Internet Connectivity for Development in the Urban Periphery

PalmasNet and Community-Driven Internet Initiatives

Banco Palmas | Columbia SIPA
Workshop in Development Practice 2015-16

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Executive Summary

Banco Palmas, Brazil’s first community bank, was established in 1998 to promote economic and social development in the neighborhood of Conjunto Palmeiras, a low-income community located on the outskirts of Fortaleza, in northeastern Brazil. In 2016, the organization launched an initiative called PalmasNet that aims to use Internet connectivity to promote community development in Conjunto Palmeiras, and capitalize on the potential of a fully connected neighborhood.

To assist Banco Palmas in developing this initiative, a team of students from Columbia University’s School of International and Public Affairs (SIPA) made two field trips to Conjunto Palmeiras and conducted an extensive analysis of Banco Palmas, its external environment, the needs and opportunities in the community, and the constraints these factors represent for the development of the PalmasNet initiative. In addition to this fieldwork, the team conducted a global benchmarking study of Internet connectivity projects worldwide, to identify best practices and successful models, and evaluate the possibility of replication in Conjunto Palmeiras.

The result of this project is a strategic planning document containing a series of recommendations for the implementation of PalmasNet. The team recommends strategies for the implementation of three complementary components of PalmasNet. First, the creation of free public WiFi hotspots to meet current community needs, improve community engagement, and leverage available resources for social and economic development. Second, the creation of a community portal and online content to complement these initiatives by streamlining access to Banco Palmas’ services, community resources, and promote community content creation. Finally, a low-cost and high-quality paid Internet service to homes and businesses in Conjunto Palmeiras, implemented in partnership with local ISPs, to strengthen Banco Palmas’ role as a convener and catalyst for quality Internet service for all.

Overall, recommendations are designed to allow Banco Palmas to pursue its mission of community development by bringing faster, more affordable Internet to Conjunto Palmeiras and to leverage this expanded access for community mobilization and social inclusion.
Introduction

Today, access to Internet is considered a basic human right, and for developing countries it is believed to be the single most important tool to achieving sustainable economic growth. Yet, billions of people living in some of the world’s poorest regions are unable to connect to the Internet. More than 57% of the world’s population do not have access to the Internet and are unable to leverage the enormous benefits offered by it. With the UN urging countries and all actors involved to ensure “access, use and affordability” of the Internet, there has been a specific interest and urgency created around the world in bridging this digital divide.

The Conjunto Palmeiras neighborhood of Fortaleza, a city in northeastern Brazil, is situated on the outskirts of the city and is one of the poorest neighborhoods in the region. As Conjunto Palmeiras faces challenges of meeting its basic infrastructure needs, the local community bank, Banco Palmas, views the potential of Internet access as a key tool to improving the social and economic lives of the community.

A team of graduate students from Columbia University’s Economic and Political Development Workshop (“the team”) was tasked with working with Banco Palmas to help develop and expand Internet services in Conjunto Palmeiras. Through field trips and extensive benchmarking research, the team developed a comprehensive report outlining steps that might be taken to expand Internet access in the community.

The Client

Banco Palmas, Brazil’s first community bank, was established in 1998 by Ashoka fellow Joaquim de Melo to promote economic and social development in Conjunto Palmeiras. Rooted in the principles of “Solidarity Socio-Economy”, the bank strives to stimulate the local economy by providing credit to residents in the community. Banco Palmas, managed by the association of residents of Conjunto Palmeiras (ASMOCONP), seeks to reduce financial exclusion through the use of a social currency (the “Palma”), microcredit, professional training, and mapping of local consumption and production.

To expand the functions of the bank, in 2003, de Melo established Instituto Palmas. Instituto Palmas functions as an umbrella organization providing legal and technical support for a network

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2 Ibid.
of community development banks (CDBs) across Brazil. Since 2012, Banco Palmas has operated PalmasLab, a research and innovation lab focused on technology development and research activities to promote social and economic development in Conjunto Palmeiras.

Driven by a strong belief that “the Internet is a right for all,” Banco Palmas created PalmasNet with the objective of developing “a 100% connected neighborhood to build a local system of collaborative governance.” PalmasNet will function under the aegis of PalmasLab. The PalmasNet initiative has two main objectives: bringing faster and more affordable Internet to Conjunto Palmeiras, and leveraging expanded access for enhanced community mobilization and social inclusion.

Banco Palmas has also partnered with e-dinheiro, a financial technology company that offers affordable mobile banking solutions. E-dinheiro operates with a social objective to provide a viable financial solution to small communities without burdening them with high fees. As part of their mission to support communities, e-dinheiro returns 50% of its revenue back to community banks with whom they partner. Maximizing the value created by this service is essential in achieving long-term sustainability of PalmasNet.

Banco Palmas tasked the 2015-2016 Columbia University workshop team with creating a strategic plan to help actualize the vision and objectives of PalmasNet. In this report, the workshop team provides recommendations to the client based on an in-depth analysis of the client’s internal and external environment as well extensive global research on Internet services in various communities similar to Conjunto Palmeiras. This report serves as a guide to help Banco Palmas address the key issues in establishing PalmasNet.

