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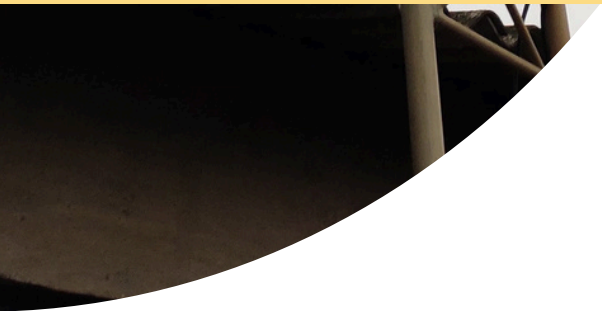
BRIDGING THE DIGITAL DIVIDE IN A TRIBAL COMMUNITY IN INDIA:

The Pathardi Community-Centered Connectivity Initiative



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List of Abbreviations

AePs	Aadhaar-enabled Payment System
APC	Association for Progressive Communications
ARPU	Annual Revenue Per User
ATM	Automated Teller Machine
BAIF	BAIF Development Research Foundation
BBNL	Bharat Broadband Network Limited
BISLD	BAIF Institute for Sustainable Livelihood and Development
BOT	Build-Operate and Transfer model
CAPEX	Capital Expenses
CCCI	Community-Centered Connectivity Initiatives
CERT-IN	Indian Computer Emergency Response Team
CN	Community Network
COVID-19	Coronavirus Disease of 2019
CSC	Common Service Centre
CSC	Community Support Center
CSR	Corporate Social Responsibility
DI	Development Indexing
DTH	Direct-to-Home
E-SHRAM	Electronic Shram / Electronic Labour
EMI	Equated Monthly Installment
FAST	Fast, Agile, Secure Toll
FinTech	Financial Technology
GP	Gram Panchayat
GPDP	Gram Panchayat Development Plan
ICDS	Integrated Child and Development Services

List of Abbreviations

ICT	Information and Communication Technology
ID	Identification
IIT	Indian Institute of Technology
ISEA	Institute for Social Entrepreneurship in Asia
ISP	Internet Service Provider
JV	Joint Venture Model
LocNet	Local Networks
KRA	Key Result Areas
KYC	Know Your Customer
Mbps	Megabytes per second
NOFN	National Optic Fiber Network
OPEX	Operational Expenses
PAN	Permanent Account Number
PI	Performance Indicator
OTG	On-The-Go
PDO	Public Data Offices
SIM	Subscriber Identity Module
SROI	Social Return on Investment
SVI	Social Value International
USD	United States Dollar
VAPCOL	Vasundhara Agri-Horti Producer Company Ltd
VLE	Village-level entrepreneurs
WANI	Wi-Fi Access Network Interface
WEF	World Economic Forum
Wifi	Wireless Fidelity

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INTRODUCTION

This case study is one of four research outputs on the social impact of community-centered connectivity initiatives (CCCIs) that the Institute for Social Entrepreneurship in Asia (ISEA) generated in partnership with the Association of Progressive Communications (APC). These case studies use social entrepreneurship concepts and tools to explore the multifaceted impact of initiatives that have achieved relative success in bringing meaningful connectivity to marginalized populations and communities in Indonesia, India, South Africa, and Kenya.

These CCCIs may be considered as social enterprises in the digital industry. They enable marginalized people and communities not only to access but to control, manage, and use digital resources and connectivity in ways that improve their quality of life and enhance their capacity to be actors in their own development.

As social enterprises, they provide three types of services: transactional, social inclusion, and transformational services. Transactional services are connectivity services that can be accessed via a payment of money or other form of agreed transaction in exchange for the service. Social inclusion services are oriented towards addressing digital exclusion and meaningful connectivity, or other factors behind the "usage" gap. Examples include the provision of affordable or free internet; developing and sharing local digital knowledge resources relevant to meeting community needs; provision of hubs or community-based facilitators to broaden access; and provision of training on digital skills. Transformational services are oriented at enabling the poor and excluded to overcome their capability deprivation and become actors in their own development. These are services that build their capability to own, govern, and manage digital resources in a way that would positively impact their lives and the lives of their families, communities, and the marginalized sectors they are a part of. Transformational services enable the poor and excluded to be co-owners, supervisors, managers, and decision-makers or to become leaders and stakeholders of the social enterprises that provide digital-related services and ensure meaningful connectivity. Transactional and social inclusion services are usually directed at the potential users or customers of digital-related services. Transformational services are usually directed towards those who are capacitated to provide, manage, and operate the provision of digital-related services to communities.

These three types of services result in or facilitate various social impacts. Depending on which type of service played the most significant role in bringing about the social impact, they are then referred to as transactional services-facilitated impacts, social inclusion services-facilitated impacts, and transformational services-facilitated impacts. Profit-oriented internet service provider companies mainly bring about transactional services-facilitated impacts. The cases studied would substantiate that beyond these transactional services-facilitated impacts, many of the social impacts brought about by CCCIs are facilitated by their social inclusion and transformational services.

The analytical tools used to study the social impact of these 4 CCCIs are Development Indexing (DI) and Social Return on Investment (SROI).

Development indexing is a methodology that assists in the quantification of social impacts where simple proxy measures are deemed inadequate. As shown by the 4 cases studied, CCCIs have many social inclusion and transformational services-facilitated impacts including the improvement in the economic position and conditions of community stakeholders and increased levels and capacities for inclusive human development. Faced with time and resource constraints and as the first case studies to explore the use of development indexing to quantify these complex social impacts of CCCIs, the cases were able to define main elements or key result areas, sub-elements of such and potential performance indicators where significant social impacts were noted. The case research did not reach the stage of developing and using a scorecard, usually from one to one hundred (1-100), assigning scores based on relative weights to quantify the performance indicators under each key result area, the last stage when using development indexing as a methodology. In lieu of quantification based on assigned scores, the case studies identified what may be considered significant social impacts based on the available data approximating relative scale and depth of impact characterized as high, medium, and low. The social impact characterized by the performance indicator is considered significant when both scale and depth were approximated as high, at least one was deemed high, or both scale and depth were deemed as medium.

Social return on investment (SROI) is a methodology that articulates the financial and social costs and benefits of social enterprises, in the process showing whether the benefits derived from such investment outweigh the costs. With the total value of the net financial return of the CCCI together with the monetized value of social outcomes using established conventions as numerator and investments as denominator, the ratio needs to be greater than one to show cost-effectiveness. SROI follows certain conventions in quantifying and defining proxy measures for monetizing both tangible and intangible social impacts. The SROI methodology used in the 4 cases follows the procedures, requirements, and conventions developed by Social Value International (SVI) that are accessible through their website (https://www.socialvalueint.org/guide-to-sroi). The SVI-prescribed SROI Value Map that was generated as a result of the case study is made available as an appendix to each case study.

Tangible social impacts that can be easily monetized include economic benefits such as increased incomes or cost savings derived from the use of the Internet. Intangible social impacts such as increased capacities for inclusive human development and community empowerment are much harder to quantify and monetize. Following the principles and conventions of SROI as a methodology, the cases approximated the quantification of significant social impacts and used monetary proxies that were deemed meaningful and acceptable to the stakeholders benefiting from the CCCI's services, as represented by the key informants for the cases. Given resource and time constraints, the case studies were only able to explore the quantification and monetization of a limited set of performance indicators deemed significant and as such, the SROI values derived are undervalued.

DI and SROI are complementary measures of effectiveness: development indexing is a measure of effectiveness in terms of qualitative impact on relevant stakeholder groups while SROI is a measure of cost-effectiveness. With the aid of DI and SROI as methodologies, the case that follows provides indications of the most significant social impacts that the CCCI in Pathardi has made on the Indigenous stakeholders and communities it served, as well as the cost-effectiveness of the intervention in bridging the digital divide in rural India.

BRIDGING THE DIGITAL DIVIDE IN A TRIBAL COMMUNITY IN INDIA:

The Pathardi Community-Centered Connectivity Initiative

THE STATE OF DIGITAL CONNECTIVITY IN INDIA

Approximately 3.2 billion individuals[1] worldwide remain unconnected to the internet. Despite having the world's second-largest population of internet users,[2] India ironically leads the top 10 countries with the highest number of people without internet access. According to data from the World Economic Forum, 685.6 million Indians—50 percent of the population—lacked internet connectivity in 2020.[3] This digital divide is most pronounced in India's more than 600,000 rural villages, where most of the unconnected population lives, presenting a pressing challenge that requires urgent attention.

Government Initiatives to Close the Gap

Internet connectivity is a catalyst for both economic and social development. Research shows that a 10 percent increase in mobile broadband penetration boosts gross domestic product by 1.8 to 2.0 percent in middle- and lower-income countries.[4] It plays a key role in sectors such as agriculture, healthcare, education, e-governance, banking, disaster preparedness, and e-commerce, all of which improve quality of life. The Indian government recognizes the importance of digital connectivity in nation-building. While significant strides have been made in the digital revolution, connecting rural areas remains a major challenge.

The government has implemented several ways to bridge India's digital divide, focusing primarily on middle-mile connectivity through various projects and initiatives:[5]

1. Digital India Initiatives by the Indian Government aim to make government services digitally available to all citizens by providing infrastructure needs such as high-speed internet networks. Digital India's initiatives comprise of:
   - The set-up of the Bharat Broadband Network Limited (BBNL) for internet connectivity of Gram Panchayats, the local village councils,
   - The Indian Computer Emergency Response Team (CERT-IN) to develop a secure cyberspace architecture, and
   - Common Service Centres (CSCs) as access points for the delivery of these digital services to the villages.

2. BharatNet, also known as the National Optic Fiber Network (NOFN), set up by the BBNL, a government Special Purpose Vehicle set up under the Companies Act by India's Government, is commissioned to connect 165,082 Gram Panchayats through a state-of-the-art middle-mile infrastructure using optical fiber to deliver broadband connectivity.

3. PM WANI (Wi-Fi Access Network Interface) creates decentralized public access points at Public Data Offices (PDOs), which can include small shops or CSCs providing affordable internet connectivity across India. No license, registration, or fee is required from PDOs and CSCs.

[1] https://datareportal.com/reports/digital-2020-global-digital-overview
[2] https://www.internetworldstats.com/top20.htm#google_vignette
[3] https://www.weforum.org/agenda/2020/08/internet-users-usage-countries-change-demographics/
[4] Belur, S.B. et.al, "Gram Panchayat Development Plan (GPDP): An Opportunity for Funding Rural Internet Connectivity in India," Community Networks: Towards Sustainable Funding Models, p. 129.
[5] Kumar, S.K.A., et. al., "A Survey on Rural Internet Connectivity in India,"January 2022, p. 4-5.

