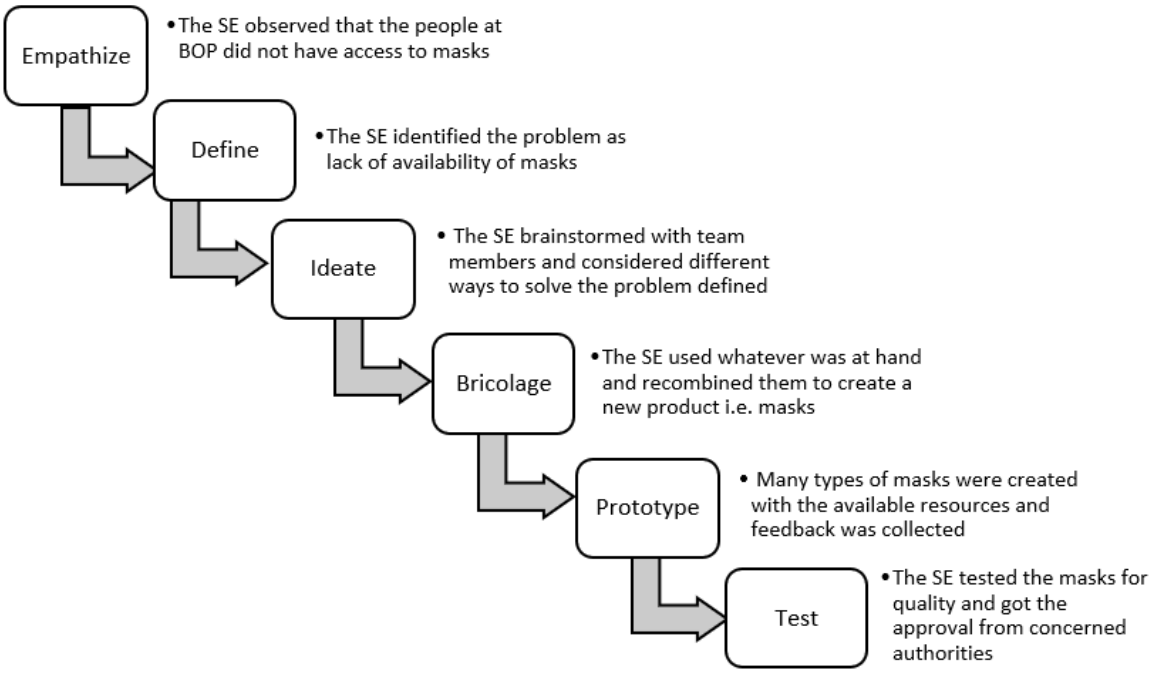

Figure 1. Sequence of activities undertaken by Social Entrepreneur.

Apart from feelings, the other issue that had to be considered is the resource constraint. In the research study, it was observed that the social entrepreneur worked in close collaboration with their suppliers of materials that were used for making sanitary napkins and used them for making masks. The concept of bricolage, as given by Baker and Nelson (2005), is characterized by making do with whatever is available by using the internal under-exploited resources and obtaining low-cost external resources, and recombining resources for different purposes. This has been observed in the research study where the social entrepreneur has practiced bricolage to solve the problem of the people. Figure 1 shows the different steps that the social entrepreneur and her team went through to ensure that they can address the situation in the best possible manner within the resources.

The figure shows that the social entrepreneur and her team worked with their women entrepreneurs to find possible solutions and address their problems. The interview with them highlighted that they carried out the design thinking and design feeling process along with bricolage. The combination of design thinking and design feeling helped the social entrepreneur achieve the most suitable solution without too many iterations. The team worked on solving the problem on their own. A new step has been included in the design thinking process, i.e., bricolage. In times of crisis like the pandemic, several constraints had to be overcome. The best way to sort out the resource constraints issue was by implementing bricolage. Bricolage in terms of skills, materials, and network was implemented. The women entrepreneurs were trained to make sanitary napkins earlier. They were asked to use the materials, i.e., non-woven cloth, cotton, to make masks by stitching which is a well-known skill. The existing network of women entrepreneurs in rural areas, suppliers, testing labs, etc., were used for carrying out the manufacturing process smoothly. The result of the whole process was a frugal innovation. The masks thus manufactured were used by the local villagers. Later, these masks were also sent to the nearby villages and distributed at a low cost through government bodies and e-marketplaces.