4. Deendayal Upadhyaya Gram Jyoti Yojana is the Indian Government's village electrification and electricity distribution infrastructure for the rural areas.

5. OceaNet is a low-cost internet connectivity solution designed to extend internet signal to fishermen of up to 60 km at sea and 45 km beyond the range of cell phone towers. This system is particularly useful for providing real-time disaster alerts.

Challenges in Rural Connectivity

While the government supports rural connectivity projects and initiatives, they still fall short of effectively bridging the rural divide. As such, challenges in reaching the end-users at the last mile need to be addressed.[6] To better understand why, the key challenges in rural connectivity are as follows:

Demand Side

1. ***Topography and population distribution:*** India has diverse topography, ranging from plains and plateaus to mountains and deserts, with weather conditions often being extreme. Villager populations can vary widely, from as few as 100 to over 10,000. Operators prefer smooth terrain with fewer obstructions for better line-of-sight, making it difficult to implement a uniform solution for rural connectivity. On the other hand, for demand planning, densely populated villages are more favorable than sparsely populated ones, as they offer a better return on investment.
2. ***Low per capita income:*** People in rural areas generally have lower per capita incomes than those in urban areas, making affordable pricing for internet services crucial. There is a need for innovative models to make internet access more affordable and attractive, which requires finding ways to reduce service costs.
3. ***Electricity:*** Power supply in rural areas is often unreliable. To address this, the use of renewable electricity sources and energy-efficient systems is necessary to ensure consistent and sustainable service.
4. ***Digital awareness:*** People in rural areas need to be educated about the benefits of internet connectivity, especially how it can improve their lives economically. As they gain a better understanding, they will demand more digital services.
5. ***Multilingualism:*** India is a multilingual country, and content should be available in various languages to help people understand the opportunities that the internet can offer them.

Supply Side

1. ***Cost:*** The cost of providing internet connectivity in rural India is high due to several factors, including the lack of backhaul or points of presence, the cost of equipment, repair and maintenance, and spectrum licensing in remote areas. Lowering the cost of rural connectivity would also improve scalability.
2. ***Business models:*** The lack of an innovative business model for rural India is a major challenge for operators in providing rural connectivity. The traditional business model, which relies on high annual revenue per user (ARPU), a large customer base, and long investment duration, does not work in rural areas. A new business model must focus on factors such as low ARPU, a smaller customer base, and a moderate investment period.

[6] Ibid, p. 5-6.

3. ***Funding and investment:*** Operators typically build networks based on projected future profits. Funding is obtained from banks or government agencies. However, since rural connectivity is often unprofitable, the lack of funding from traditional sources presents a significant barrier. There is a need for innovative funding models to support local operators in rural areas.

Gram Marg and Indian Institute of Technology Bombay

In 2012, the Indian Institute of Technology Bombay (IIT Bombay) began researching possible solutions to the issue of rural connectivity and developed the Gram Marg Rural Broadband Project.

The IIT Bombay is globally recognized for its cutting-edge engineering education and research. The Institute's Department of Electrical Engineering took on the challenge of finding an innovative solution for India's rural connectivity. Through the Gram Marg Rural Broadband Project, IIT Bombay explored the constraints of digitizing rural India, combining a technological solution for the middle mile using the free 5.86 GHz spectrum with a sustainable partnership model for the last mile.

Dr. Sarbani Banerjee Belur, Senior Project Executive Officer at IIT Bombay and an expert in rural broadband connectivity, explained that most connectivity models followed a top-down approach. These models often excluded local communities–the ultimate beneficiaries–focusing solely on creating a customer base and ensuring a return on investment. When local and regional needs are ignored, these models prove unviable and unsustainable. To successfully connect rural India to the internet, a sustainable model was needed, one that used a bottom-up approach with active involvement from the village community, supported by a revenue-generating feature.[7]

BAIF Development Research Foundation[8]

BAIF Development Research Foundation (BAIF), a non-stock, non-profit organization established in 1967 in Pune, operates in over 300 districts across 13 states in India. With more than 6,000 staff members, it is a non-partisan, secular, and professionally managed organization. Founded by Manibhai Desai, a close associate of Mahatma Gandhi, BAIF envisions a self-reliant rural society with food security, safe drinking water, good health, gender equity, low child mortality, literacy, moral values, and a clean environment. To achieve this, BAIF focuses on creating opportunities for gainful self-employment in rural areas, especially for the disadvantaged sectors, ensuring sustainable livelihood, an enriched environment, and a higher quality of life, and good human values.

BAIF's programs are developed and implemented through collaborations with local and global partners, including private companies' corporate social responsibility (CSR) arms, charitable institutions, government agencies, and most importantly, local communities. It is well-regarded for its partnerships with various Indian government departments, serving as an implementing partner and a knowledge resource for rural development. In its

[7] Belur, S.B., et. al,"Gram Panchayat Development Plan: An Opportunity for Funding Rural Internet Connectivity in India," Community Networks:Towards Sustainable Funding Models, December 2021, p. 131.
[8] https://baif.org.in/who-we-are/vision-and-mission/

international collaborations, BAIF aims to integrate field-based research and transfer cutting-edge technologies.

Working with tribal communities is a key priority sector for BAIF. The organization has implemented nature-positive programs, including livestock development, natural resources management, agri-horti-forestry, and agrobiodiversity conservation, all aimed at promoting sustainable livelihoods and enriching the environment. These initiatives are designed with careful consideration of the needs and priorities of local communities. BAIF also integrates emerging technologies, such as ICT-based interventions, to enhance the effectiveness of its development programs. One of BAIF's partner communities is the tribal village of Pathardi and its adjoining villages.

Partnership

In 2019, BAIF approached IIT Bombay through Dr. Belur, who had already piloted IIT Bombay's rural connectivity model in 40 rural villages with support from Tata Trust. The grant of USD 500,000 helped connect around 60,000 rural villagers to the Internet. After learning about the success in these villages, BAIF requested that IIT Bombay expand the projects to the remote villages where they operate. Dr. Belur agreed to collaborate but under one condition: the villagers themselves must request connectivity from IIT Bombay to ensure the project's sustainability. She emphasized that the villagers should take ownership from the outset.

That same year, Dr. Belur initiated discussions with the Association for Progressive Communications (APC). With grant funding from APC, a partnership was formed to connect the unserved rural areas in India. Partners included APC, Rhizomatica (LocNet), Gram Marg Project IIT Bombay, BAIF, Tata Motors Limited CSR, the Government of Maharashtra, the Gram Panchayat of Pathardi, and the villagers. Together, they launched a pilot project for rural internet connectivity in Pathardi.[9] BAIF, in collaboration with IIT Bombay, became the lead implementing partner.

The following is the story of the Pathardi Community Centered Connectivity Initiative (CCCI) and how this community network evolved into a digital ecosystem tailored to the needs of the tribal people. This initiative has generated social impacts that have improved both their economic and social conditions, empowering them to take ownership and manage the infrastructure built for them.

[9] BAIF, "E-DOST in Every Day Life and During Crisis," p. 3.

PATHARDI'S COMMUNITY-CENTERED CONNECTIVITY INITIATIVE

The Pathardi Community-Centered Connectivity Initiative under the APC grant covers the seven villages of Pathardi, Jangalpada, Khuded, Vanwashi, Vanganpada, Balkapra, and Mokyachapada. These villages are in the Palghar district, in Maharashtra state, Western India.

According to BAIF, Pathardi alone has a population of around 1,440 people.[10] This is based on estimates of the populations in the villages surrounding Pathardi, where the average population is assumed to be 1,440 persons per village or 10,080 people across the 7 villages in the CCCI. This figure–1,440 persons per village–is close to the average population of 1,500 people per village in the Gram Marg Project, which includes 40 villages. For lack of exact population statistics of each of the seven villages under the Pathardi CCCI, it was assumed here that the average population size of a village is 1,440 people.

The Warli tribe,[11] an indigenous group in Western India living along the mountainous and coastal regions of the Maharashtra-Gujarat border, accounts for 99% of the population. The group speaks Marathi. In terms of gender distribution, there is a 50/50 male and female ratio. Literacy is low, with half of the population illiterate. Using an approximation based on India's national age distribution, about 25% of Pathardi's population is under the age of 14, 68% is between the ages of 15 and 64, and 7% is 65 years and older.[12]

The setting is rural, and agriculture is the primary source of livelihood. Most people are subsistence farmers with landholdings averaging between one and two and a half hectares. About 85% of the population describe their work as full-time, while 15% consider it marginal, earning a livelihood for less than six months a year. Among the full-time workers, 167 are landowners, and 592 are farm workers.[13]

The villages are located in mountainous terrain, typical of rural India. Three hills surround the CCCI area, which weakens the internet signal. In Pathardi, for example, people must find specific spots within the village with the strongest signal to make calls. For online transactions, however, they have to travel outside the village.

Pathardi's Community-Centered Connectivity Initiative as a Social Enterprise

As social enterprises in the digital industry, CCCIs engage the poor not only in a transactional way, like selling internet services, but in a transformational way that empowers them as active participants in their own development. By promoting social inclusion and transformation, CCCIs facilitate the creation and distribution of wealth among their primary stakeholders, usually the marginalized sectors of the community.[14]

[10] 1,818 individuals, https://geoiq.io/places/Pathardi/5hr259fXEe
[11] https://geoiq.io/places/Pathardi/5hr259fXEe
[12] India Age Distribution 2012 to 2022, https://www.statista.com/statistics/271315/age-distribution-in-india/
[13] https://www.census2011.co.in/data/village/551947-pathardi-maharashtra.html
[14] Dacanay, L. "Social Enterprises are Drivers of Social Change Too: Dr. Lisa Dacanay Founding President of ISEA," https://asianngo.org/magazine/post-magazine/interview/article-detail/224/social-enterprises-are-drivers-of-social-change-too-dr-lisa-dacanay-founding-president-of-isea

In the case of the CCCI in Pathardi, it was founded with the goal of providing better digital services to the community. The CCCI does not aim to generate revenue for itself but instead enables marginalized groups such as tribal women, Warli artists, and small farmers to create new income streams, improving their economic and social conditions. The CCCI in Pathardi also focuses on promoting cultural preservation and agro-biodiversity for future generations. Social inclusion and transformation of its primary stakeholders have been central to the CCCI's mission from the start. The CCCI also features a distinct sustainability model involving the Panchayat, the local self-government institution in rural areas mandated by the Indian Constitution. Rather than relying on income from internet service sales, the Panchayat manages the community infrastructure and allocates funds annually through the Gram Panchayat Development Plan to ensure its continued operation and sustainability. In this way, the internet service is treated as a public good.

The Theory of Change

BAIF and IIT Bombay gathered input from the villagers on why internet connectivity would be beneficial to them. Their reasons and expectations from the project are as follows:
Due to weak internet connection, residents of Pathardi travel 20 kilometers by bus or on foot to Jawhar, the nearest town, for essential activities like banking, utility payments, mobile charging, and government-related transactions. On average, they make these trips five times a month, spending USD 1.20 to USD 2.40 per visit and losing a day's wages. The community seeks internet connectivity to resolve this perennial problem.

Another key request from the villagers is to create income-generating opportunities through improved livelihoods. Women, in particular, have fewer work opportunities than men. Hence, the villagers hope that internet connectivity can open up new livelihood opportunities for women and other community members.

The villagers also hope that connectivity will provide a platform to store knowledge and information, helping preserve and promote their indigenous culture for the next generations, while also conserving agro-biodiversity on their ancestral land.

The 4P Sustainable Model

In addition to finding a cost-effective technological solution to rural internet connectivity, the Pathardi CCCI adopts a 4P Model for Sustainability, involving the Gram Panchayat, the local village council, and the community. This model draws on the experience of Gram Marg IIT Bombay's initiative with 40 villages. The 4P Model engages three major sectoral stakeholders–Private, Public, People working in partnership, with each playing a distinct role. The specific actors under each sector and their distinct roles are provided in *Table 1*.

Table 1. Actors and Roles in the Public, Private, People Partnership (4P) Model for CCCI Sustainability		
PRIVATE Actors and Roles	**PUBLIC Actors and Roles**	**PEOPLE Actors and Roles**
BAIF: Lead implementer, project management, capacity building of people	State of Maharashtra: Provide enabling policies; Facilitation and convergence support	Village-level entrepreneurs: Engagement in revenue-generating activities through the sale of digital services
IIT Bombay: Technology, infrastructure set-up/network planning	Panchayat (Village Government): Take responsibility for the operation and management of the infrastructure. Finance the maintenance and operation of the CCCI after turnover of ownership Customize the connectivity based on the villagers' needs	Villagers: Involved in maintenance Users of the internet and digital services to improve their quality of life
Other private partners of BAIF: Provide support in terms of technology, funding		
APC & Rhizomatica: Partners that provided a grant to finance the set-up of the CCCI		
Local ISP: Provider of the broadband bandwidth		

There were two models of partnerships in the past: the Build-Operate and Transfer (BOT) Model and the Joint Venture (JV) Model. BharatNet is an example of the BOT model where private internet service providers (ISPs) built, maintained, and operated the infrastructure under contract with the Gram Panchayat office. After the contract expired, the village government, the original owner, took over operations from the private partner. In the JV model, both the private and public sectors jointly invested in setting up the infrastructure. However, neither model explored providing entrepreneurial opportunities to the villagers.

In the 4P model of Gram Marg, the Gram Panchayat (GP), the local village council or governing body, becomes a partner. The Gram Panchayat is responsible for the operation and management of the infrastructure, customizing connectivity to meet the villagers' needs. After BAIF transfers ownership, the Gram Panchayat becomes responsible for maintaining, operating, and financing the CCCI infrastructure. They fund these activities by accessing government resources through the Gram Panchayat Development Plan.[15]

In the early stages of the Pathardi CCCI, the Gram Panchayat represented the voice of the villagers and allowed the Community Support Centre to house the equipment. In return, the Centre had free access to the internet and solar power. Over time, the Gram Panchayat personnel, along with selected women from the community, were trained to maintain and operate the equipment. The Gram Panchayat also had the potential to take over and manage the infrastructure once the project was completed.

One unique aspect of the 4P Model is the inclusion of a revenue-generating component through the creation of village-level entrepreneurs (VLEs), a feature not seen in previous government initiatives like the BharatNet. This model allows villagers to start revenue-generating activities by offering digital services within the village. It also provides an incentive for the villagers to take care of the infrastructure and ensure it remains functional.

[15] Belur, S.B. et.al., "Gram Panchayat Development Plan (GPDP): An Opportunity for Funding Rural Internet Connectivity," Community Networks: Towards Sustainable Funding Model, Internet Society, FGV Direito Rio, Internet Governance Forum, December 2021, p. 134.

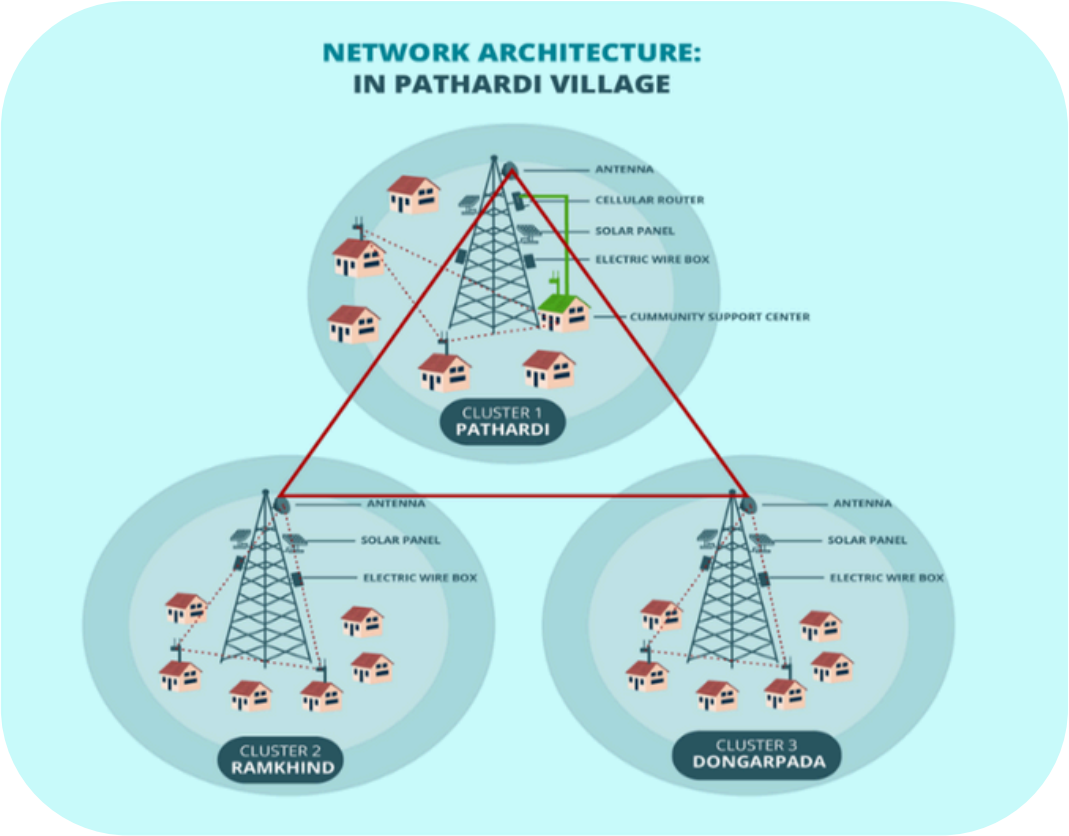
In the Pathardi CCCI's case, the equivalent of VLEs were young women selected and trained to become digital entrepreneurs, providing digital services to the community.

The Logic of the CCCI[16]

The network architecture *(see Figure 1)* is divided into two: online and offline.

During the network planning stage, BAIF's review of each hamlet's[17] location showed that Pathardi was the central point, easily accessible from all surrounding hamlets based on line of sight.[18] A survey of Pathardi and the other hamlets revealed two 15-meter towers, one in Pathardi and another in Ramkhind. However, at the time of planning, these towers were not operational. As the central hub, Pathardi was the only location with online connectivity, while the rest of the hamlets were linked to an offline mesh network.

Figure 1: Network Architecture



Source: BAIF

Online connectivity was enabled at the Pathardi Community Support Center (CSC), owned by the Gram Panchayat, through a SIM card-based cellular router. A technical test showed that Vodafone and Reliance Jio provided the strongest signal (5Mbps), so SIM cards from these two ISPs were procured to provide connectivity at the CSC. The two ISPs were also selected as backups.

[16] Belur, S and Ramprasad V, "Jawhar Visit For Hamlet Survey and Network Deployment," 18 to 19 November 2019.
[17] A hamlet is a small village. https://www.dictionary.com > hamlet
[18] It is a small settlement, smaller than a village. In Maharashtra, it is called a pada.
https://en.wikipedia.org/wiki/Hamlet_(place)#:~:text=A%20hamlet%20is%20a%20human,for%20official%20or%20administrative%20purposes.

Through this infrastructure, the villagers gain access to online services such as e-banking, e-governance, bill payment, mobile recharges, and utility bill payments. BAIF trains young women from the village to connect their smartphones to the cellular router and deliver digital services directly to the villagers' doorsteps. These women, called e-DOSTs, are selected based on specific criteria, outlined below. In Hindi, "e-DOST" translates to "digital friend or companion". In the Pathardi CCCI, an e-DOST is a woman from the village who acts as a catalyst, providing digital services to the community and earning a livelihood through commissions on these services.[19]

For the offline mesh network, each hamlet has two access points connected to the point-to-point link set on the towers. A local access server acts as the local knowledge repository for all offline transactions. This set-up addresses the villagers' request for a facility to preserve their cultural heritage. Selected locals, especially women and youth, receive training from BAIF to collect photos, recordings, and videos of tribal dances, music, crafts, festivals, heirloom seeds, crops, recipes, and traditions. Using an offline application, Epicollect5, they upload and archive the content on a WordPress-enabled website, with all materials posted in the local language.

Not all rural villages had a reliable electricity supply of eight to twelve hours daily. Solar power provided an alternative energy source for the internet infrastructure in case of electricity outages.

A group of BAIF-trained e-DOST women initially provided network repair and maintenance support. Later, other villagers took over this responsibility under the Integrated Child and Development Services (ICDS), a government office managed by the Gram Panchayat[20] of Pathardi.

An e-commerce platform was added to help farmers, women's self-help groups, and artisans promote and sell their products online, expanding their market reach. VAPCOL, a BAIF subsidiary, develops and manages the e-commerce portal, while a local cooperative consolidates agricultural products from participating villagers. BAIF provides supply chain support in Pune. The Farming Monk is the brand under which small farmers sell their indigenous rice varieties to external markets while educating buyers about the products and Pathardi village. Another brand, Vrindavan, offers processed fruits, nuts, and other items from women's self-help groups. Warli[21] artists also sell paintings and masques on the portal[22].

e-DOST Program

The e-DOST Program is a women-led enterprise model, with internet connectivity serving as the backbone to launch a digital ecosystem within Pathardi.