7 Final remarks

The research study addressed the gap in the existing literature about social entrepreneurship, frugal innovations, and design thinking. There have been hardly any studies that highlight the link between these concepts. In this research study, the author has attempted to show the inter-connection among these concepts by showing their application in a social enterprise during a crisis. An important observation in this research study is identifying how design thinking and design feeling have been implemented together to solve the problem better. The research paper proposes that in times of crisis or turbulence, a social entrepreneur will solve the problems for the people at the bottom of the pyramid by design thinking and design feeling. The solution can be implemented by arranging skills, materials required, and network through bricolage. The outcome will be a frugal innovation that will be available, affordable, acceptable, and accessible to the rural people. Such innovations, where the innovator shares how the manufacturing process can be carried out, help more people become financially independent. According to Radjou (2021), this type of innovation is known as meta-innovation. The innovator is involved in making the innovation and training others to become innovators—this way, a cycle of creation will be created in a robust and sustainable innovation ecosystem. In times of crisis, there is a need for design thinking and design feeling as they bring in compassion and innovation. It will ultimately lead to saving the lives of thousands of people in times of crisis.

8 Limitations and Directions for Future research

One of the significant limitations of this study is that it is based on a single case study; as in the current scenario, this case appeared to be the most suitable one. There is no way to generalize the assumptions of this model. Researchers will have to study multiple cases in the future. Also, the study is based on a single emerging economy, i.e., India. Further research may be carried out in other countries.

Future researchers could investigate with considerable sample size and carry out quantitative analysis if the same proposition can be implemented in other social enterprises. Another path for future research is to conduct a cross-cultural analysis, comparing the implementation of the proposition by social enterprises in developing versus developed countries. Similarly, a comparative study between commercial enterprises and social entrepreneurs can give better insights.

9 Conclusion

The research paper shows that the social enterprise has implemented design thinking, design feel, and bricolage to make a frugal innovation possible in the form of COVID-19 protection item, i.e., masks, which are supplied through existing supply chain networks to people at the bottom of the pyramid. Also, social entrepreneurs are not intimidated by the sudden changes in the business environment; instead, they look at such adversities as an opportunity to do something new. They are always willing to take the risk to innovate a solution that will address people's problems. The social entrepreneur requires team members' cooperation to ensure that the plan is executed rapidly and people are benefitted from it. The social entrepreneur had to make do with the existing resources and re-purpose them to manage the demand of COVID-19 protection items and provide a source of livelihood to rural women. Thus, due to its highly collaborative nature and its ability to make the most from limited resources, frugal innovation is the only way social entrepreneurs can create a secure, sustainable future. Moreover, bricolage skills enable social entrepreneurs to

become more innovative and inclusive.

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Biographies

Oly Mishra. Dr. Oly Mishra was born in Malda, West Bengal, India in 1988. She received the BBM degree from Andhra University and MBA (International Business) degree from GITAM University. She completed her Ph.D. in marketing from Andhra University in 2017. She was a Teaching Assistant in Andhra University from 2014 to 2017. Since 2017, she has been an Assistant Professor in Gayatri Vidya Parishad, followed by IILM Institute for Higher Education. She is presently working in GITAM University as an Assistant Professor in Department of Marketing. She has published research papers in ABDC, and Scopus indexed journals. Her research interests include consumer behavior, online retail, frugal innovations, bottom-of-the-pyramid, sustainability, circular economy. Dr. Mishra was a recipient of the TEQIP Scholarship during 2014 – 17, while pursuing her doctoral studies.
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