[19] BAIF Development Research Foundation Presentation, April 23, 2024.
[20] An Indian village council, a basic governing institution in Indian villages, https://en.wikipedia.org/wiki/Gram_panchayat
[21] The Warli or Varli are an indigenous tribe of western India, living in mountainous as well as coastal areas along the Maharastra-Gujarat border and surrounding areas. They have their own animistic beliefs, life, customs, and traditions. Warli painting is tribal art created by people in the North Sahyadri Range in Maharashtra, India. The Warli culture is centered on the concept of Mother Nature and elements of nature are often depicted in Warli art. https://en.wikipedia.org/wiki/Warli_painting
[22] https://vapcol.com/products/

BAIF designed the e-DOST program with the following specific outcome targets:

For the e-DOST women:
- Provide livelihood for women in need;
- Enhance the communication skills, confidence, and technical knowledge of e-DOSTs; and
- Improve their social standing within the household and community.

For the villagers:
- Provide banking, utility, and e-governance services at their doorsteps;
- Save time, money, and physical effort; and
- Allow people to conduct their transactions according to their own schedules and availability.

The range of e-services available to the village through e-DOSTs is outlined in *Table 2*.

Table 2. E-services that e-DOSTs Provided to Villagers

Type of E-service	Benefits derived by villagers
AePs Services	cash withdrawal; cash deposit; balance inquiry; mini-statement; money transfer; EMI payment; ATM cash withdrawal
Online form	Access to Ujwala gas scheme[23] form; Education Application form filling
Utility services	Mobile recharge; DTH recharge; electricity bill payment; train tickets; bus tickets; FAST tag; vehicle insurance; gas cylinder booking
e-Governance services	Aadhaar services; PAN services; E-shram card; National health card; 7/12 extract & 8 A Extract; Voter ID services; driving and learning license; birth/death/income certificates
e-Commerce	Amazon; Flipkart; Agri products
Other services	Printouts; scanning; photocopying; passport size photos

BAIF, with its partners, developed a range of services to provide the e-DOSTs with a diverse set of offerings for villagers.

While the ability to offer a wide range of services is a starting point, an e-DOST's ability to make her enterprise profitable depends on the needs of the village she serves, her knowledge and capability to provide different digital services, and her enterprising spirit.

BAIF established standards for setting up the e-DOST program in a village, including criteria for village selection, recruitment of e-DOSTs, and a system of coordination within each cluster[24] to address issues.

[23] Pradhan Mantri Ujjwala Yojana (PMUY, Prime Minister's Lighting Scheme) was launched in 2016 to distribute 50 million LPG to women from below-poverty-line families. The scheme aimed to provide access to clean cooking technologies such as LPG. https://services.india.gov.in/service/detail/apply-for-new-ujjwala-20-connection
[24] A cluster in the Pathardi community network is a group of hamlets or a village.

The criteria for village selection included:

- No existing digital service provider in the area;
- A clear need for the services, with matching sponsors for financial support.

After a survey, BAIF found that many villagers lacked Aadhaar-enabled Payment System (AePs) bank accounts. Aadhaar is a 12-digit identification number used as proof of identity and address for Indian residents. The government requires Aadhaar to access social welfare services. [25] On the other hand, AePs allows a bank customer to use Aadhaar as their identity to access their bank account and perform basic banking transactions such as balance inquiries, cash deposits, cash withdrawals, and remittances through a business correspondent.[26]

For selecting e-DOSTs, BAIF project coordinators invited potential candidates and shortlisted them based on the following criteria:

- There was no minimum educational requirement, but candidates should at least be able to read and write basic English, albeit moderately.
- The candidate should speak and write fluently in Marathi, the regional language.
- The candidate should have a bank account with any bank linked with Aadhaar. This was necessary for KYC purposes, as the amount from the Fintech account wallet was settled and transferred to the bank account.
- She must have a Permanent Account Number (PAN) card for tax purposes.
- She must have one smartphone with On-The-Go (OTG) support[27] and have basic knowledge of how to operate it.
- She should have at least another source of income.
- She should be confident in handling financial transactions and cash.
- She must have a bank account with the Aadhaar-enabled Payment System (AePs).

BAIF also surveyed the villagers with AePs-enabled bank accounts before e-DOST selection. BAIF's recruitment and onboarding of e-DOSTs involved three sessions.[28]

In the first session, candidates received an orientation explaining the program and the dos and don'ts of being an e-DOST. After this, a virtual interview was conducted with a panel arranged by BAIF to evaluate the candidate's communication skills and digital responsiveness. Following the interview, women were officially admitted to the program.

In the second session, candidates completed verification and registration procedures in collaboration with BAIF's Fintech partner (e.g., Bankit). By the end of the session, a fingerprint scanner was provided to the newly registered e-DOSTs.

In the third session, e-DOSTs started practicing digital financial services to the community. Those who encountered operational issues received assistance, and e-DOSTs were encouraged to share their best practices with one another.

[25] https://www.uidai.gov.in/en/16-english-uk/aapka-aadhaar/14-what-is-aadhaar.html
[26] What is AePs? National Payments Corporation of India, https://www.npci.org.in/what-we-do/aeps/faqs
[27] USB On-The-Go or OTG allows tablets or smartphones to act as a host to other USB devices such as USB flashdrives, digital cameras, mouse or keyboards to be attached to them, https://en.wikipedia.org/wiki/USB_On-The-Go#:~:text=USB%20On%2DThe%2DGo%20(,to%20be%20attached%20to%20them.
[28] https://www.aesanetwork.org/good-practices-44-edost-women-first-digital-village-catalyst-model/

A system for resolving issues within each cluster was also established. This involved creating a WhatsApp group with the project coordinator and a representative from the FinTech company. Whenever e-DOSTs encountered technical issues with the Fintech app, they could post in the group, and the Fintech representative would resolve the issue immediately. The project coordinator handled other service-related matters, ensuring continuous support for the e-DOSTs.

Initial Investments, Financial and Non-financial

Various organizations collaborated to support different aspects of the e-DOST program. Tata Motors Limited and APC provided financial support, IIT Bombay and National Payments Corporation of India contributed technical expertise, and the Government of Maharashtra facilitated convergence efforts. BAIF, through its subsidiary, the BAIF Institute for Sustainable Livelihood and Development (BISLD), led the initiative and its implementation.[29] BAIF's facilitation support, which included candidate selection, training, post-training support, and promotion, cost approximately USD 179.62 per candidate.[30]

APC granted USD 40,000[31] to support part of the CCCI development and implementation of the e-DOST program, including network setup, a learning grant for implementers, livelihood training of the e-DOSTs, and program administration. Separate funding from APC also supported the development and implementation of the knowledge-sharing platform and the e-commerce portal.

The initial investment required from each e-DOST ranged from USD 83.22 to USD 239 to set up her digital service enterprise. The amount varied depending on whether the e-DOST needed to purchase a new smartphone or tablet. E-DOSTs paid USD 6 for the registration process, which they could recover by the first or second month of operation. Financial support from sponsors covered the cost of the hardware fingerprint scanner at USD 36. Any remaining investment was either covered out-of-pocket by the e-DOST or financed through a loan.[32]

Operational, Financial, and Impact Sustainability

Table 3 shows the earnings or commissions received by e-DOSTs for every successful transaction, based on records from BAIF for FY 2019 to 2022. These figures represent consolidated data from seven e-DOSTs women involved in the BAIF, IIT Bombay, APC, and Pathardi CCCI partnership.

Table 3. Earnings and Average Monthly Transactions of E-DOSTs

	FY 2019-2020	FY 2020-2021	FY 2021-2022	FY 2019-2022
Annual commissions /or earnings earned by the e-DOSTs	$3,679.98	$3,344.69	$2,785.89	$9,810.56

Source: BAIF file; Rs83.51/USD

[29] https://www.aesanetwork.org/good-practices-44-edost-women-first-digital-village-catalyst-model/
[30] Ibid.
[31] BAIF Development and Research Foundation, APC Grants BAIF Gram Marg file.
[32] https://www.aesanetwork.org/good-practices-44-edost-women-first-digital-village-catalyst-model/

The commissions earned by e-DOSTs for services provided were fully retained by the e-DOSTs; BAIF did not take a share. Total commissions/or earnings for e-DOSTs, based on BAIF records, were USD 3,679.98 for FY 2019-2020, USD 3,344.69 for FY 2020-2021, and USD 2,785.89 for FY 2021-2022. Commissions peaked in FY 2019-2020, during the pandemic lockdown, when people heavily relied on the online system to withdraw government financial support or send and receive remittances. With travel restrictions in place during COVID-19, villagers could not work, making digital services through e-DOSTs essential for financial transactions, registering for vaccination, obtaining vaccination certificates, and securing Universal Passes for travel. COVID-19 accelerated the adoption of digital services in the villages. However, after the lockdown, when mobility resumed and COVID-19-related transactions ceased, e-DOSTs commissions/earnings declined.

According to BAIF, the average monthly income of an e-DOST ranges from USD 48 to USD 72.[33] Each e-DOST processes between 170 to 200 transactions per month. The range of digital services offered by e-DOSTs through the online platform continues to evolve with support from BAIF and its partners.

Seven e-DOSTs are assigned to seven different villages, serving approximately 828 users per village out of an average population of 1,440.[34] BAIF aims to ensure the viability of the e-DOST business by having one e-DOST meet the digital needs of each village. So far, no other digital service providers have entered these villages to compete with e-DOST. However, BAIF acknowledges that it cannot control the situation if a competitor establishes an alternative service for the villagers.
Starting as a proof of concept in 2019, the program scaled up in 2020.[35] With support from various funders beyond APC, around 15 e-DOSTs were added in Jawhar by the end of the first quarter of 2020. Private sponsors include Tata Motors Ltd., Hinduja Foundation, ASK Foundation, Panasonic, and others. The model proves entirely replicable across rural India. In 2024, there are 101 active e-DOSTs distributed as follows: 75 in Maharashtra, 22 in Madhya Pradesh, three in Gujarat, and one in Odisha.[36]

Knowledge-sharing Platform and the E-commerce Portal [37]

Indigenous communities worldwide struggle to protect their land rights and preserve their culture and traditions for future generations. Indigenous knowledge, which encompasses cultural traditions, values, beliefs, and worldviews, has traditionally been passed down through storytelling and practice. For centuries, this knowledge helped communities navigate various aspects of life, including nutrition, education, spirituality, health, and entertainment, and enabled them to survive crises. However, the absence of formal documentation and the pressures of modernization threaten the transmission of indigenous knowledge to the next generations.

A similar situation exists for the tribal people in Pathardi. When the Pathardi network was established in 2019, preserving Indigenous knowledge, including agro-biodiversity, emerged as a key priority, as BAIF discovered during consultations.

[33] Rs4,000 to Rs6,000
[34] BAIF interview May 29, 2024.
[35] BAIF, "E-DOST in Everyday Life and During a Crisis," p.3.
[36] BAIF, "Swayamshree" presentation, 23 April 2024.
[37] Belur, S. and et. al., "From Ethno-biodiversity and Cultural Conservation to Sustainability: Case Study of the Aaple Pathardi Community Network," https://www.apc.org/en/blog/seeding-change-baif-partners-community-members-create-digital-ecosystem-tribal-village

This priority led to the creation of the Pathardi CCCI offline mesh network. BAIF and its partners developed an open-source platform for sharing traditional knowledge. Tribal villagers, particularly women and youth, were trained to collect data for the platform, enabling them to upload and share audio, videos, photos, and text-based information. This initiative marked the beginning of a formal effort to record and preserve their indigenous knowledge for future generations.
As Dr. Belur explained in an interview, the knowledge-sharing platform–a local intranet–provided apps that allowed villagers in Pathardi to gather information, communicate, collect and store data about their way of life, and share knowledge. This platform was customized to meet the specific needs of the villagers and was accessible only to them. Unlike the e-DOST model, which expanded to other villages, the knowledge-sharing platform remained confined to Pathardi.

Initial Investments, Financial and Non-financial

The APC provided a total of USD 23,000.00[38] in grants, which were invested in the design and creation of the knowledge-sharing platform, as well as activities related to archiving and promoting livelihoods for the e-commerce portal. According to BAIF's record, this was spent on creating and promoting the livelihood platform for biodiversity and cultural art forms, the design of livelihood and archiving activities. This funding is separate from the e-DOST program funding.

BAIF selected a group of locals, including farmers and artists, and guided them to collect data using an app called Epicollect5. The data was organized into themes such as rice, millets, lentils, other crops, tribal food, arts and crafts, herbal food, and bamboo-based jewelry on the offline platform. Later, this data was uploaded to a WordPress website. The e-DOST women also contributed by tagging geolocations during data collection. This effort was significant for the locals, as it created the first-ever database in their local language.

Operational, Financial, and Impact Sustainability

While creating a repository of Indigenous knowledge was important, making this knowledge meaningful for the present generation and ensuring its sustainability required the positive impact of the internet on their daily lives–often in economic terms. To achieve this, the online e-commerce portal was developed through the APC catalytic intervention grants.

VaPCOL, a subsidiary of BAIF, engaged small farmers, women in self-help groups, and artisans in the Pathardi community to sell their products on the e-commerce portal, with VaPCOL handling the packaging and marketing. New brands emerged, one of which was Farming Monk which sold rice varieties grown by the small, marginal farmers to discerning consumers in Pune and later other parts of Maharashtra. Another brand, Vrindavan, offered processed mangoes, cashews, and gooseberry-based products such as pickles, preserves, and solar-dried fruits made by local women.

The e-commerce portal opened new livelihood opportunities while promoting awareness about the Pathardi tribal community's culture and agro-biodiversity.

[38] BAIF Development Research Foundation, APC Grants BAIF Gram Marg file.

According to BAIF, the e-commerce portal reached 480 individual farmers, 10 artists, and five self-help groups in Pathardi. However, BAIF did not track the revenues generated for monitoring purposes. BAIF clarified that all the revenues generated by the farmers, women's self-help groups, and artisans through the portal went directly to them.

RESULTS AND IMPACT

Outcomes

To assess the impact of the Pathardi CCCI, BAIF selected five residents to share their experiences and insights in a focus group discussion on how internet connectivity has positively changed their daily lives. Each participant represented a specific segment of the Pathardi CCCI. The participants include the following:

- Ms. Anjale Wazre, first e-DOST
- Ms. Manisha Pawar, e-DOST
- Mr. Ganesh Mahale, farmer
- Mr. Manoj Pawar, farmer
- Mr. Sitaram Bujad, a Warli artist

Their views on the impact of the Pathardi CCCI are summarized below.

Easy and convenient access to digital services

The advent of the CCCI, particularly the creation of the e-DOST program, significantly benefited the residents. With e-DOST services available on-demand, villagers could access digital services anytime, saving them time, effort, and money. One resident said his electricity bill for phone charging in Pathardi was USD 1.20, compared to USD 1.80 to USD 2.40 in Jawhar, which added an extra USD 3.59 in travel costs. In addition, each trip costs USD 0.60 for transportation and USD 3 in lost wages. Since the e-DOST is a local resident, the service was available 24/7. Although villagers still paid a transaction fee for e-DOST services, the digital service fees were much lower than the cost of traveling to Jawhar.

The positive impact of the e-DOST Program was especially evident during the COVID-19 lockdown. When travel restrictions were imposed and some villagers who had migrated to cities for work became stranded, the e-DOSTs facilitated critical financial transactions, such as sending and withdrawing money. Despite the pandemic restrictions, the e-DOSTs continued to roam the village, providing much-needed services, which villagers considered a significant help.

Digital inclusion of seniors and illiterates

In a community where an estimated 30 percent[39] of the population was illiterate, the e-DOST helped ease access to digital services for this group. Like others, the illiterate villagers had to travel to banks, government offices, or business establishments in Jawhar. However, they struggled with understanding banking transactions and processes due to their inability to read and write. Often there was no one to assist them at these establishments. The e-DOST, with her personalized service and ability to communicate in the local language, guided them through banking transactions, making the process less daunting for this segment of the community.

Senior citizens also gained convenient access to digital services through the e-DOST, eliminating the need to wait for their children to handle transactions on their behalf.

[39] BAIF interview, May 29, 2024.

Availing the services of an e-DOST became an accepted practice among 80 percent of the population. Since the system was Aadhar-enabled[40], everyone over 18 years old could access the services.

No other competing service providers had offered such access, and the villagers believed it would have taken many more years to experience this positive change had the CN not come to their community. They would have had to rely on the government, with no certainty about when such access would be available. Many felt that outsiders wouldn't take an interest in their village because of its remote location and limited business potential. As a result, the villagers expressed gratitude, seeing the program as a timely intervention, especially during the pandemic.

Improved economic and social well-being of e-DOST women

Before the CN Program, work opportunities for tribal women were limited. The program specifically targeted young women in the community, training them to become e-DOSTs. For e-DOSTs like Ms. Pawar and Ms. Wazre, providing digital services became a valuable livelihood option for those who were homemakers or earning meager wages. Ms. Wazre, in particular, was grateful for the opportunity, as she needed work to support her child and parents, after her husband suddenly died, leaving her a widow.

To join the program, the e-DOSTs made personal investments. For example, Ms. Pawar and Ms. Wazre each contributed USD 32.33 for a fingerprint scanner and USD 6 for other documentation. Some women invested more, such as purchasing a smartphone.
They took pride in making life easier for others while earning an additional USD 36 to USD 60 per month. An e-DOST's potential earnings varied based on the range of digital services she could offer. This increase in income allowed e-DOSTs to meet their needs, such as buying clothes, feeding their family, purchasing business supplies, and supporting aging parents with medical expenses. One e-DOST even bought a motorbike for better mobility, another opened a bank account and set aside USD 24 a month for future needs along with life insurance to protect her family. Their improved earning capacity enhanced their economic well-being and fostered financial independence.

Beyond financial gains, both e-DOSTs reported non-financial benefits. They noticed increased respect from the villagers, who came to rely on them for critical transactions. One e-DOST said her communication skills improved through her work, while another appreciated having a reason to leave her house. As her reputation as the village e-DOST grew, she expanded both her business and social networks.

Preservation of cultural heritage and conservation of agro-biodiversity and seeds

For the tribal groups in Pathardi, preserving their cultural heritage and conserving their unique biodiversity and indigenous seeds are essential. Before the CN program, they practiced seed banking at the village level, but on a smaller scale.

[40] Aadhaar is a 12-digit individual identification number that serves as proof of identity and proof of address for residents of India. https://www.uidai.gov.in/en/16-english-uk/aapka-aadhaar/14-what-is-aadhaar.html#:~:text=Aadhaar%20is%20a%2012%20digit,address%20for%20residents%20of%20India.

For artists skilled in playing the tarpa[41] or creating Warli paintings, the traditional techniques were passed down orally and through demonstrations. When the CN program was introduced, they sought to digitize and preserve this knowledge for younger generations and communities beyond their village. BAIF helped them produce content—videos, audio, text, and photographs—which they freely uploaded to the platform. Creating the content was not time-consuming, as they managed to balance it with their primary work, using their free time to contribute.

Facilitated exchange and information dissemination

One significant impact of the knowledge-sharing platform is the availability of content in Marathi, the local language.[42] This makes it easier for Pathardi villagers to exchange information with residents of nearby villages who speak the same language, helping to spread knowledge and raise awareness.

Fostered networking with other village folks

The CN Program also helped strengthen connections among farmers. When Mr. Mahale, a village farmer, shared his effective cultivation techniques, other farmers in Pathardi and nearby villages improved their production and diversified their crops.

A Warli artist expanded his networks outside his village, promoting Warli cultural heritage while earning from customers in larger cities like Pune, thus increasing his earning potential.

Crop diversification and improved land productivity

Mr. Mahale initiated content on the knowledge-sharing platform to raise awareness about low-yielding rice varieties and the cultivation techniques he used to improve his production. He also shared insights on the nutritional value of different rice varieties and seed conservation methods. His content inspired others to adopt his techniques, resulting in higher production yields and reaching farmers beyond his community.

The CN Program facilitated the exchanges of cultivation techniques and seed conservation, increasing awareness of advanced practices and promoting the planting of new rice varieties. This led to crop diversification and improved yields in Pathardi and surrounding villages. In measuring the impact, Mahale noted that his yield had doubled, going from one sack of rice per field to two, owing to improved cultivation methods.

Food security and improved nutrition

They added that the increased yield and crop variety meant more food for their families, improving nutrition and food security. They emphasized that the main benefit was in supporting their household needs, rather than having surplus crops to sell.

[41] The tarpa is a tribal musical wind instrument from Western India. The makers and players of this musical instrument come from the Warli tribe from Maharastra and Gujarat. The tarpa alongside another musical instrument, the dhol are played during Warli gatherings and festivals, https://en.wikipedia.org/wiki/Tarpa_(instrument)
[42] Marathi is a classical Indo-Aryan language spoken in by the Marathi people in the Indian state of Maharashtra, https://en.wikipedia.org/wiki/Marathi_language.

Market expansion

The CN program enabled Warli artists to digitally document their art and culture, promoting awareness to a broader audience outside Pathardi and opening new markets in cities like Mumbai and Pune. The e-commerce portal helped buyers connect with artists, boosting their earnings, according to Mr. Bujad. He reported that before the portal, he earned between USD 180 and USD 239.50 per month. After that, his income increased by USD 18 to USD 36 per month or 10 to 15 percent.

The CN Program not only helped preserve Warli cultural heritage and conserve biodiversity and seeds in Pathardi by documenting this information in the local language on the knowledge-sharing platform, but also made it accessible online through the e-commerce portal for broader communities and future generations. It also facilitated crop diversification, improved land productivity, better knowledge-sharing among residents, expanded markets, and improved nutrition for the present generation, according to the interviewees.

Strengthened trust among the villagers

The e-DOST Program selected only women from the community to provide digital services. To earn the villagers' trust, each e-DOST underwent a series of training sessions under a mentor to ensure competence in services like financial transactions, e-governance, utility bill payments, and other digital services.

The e-DOST system was also transparent. Villagers reported that e-DOSTs were required to maintain detailed records of each transaction, including the name of the person and the type of service provided. To authenticate transactions, the e-DOST used the person's thumbprint as proof. For illiterate individuals, a trusted witness was always present to verify the transaction. For instance, if an illiterate person withdrew USD 10, a family member or close friend would confirm the amount. The system eliminated ambiguity, according to the villagers.

For utility payments, an SMS confirmation was sent immediately after the e-DOST processed the payment, further strengthening the villagers' trust in both the e-DOST and the network.[43]

Creation of new enterprises

Due to its success in fostering digital connectivity in rural India, the e-DOST model, after its pilot in Pathardi, was expanded to other rural villages in Maharashtra and beyond, benefiting not only the women in Pathardi but also those in remote areas across different states. The villagers proudly acknowledged that this was the contribution of the Pathardi CN, not just in terms of jobs but in creating new enterprises.

BAIF's data supports this claim, reporting that as of 2024, 101 e-DOSTs have been established across Maharashtra and in other states such as Gujarat, Madhya Pradesh, and Odisha, with funding support from private corporations.

[43] BAIF Development Research Foundation, "e-DOST Initiative, Pathardi," 2020. https://www.youtube.com/watch?v=Pe0kVGmDcAc

Initiating the Use of Development Indexing to Measure Social Impact

Considering the multifaceted social impacts of the Pathardi CCCI, simple proxy measures are inadequate to capture them. Development Indexing (DI) has been employed as a methodology to define the most important elements, sub-elements and performance indicators of the social impacts of this CCCI as a social enterprise.

In the process of using DI as methodology, BAIF participated in identifying the stakeholders, key result areas, and the performance indicators up to the extent of providing their rating on each of the performance indicators based on their observations of the impact on Pathardi community stakeholders.

Based on gathered data, what may be defined as the main elements of a development index to characterize the multi-faceted social impacts of the Pathardi CCCI may be synthesized into the following key result areas (KRAs):

- Increased levels and capacities for inclusive human development and community empowerment
- Improvement in the economic position and conditions of community stakeholders
- More effective preservation of cultural identity, heritage and integrity
- Increased levels and capacities for conservation and development of agricultural or ancestral lands and biodiversity

The data also provided inputs for determining sub-elements and performance indicators under these KRAs, evaluating whether each indicator was significant or not. The approximate qualitative ratings of high, medium, and low were used to determine the significance of the relevant social impact or performance indicator under the aforementioned KRAs based on two factors: extent of reach and depth of impact. The impact is considered significant for a particular stakeholder if (1) Both are high; (2) Both are medium; (3) At least one is high. Of the 18 relevant social impacts or performance indicators, 14 indicators were rated significant. Table 4 details the KRAs, sub-elements, performance indicators (PIs) relevant to various stakeholder groups and whether the concerned PIs were significant.

Table 4: Elements and Sub-elements of an Evolving Development Index for the Pathardi CCCI					
Stakeholders	**Key Result Area (KRA) sub-elements**	**Description of Performance Indicators / Performance Indicators**	**Approximate Rating for Pathardi**		
			Extent of Reach	**Depth of Impact**	**Significance**
KRA #1: Increased levels and capacities for inclusive human development and community empowerment					
Villagers	Easy and convenient access to digital services	Cost savings; wages earned from productive use of time at work and not having to travel	**High**	**Low**	**Significant**
Senior citizens/illiterates	Inclusion in the digital economy	Need not wait for their sons or daughters to transact on their behalf; making digital transactions less daunting for illiterates	**High**	**Medium**	**Significant**
Tribal women (e-DOSTs)	Improved skills and competence in delivering digital services	From being not savvy, they became digitally literate, capable of using devices like smartphones and navigating through apps such that they became effective in delivering digital services	**High**	**High**	**Significant**
		Explored new apps or other services and offered new services to the community based on the perceived needs of the community	**Low**	**Low**	**Not significant**
		Mentored new e-DOSTs	**Low**	**Low**	**Not significant**
	Improved social standing	Built a loyal customer base	**High**	**Medium**	**Significant**
		Acceptance and respect of family and community	**High**	**High**	**Significant**
Small farmers	Networking opportunities for knowledge-sharing	Made it easier to share and learn from each other	**High**	**High**	**Significant**
ICDS[44] of GramPanchayat (tribal governing body) and association of tribal women e-DOSTs	Empowerment of the community to own and manage the physical infrastructure	Equipped in the maintenance of the physical infrastructure to ensure smooth operation of internet connectivity	**High**	**High**	**Significant**

[44] Integrated Child Development Services

Table 4: Elements and Sub-elements of an Evolving Development Index for the Pathardi CCCI *[cont.]*

Stakeholders	Key Result Area (KRA) sub-elements	Description of Performance Indicators / Performance Indicators	Approximate Rating for Pathardi		
			Extent of Reach	Depth of Impact	Significance
KRA #2: Improvement in the economic position and conditions of community stakeholders					
Tribal women (e-DOSTs)	Financial empowerment	Started generating their income or increased their earnings	**High**	**High**	**Significant**
		Started saving by opening bank accounts	**Medium**	**Medium**	**Significant**
		Invested in assets such purchase of motorcycle, land, financial assets such as insurance and other financial products	**Low**	**Low**	**Not Significant**
		Reinvested earnings in digital business	**Low**	**Low**	**Not significant**
Warli artists and small farmers	Expansion of markets online	Increased customer base and improved earnings	**Medium**	**Medium**	**Significant**
KRA #3: More effective preservation of the cultural identity, heritage, and integrity					
Villagers	Improved capacity for the preservation of local knowledge	More effective and comprehensive documentation and archiving such that information could be shared with the younger generation and the outside world	**High** =	**High**	**Significant**
		Enabled to produce content online such as images, videos, and audio recordings, and upload them	**High**	**High**	**Significant**
KRA #4: Increased levels and capacities for conservation and development of agricultural or ancestral lands and biodiversity					
Small farmers	Crop diversification and improved land productivity	More crop varieties and higher yields	**High**	**Medium**	**Significant**
	Biodiversity conservation and development	Indigenous seed varieties more systematically preserved, developed and propagated	**High**	**High**	**Significant**

Towards Using SROI to Measure Cost-Effectiveness

Social return on investment (SROI) was also used to measure the cost-effectiveness of the Pathardi CCCI. Following the SROI methodology prescribed by Social Value International, the most relevant and significant social impacts, identified by the villagers, e-DOSTs, small farmers, and Warli artists, were prioritized for quantification and monetization. The resulting SROI Value Map is provided as an Annex to this case study, with key findings presented in the report.

BAIF's past project records provided quantitative data for valuing the impact indicators. It is worth noting that the study was conducted after the project's completion, and the original BAIF team had already left the organization.

Except for farm yield increases, which were based on government agricultural data for Maharashtra[45], other impact estimates relied on BAIF's internal records.

Since this SROI exercise was new to BAIF, staff offered feedback on the impact indicators and monetized values, with a focus on prioritizing stakeholder outcomes in the valuation process.

Table 5 outlines the key community stakeholders impacted by the CCCI, the number of beneficiaries who experienced the outcome, specific changes experienced, impact measures used, and the value of the outcomes in USD per beneficiary from FY 2019 to 2022.

The analysis included:

- **Villagers:** An estimated 828 users in each of the seven villages where e-DOSTs provided digital services
- **e-DOSTs:** Seven women who played a central role in delivering digital services in each of the villages
- **Small farmers:** Participants in knowledge-sharing-platform that provided information on seeds, cultivation techniques, and networking
- **Warli artists:** Artists whose work was promoted through an e-commerce portal, expanding their markets.

Table 5. Monetization of Impact

Description of social impact (No. of beneficiaries)	Link to KRA	Means of Monetization
Easy and convenient access to digital services (5,796[46])	KRA on inclusive human development and community empowerment	Transportation costs saved and wages earned at work by villagers
Improved economic well-being and social standing (7 e-DOSTs)	KRA on inclusive human development and community empowerment	Started earning or increased earnings of the tribal women
Empowering women in digital literacy and improving communication skills (7 e-DOSTs)	KRA on economic position and conditions of stakeholders	Turnover of digital service transaction processed by tribal women
Conservation of agro-biodiversity, crop diversification and improved land productivity (480)	KRA on conservation and development of agricultural or ancestral lands and biodiversity	Increased in yield per ha

[45] https://www.ceicdata.com/en/india/yield-of-foodgrains-in-major-states-rice/agricultural-yield-foodgrains-rice-maharashtra
[46] Accounting for seven villages being served by seven e-DOSTs at 828 users per village with an average population of 1,440.

The data on the monetization of outcomes in Table 5, along with investments detailed in *Tables 5.1* and *5.2* were the primary inputs for the SROI analysis.

According to BAIF, APC contributed USD 63,000 in grant funding for the entire project. This amount was included in the SROI Value Map as inputs, spread over the three-year project duration based on fund disbursements, and classified as CAPEX and Operating expenses.

When asked about other funding sources, BAIF did not provide additional records.

Table 5.1. Investments from APC

Input from APC Grant	FY 2019-2020	FY 2020-2021	FY 2021-2022
Investment in equipment	$14,724.00	$3,808.00	
Operating Expenses	32,349.00	6,059.59	6,059.59
Depreciation- equipment	-	$7,996.67	$6,177.00

The investment and operating expenses of the e-DOSTs are also considered in the SROI value computation, as shown in *Table 5.2*.

Table 5.2. Investments of the E-DOSTs

Input from e-DOSTs	FY 2019 to 2020	FY 2020 to 2021	FY 2021 to 2022
Investment in fingerprint scanner and documentation requirements to participate	$293.38		
Reload of data, transportation, materials	$1,005.90	$1,005.90	$1,005.90

Table 6 presents an SROI Summary for the Pathardi CCCI, using data from Table 5 to calculate the aggregate outcomes as numerator and data from Tables 5.1. and 5.2. to determine the aggregate investments as denominator. This results in an SROI value for each of the 3 years. The complete SROI Value Map for Pathardi CCCI, following the Social Value International principles, procedures and conventions, is available through this link: https://tinyurl.com/PathardiBAIF-SROIValueMap

From FY 2020 to 2022, the ratio of aggregate outcomes to aggregate inputs showed an **increasing trajectory**—1.23 in 2020, 3.25 in 2021, and 8.19 in 2022. This indicates increasing cost-effectiveness in producing social impacts. The highest SROI Ratio of 8.19 in 2022 means the Pathardi CCCI generated social outcomes valued at USD 8.19 for every USD 1.00 invested. Given the nature of the CCCI in Pathardi, particularly its sustainability model within the Gram Panchayat Development Plan of the Pathardi village government, no financial outcomes or revenues are included in the outcomes.

Table 6. SROI Summary for the Pathardi CCCI			
Social Outcomes: Performance Indicators	**2020**	**2021**	**2022**
Transportation costs saved and wages earned at work by villagers	$46,847.62	$46,947.60	$86,500.95
Started earning or increased earnings of the tribal women	$137.98	$125.43	$104.47
Turnover of digital service transactions processed by tribal women	$2,467.50	$1,930.44	$1,592.43
Increase in yield per hectare by the small farmers	$9,559.44	$11,559.15	$19,559.52
Increased income from new online customers by the Warli artists	$688.50	$688.50	$688.50
Aggregate Outcomes	**$59,701.03**	**$61,251.12**	**$108,445.88**
Aggregate Inputs	**$48,612.25**	**$18,870.16**	**$13,242.49**
SROI Ratio	**1.23**	**3.25**	**8.19**

A Closer Look at the Significant Social Impacts and Cost Effectiveness of the Pathardi CCCI

As a social enterprise, the Pathardi CCCI offered more than just transactional services typically provided by commercial ISPs. Interestingly, it was the women e-DOSTs who delivered transactional services or paid digital services to villagers who would otherwise lack access. Other paid digital services provided by BAIF and its subsidiaries were designed to ensure the inclusion of the villagers in the digital economy. In this way, these transactional services also served as tools for social inclusion. Additionally, most of the services provided by BAIF and the CCCI were focused on social inclusion and transformation, ensuring that digital resources were controlled, managed and utilized by marginalized stakeholders in Pathardi. *Table 7* shows the types of services provided by BAIF and the Pathardi CCCI.

Table 7. Various Types of Services Provided by BAIF/Pathardi CCCI		
Transactional	**Social Inclusion**	**Transformational**
Provision of internet connectivity and services for the villagers by the e-DOSTs Provision of digital services by the e-DOSTs Aadhaar Enabled Payment System (AePS) Services: cash withdrawal; cash deposit; balance inquiry; mini-statement; money transfer; EMI payment; ATM cash withdrawal. Submission of online forms: Education Application form filling, Ujwala gas scheme form Utility services: Mobile recharge; DTH recharge; electricity bill payment; train tickets; bus tickets; FAST tag; vehicle insurance; gas cylinder booking E-governance services: Aadhaar services; PAN services; E-shram card; National health card; 7/12 extract & 8 A Extract; Voter ID services; driving and learning license; birth/death/income certificates Printing, scanning, photocopying, passport size photos Provision of E-commerce services by BAIF: Amazon; Flipkart; Agri products	Provision of internet connectivity to the village by BAIF and the Panchayat village government Development and management of e-commerce platform where consolidated products can be marketed and sold online	Capacity building for the Panchayat village government to manage, operate, support and finance the operating cost of the CCCI infrastructure Training of villagers on network repair and maintenance support Setting up the e-DOST program and training of women to become e-DOSTs Establishment of Pathardi CN offline mesh network, an open-source traditional knowledge-sharing platform where knowledge and information can be preserved to promote indigenous culture and conserve agro-biodiversity in the villagers' ancestral land. Capacity building for tribal villagers to upload content and other data in the offline mesh network Training on local content development to capture tribal dances, crafts, festivals, recipes and the like of the community

Table 7.1 presents an analysis of the significant impact indicators, categorizing them by type of social impact, and indicating whether they were monetized or not for inclusion in the SROI analysis for this case study.

The table identifies three general types of social impacts generated by the Pathardi CCCI, classified based on the type of service that facilitated their creation. These are:

- **Transactional services-facilitated impact:** Impact mainly facilitated by the provision by the CCCI of transactional services
- **Social inclusion-facilitated impact:** Impact mainly facilitated by the provision of the CCCI of social inclusion services
- **Transformational services-facilitated impact:** Impact mainly facilitated by the provision of the CCCI of transformational services.

Table 7.1. Analytical Table on the Significant Social Impacts of Pathardi CCCI

Stakeholders	Key Result Area (KRA) sub elements	Description of Performance Indicator / Performance Indicator	Indication if monetized or not in the SROI Analysis	Indication of Type of Impact		
				Transactional services-related impact	Social Inclusion-related impact	Transformational services-related impact
KRA #1: Increased levels and capacities for inclusive human development and community empowerment						
Villagers	Easy and convenient access to digital services	Cost savings; wages earned	Monetized	X	X	
Senior citizens/ Illiterates	Inclusion in digital economy	Need not wait for their sons or daughters to transact on their behalf; less daunting for illiterates	Not monetized	X	X	
Tribal women (e-DOST)	Improved skills and competence in digital services	Became digitally literate, capable of using devices like smartphones and apps	Monetized			X
	Improved social standing	Built a loyal customer base	Not monetized			X
		Acceptance and respect of family and the community	Not monetized			X
Small farmers	Networking opportunities for knowledge-sharing	Made it easier to share and learn from each other	Not monetized			X
ICDS of Gram Panchayat and association of e-DOSTs	Equipped in the maintenance of the physical infrastructure	Ensure smooth operation of internet through the prevention of breakdowns or effective troubleshooting	Not monetized			X
KRA #2: Improvement in the economic position and conditions of community stakeholders						
Tribal women (e-DOSTs)	Financial empowerment	Started generating income or increased earnings	Monetized			X
		Started saving and opened a bank account	Not monetized			X
Warli artists and small farmers	Expansion of markets online	Increased customer base and improved earnings	Monetized		X	

Table 7.1. Analytical Table on the Significant Social Impacts of Pathardi CCCI *[cont.]*

Stakeholders	Key Result Area (KRA) sub elements	Description of Performance Indicator / Performance Indicator	Indication if monetized or not in the SROI Analysis	Indication of Type of Impact		
				Transactional services-related impact	Social Inclusion-related impact	Transformational services-related impact
KRA #3: More effective preservation of the cultural identity, heritage, and integrity						
Villagers	Improved capacity for the preservation of local knowledge	More effective and comprehensive documentation and archiving such that information could be shared with the younger generation and the outside world	Not monetized			X
		Enabled to produce content online	Not monetized			X
KRA #4: Increased levels and capacities for conservation and development of agricultural or ancestral lands and biodiversity						
Small farmers	Crop diversification and improved land productivity	More varieties and higher yields	Monetized			X
	Biodiversity conservation and development	Indigenous seed varieties are more systematically preserved, developed, and propagated	Not monetized			X

In analyzing the different impacts based on the services that produced them, the focus is on the Pathardi CCCI's core intent in offering these services to its primary stakeholders.

When the Pathardi CCCI introduced digital services through infrastructure development, online and offline mesh networks, and the e-DOST program, it provided the community with easy and convenient access to digital services. The elderly and illiterate villagers, who once felt insecure about transacting on their own, were empowered to do so without waiting for relatives. Although villagers paid the e-DOSTs for access to digital services (a transactional service-facilitated impact), the provision of these services also promoted social inclusion (a social inclusion-facilitated impact). Before the initiative, there was no internet connectivity, and a commercial ISP would not have found it profitable to invest in the community.

When the e-commerce portal was made available to Warli artists, small farmers, and women in self-help groups, it expanded their market online and increased their earnings. This was a social inclusion services-facilitated impact as their access to the portal facilitated their digital inclusion, allowing them to promote their cultural heritage and reach external markets beyond their villages.

When young tribal women were trained to become e-DOSTs, they not only gained digital literacy (a social inclusion-facilitated impact) but also the ability to offer digital services to villagers who lacked the skills or resources for digital transactions. Transforming women into digital entrepreneurs was a transformational service-facilitated impact.

On an individual level, e-DOSTs—digitally literate women equipped to set up digital enterprises—became financially empowered to support themselves and their families, including saving for future needs. This highlights a transformational service-facilitated impact.

Similarly, by enabling small farmers to develop and upload content to a knowledge-sharing platform, the Pathardi CCCI fostered a transformational service-facilitated impact. The farmers used the platform to network, adopt new planting methods, improve their livelihoods, and care for their ancestral lands. As a result, they grew new crop varieties, adopted better cultivation techniques, and improved land productivity. The community also strengthened its biodiversity through systematic seed preservation and propagation.

The most significant transformational service-facilitated impact of the Pathardi CCCI was empowering the community to take over its ownership and management from BAIF and partners after the project ended. Personnel from the ICDS under the Gram Panchayat, along with the e-DOST association, took responsibility for maintaining and operating the infrastructure, ensuring the sustainability of the Pathardi CCCI.

Due to time and resource constraints, not all significant social impacts were quantified and monetized. Of the 14 significant impacts identified in the evolving development index in *Table 4,* only five were included in the SROI analysis. The remaining 10, mainly transformational services-facilitated impacts, were not monetized. These impacts are intrinsic to the social enterprise model of the Pathardi CCCI, a digital industry initiative. While the SROI analysis indicates positive cost-effectiveness, further refinements in a future study are expected to yield even higher returns.

Empowering and enabling the villagers was central to the Pathardi CCCI's objectives. The project equipped the primary stakeholders to take ownership and maintenance of the infrastructure upon project completion. Revenue and profit-generating opportunities were created for the primary stakeholders like e-DOSTs, small farmers, and Warli artists. Social inclusion and transformational services were key in driving these impacts, motivating the community to take responsibility for the Pathardi CCCI's ongoing success.

SUMMARY AND CONCLUSION

The Pathardi CCCI addresses India's critical need to connect rural villages to the internet. Previous government and private initiatives had failed to bridge the digital divide effectively. Using the 4P multi-stakeholder approach, the Pathardi CCCI offers a successful, bottom-up strategy for overcoming the complex challenges of rural connectivity in India.

The 4P model initially engaged local communities through the Gram Panchayat, the village's governing body. From the start, the project prioritized the people's goals in its design and implementation, fostering ownership and ensuring community involvement.

Unlike earlier BOTs and JVs, which focused on customer growth and return on investments, the Pathardi CCCI, as a social enterprise, placed social inclusion and the transformation of its primary stakeholders at the forefront of its objectives. The Pathardi CCCI continues to operate through the Gram Panchayat, with personnel from the ICDS and a network of e-DOST women managing the infrastructure. Its long-term sustainability is secured through the village government's annual budget allocation for operation and maintenance as part of its public service commitment.

Development Indexing and the SROI methodologies were used to assess the social impacts of the Pathardi CCCI. Development indexing revealed four key result areas with significant social impacts:

1. **Increased levels and capacities for inclusive human development and community empowerment**
2. **Improved economic position and conditions of community stakeholders**
3. **More effective preservation of cultural identity, heritage, and integrity**
4. **Increased levels and capacities for conservation and development of agricultural or ancestral lands and biodiversity.**

SROI analysis also demonstrated cost-effectiveness, with increasing SROI values: 1.23 in 2020, 3.25 in 2021, and 8.19 in 2022. This indicates positive cost-effectiveness in producing the social impacts. In 2022, the highest SROI ratio of 8.19 means the Pathardi CCCI generated social outcomes worth USD 8.19 for every USD 1.00 invested.

Out of 14 significant social impact indicators, only five were monetized, suggesting that the overall cost-effectiveness could be even greater if all significant indicators were monetized. Most unmonetized indicators were transformational services-facilitated impacts, which commercial ISPs do not typically provide.

The Pathardi CCCI's social impacts were mainly facilitated by social inclusion and transformational services that empowered community stakeholders to own, govern, and manage the infrastructure after the project's completion. The initiative did not generate profits for itself, but it created opportunities for villagers, such as e-DOSTs, Warli artists, and small farmers to benefit economically.

This model offers a potential framework for bridging the digital divide in remote rural communities while fostering sustainable local economic development. By engaging village governments to manage, operate, and finance internet connectivity as a public good in partnership with local institutions and entrepreneurs, this model could be replicated in other developing countries to provide meaningful connectivity and stimulate economic growth.

Annex

Table 4: Elements and Sub-elements of an Evolving Development Index for the Pathardi CCCI					
Stakeholders	**Key Result Area (KRA) sub-elements**	**Description of Performance Indicators / Performance Indicators**	**Approximate Rating for Pathardi**		
			Extent of Reach	**Depth of Impact**	**Significance**
KRA #1: Increased levels and capacities for inclusive human development and community empowerment					
Villagers	Easy and convenient access to digital services	Cost savings; wages earned from productive use of time at work and not having to travel	**High** 80% of the population experienced the benefit.	**Low** Depth is not the point here. This is about internet connectivity or social inclusion so that the villagers can have better access to the internet.	**Significant**
Senior citizens/ illiterates	Inclusion in the digital economy	Need not wait for their sons or daughters to transact on their behalf; making digital transactions less daunting for illiterates	**High** 100% of the 30% of the tribal population are seniors	**Medium** The e-DOST program made this possible	**Significant**
Tribal women (e-DOSTs)	Improved skills and competence in delivering digital services	From being not savvy, they became digitally literate, capable of using devices like smartphones and navigating through apps such that they became effective in delivering digital services	**High** All hamlets in the target village have one to two capable e-DOSTs to serve and efficiently deliver digital services adequately.	**High** Carefully selected and well-trained to effectively deliver the services	**Significant**
		Explored new apps or other services and offered new services to the community based on the perceived needs of the community	**Low** A few of the e-DOSTs started showing entrepreneurial initiatives to offer new services.	**Low** Only a few exhibited this impact	**Not significant**
		Mentored new e-DOSTs	**Low** Only very few of the e-DOST population were observed exhibiting such behavior	**Low** The capability for mentoring could be developed more	**Not significant**
	Improved social standing	Built a loyal customer base	**High** Since there were only one or two e-DOSTs based on the size of the population per village, they built a solid customer base, reaching all Aadhar-enabled adults in the tribe.	**Medium** The system was designed so that trust and loyalty were built between the e-DOST and the villagers availing the services.	**Significant**
		Acceptance and respect of family and community	**High** 100% of the e-DOST were held in high regard as a big help to the whole community, like “digital heroes,” by their families and the villagers because of their services.	**High** It developed the tribal women who were e-DOSTs to become more confident in themselves. They improved their self-image and worth.	**Significant**

Table 4: Elements and Sub-elements of an Evolving Development Index for the Pathardi CCCI *[cont.]*					
Stakeholders	**Key Result Area (KRA) sub-elements**	**Description of Performance Indicators / Performance Indicators**	**Approximate Rating for Pathardi**		
			Extent of Reach	**Depth of Impact**	**Significance**
KRA #1: Increased levels and capacities for inclusive human development and community empowerment					
Small farmers	Networking opportunities for knowledge-sharing	Made it easier to share and learn from each other	**High** 100% of tribal farmers had access	**High** They were enabled to upload content on their own with ease; communicated more frequently; related with farmers outside their village	**Significant**
ICDS of GramPanchayat (tribal governing body) and association of tribal women e-DOSTs	Empowerment of the community to own and manage the physical infrastructure	Equipped in the maintenance of the physical infrastructure to ensure smooth operation of internet connectivity	**High** 100% of the ICDS and e-DOSTs equipped	**High** Ensured sustainability of the service for the whole community	**Significant**
KRA #2: Improvement in the economic position and conditions of community stakeholders					
Tribal women (e-DOSTs)	Financial empowerment	Started generating their income or increased their earnings	**High** 100% of e-DOSTs	**High** Enabled the tribal women to support their personal needs, and have money to meet family needs, including helping extended family	**Significant**
		Started saving by opening bank accounts	**Medium** 50% of the women	**Medium** Formed the habit of regularly saving	**Significant**
		Invested in assets such purchase of motorcycle, land, financial assets such as insurance and other financial products	**Low** Not more than 30% of the tribal women who were e-DOSTs were observed doing this	**Low** Low knowledge or consciousness about investing	**Not Significant**
		Reinvested earnings in digital business	Low Not more than 30% of the tribal women were observed	**Low** The initiative to reinvest was not apparent yet	**Not significant**
Warli artists and small farmers	Expansion of markets online	Increased customer base and improved earnings	**Medium** Between 30% to 60% of artists and small farmers used e-commerce for trade	**Medium** Warli artists and farmers learned to create content and post their products online and started their e-commerce	**Significant**

Table 4: Elements and Sub-elements of an Evolving Development Index for the Pathardi CCCI *[cont.]*					
Stakeholders	**Key Result Area (KRA) sub-elements**	**Description of Performance Indicators / Performance Indicators**	**Approximate Rating for Pathardi**		
			Extent of Reach	**Depth of Impact**	**Significance**
KRA #3: More effective preservation of the cultural identity, heritage, and integrity					
Villagers	Improved capacity for the preservation of local knowledge	More effective and comprehensive documentation and archiving such that information could be shared with the younger generation and the outside world	**High** More than 60% of the population is capable of content creation about aspects of their life as a tribal community	**High** Their culture, traditions, and agro-biodiversity became available in digital format and the local language. Preserved for the next generations. It also made it easy to promote to the outside world.	**Significant**
		Enabled to produce content online such as images, videos, and audio recordings, and upload them	**High** 70% of the population trained	**High** Enabled the community	**Significant**
KRA #4: Increased levels and capacities for conservation and development of agricultural or ancestral lands and biodiversity					
Small farmers	Crop diversification and improved land productivity	More crop varieties and higher yields	**High** 100% of tribal farmers benefitted	**Medium** Created a mechanism to share best practices and address concerns in their farms	**Significant**
	Biodiversity conservation and development	Indigenous seed varieties more systematically preserved, developed and propagated	**High** 100% of tribal farmers benefited	**High** Upgraded the present system of manual seed banking for the tribe	**Significant**

About the Cooperating Organizations

The Association for Progressive Communications (APC) is an international network of Civil Society Organizations (CSOs), operating since 1990. Its work focuses on supporting Information and Communication Technology (ICTs) for social justice. In 2017, APC has embarked in exploring and supporting Community Networks, now called as Community-Centered Connectivity Initiatives (CCCIs), in bridging the digital divide worldwide. APC is present in 20 countries from the Global South.

Visit APC's website here: **www.apc.org**

RHIZOMATICA

Rhizomatica is driven by its mission to make alternative telecommunication infrastructures for vulnerable, poor, and isolated communities in Africa and Latin Africa. Using approaches combining regulatory activism and reform, critical engagement with, and development of, technology, design of novel sustainability models, and direct community involvement and participation, Rhizomatica aims to support communities towards building and maintaining self-governed and owned communication and energy infrastructure.

Visit Rhizomatica's website here: **www.rhizomatica.org**

ISEA
Institute for Social Entrepreneurship in Asia

The Institute for Social Entrepreneurship in Asia (ISEA) is a learning and action network set-up by social enterprises, social enterprise resource institutions and scholars in 2008 to undertake research, education, advocacy and building of platforms for social entrepreneurship towards sustainable development. It pursues various platforms for multistakeholder collaboration to advance social entrepreneurship towards accelerating the achievement of the Sustainable Development Goals: Technological Innovations for Sustainable Development; Women's Empowerment, Livelihoods and Food in Agricultural Value Chains; Decent Work for All in Sustainable Value Chains; Rural Revitalization, Youth and Social Entrepreneurship; Health for All and Poverty Reduction through Social Entrepreneurship. It has a membership spanning 15 countries and territories in Asia and is based in the Philippines with a regional office hosted by the Ateneo Center for Social Entrepreneurship.

Visit ISEA's website here: **www.isea-group.net**

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RHIZOMATICA

BRIDGING THE DIGITAL DIVIDE IN A TRIBAL COMMUNITY IN INDIA:
The Pathardi Community-Centered Connectivity Initiative

May 2025