Project Outline

As Banco Palmas has embarked upon developing cost-effective and easy-to-use technology to foster development, it faces significant challenges. Conjunto Palmeiras continues to lag behind the rest of Fortaleza in life expectancy, income, and education. Yet, there is enormous potential for growth considering the wealth of young human capital available in the region. Banco Palmas is seeking to channel the potential of young people towards community development through the use of technology. Widespread access to technology is still a challenge in Conjunto Palmeiras as Internet service is prohibitively expensive in the periphery of Fortaleza.

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5 Ibid.
Given this background, this project focused on better understanding the potential of and barriers to Internet connectivity in Conjunto Palmeiras and aimed at creating strategies to address these challenges. The project has two main components:

**Benchmarking Study:** a global benchmarking study was conducted to understand how similar community based Internet access initiatives were designed and implemented to achieve sustainability. The research created a knowledge base around similar initiatives that have been implemented in other areas to identify best practices from these initiatives.

**Strategic Plan:** The team conducted assessments in two phases during its January and March 2016 site visits, to collect baseline information from the community and to assess the feasibility of potential options for implementing an Internet connectivity strategy in the area. Based on the onsite assessment of the community and the client, the team designed a series of recommendations for the Internet connectivity initiative to achieve sustainability while ensuring social impact. Building on the work of the benchmarking study and a community needs assessment, the strategic plan offers a series of recommendations to help Banco Palmas implement a connectivity project in Conjunto Palmeiras. The primary focus of the strategic plan was to build on the community-based nature of Banco Palmas and ensure that recommendations made in this strategic plan match with community needs and organizational capacity. While the benchmarking study allowed the team to identify a broad and extensive vision of various global initiatives, the strategic plan narrowed these initiatives to align them with the unique needs and opportunities in Conjunto Palmeiras.

The plan will first cover the team’s field research in the form of an internal and external analysis, followed by secondary research of global best practices. It will then outline recommendations, based on three key focus areas identified from research.
ANALYSES AND RESEARCH FINDINGS

To provide achievable and realistic recommendations for the PalmasNet project, the team undertook an extensive analysis of the organizational assets and capacities of Banco Palmas, as well as of the external factors influencing the outcome of the project. The analysis is organized in three parts. The internal analysis was undertaken to assess the organizational resources and capacity of Banco Palmas in relation to implementing the PalmasNet project. An external analysis examined the political, economic, social, technological, and legal factors influencing the project. The results of these analyses are summarized in the SWOT (strengths, weaknesses, opportunities, and threats) analysis. In the third part of its research, the team conducted a benchmarking study of community-based Internet services around the world, and Internet technology solutions for community development. These findings are summarized in this section.

BANCO PALMAS

Internal Analysis

The team, in its field research, conducted a capacity analysis of Banco Palmas’ management and organizational resources. The goal of this analysis was to help determine what resources and capacities Banco Palmas possesses in order to develop the PalmasNet Internet project. This analysis consisted of two parts: an analysis of key organizational resources as they relate to project implementation, and an assessment of organizational capacities.

Organizational Resources

The team considered the tangible, intangible, and human resources of Banco Palmas available and necessary to support the Internet project.

Tangible Resources

Financial Resources

Banco Palmas has received financial support, in the form of a grant, from the insurance company MAPFRE to implement the first year of the PalmasNet project. MAPFRE indicated that it would provide additional funding for a second year of Internet implementation. Additional revenues for the Internet project may include revenue from the e-dinheiro mobile money application. E-dinheiro, the company that administers the application, has stated that 50% of the net profits from the application will be channeled to community banks who are their implementing partners. However, current information on profits was not available at the time of writing.
In addition, Banco Palmas receives significant in-kind support from companies and individuals. Through their partnership with Citinova, Banco Palmas has access to free bandwidth on the city government’s fiber network, administered by FibraFort. Through a partnership and business agreement with the Internet service provider WireLink, Banco Palmas receives discounted bandwidth, as well as technical assistance from WireLink. Finally, Banco Palmas has recruited technology specialists to provide short-term consulting on the PalmasNet project for a minimal fee.

**Physical Assets**

The physical assets owned by Banco Palmas consist primarily of physical space and computing and Internet infrastructure. Banco Palmas has a large office space, the second floor of which consists of the PalmasLab office and operations center, and a large community meeting room where presentations and trainings take place. In addition, Banco Palmas owns a space in a nearby lot, where Elas (an affiliated women’s empowerment program) is housed, and where they are currently renovating an outdoor area, set back from the street inside that compound, to be used as a community space.

For technological infrastructure, Banco Palmas has invested in approximately 2 km of fiber optic cable to connect Conjunto Palmeiras to the existing fiber infrastructure of Fortaleza. This is a key asset that Banco Palmas brings to the community. Using this connection, Banco Palmas has begun a pilot of five WiFi connected hotspots in public areas in Conjunto Palmeiras, with Internet infrastructure administered under the auspices of PalmasNet. These areas operate with equipment and routers owned by Banco Palmas. The bank also owns a radio tower/communications mast near the main office.

**Intangible Resources**

**Reputational Assets**

One of Banco Palmas’ key assets and strengths is its capacity to form organizational partnerships, due to its reputation in the local, national and international community, and its long history of work within the Conjunto Palmeiras community. These partners consist of government agencies, universities (principally international), private sector companies, other community organizations, and individuals. Partnerships with these organizations have helped to attract funding for Banco Palmas. For example, MAPFRE’s partnership with Banco Palmas led to their financial support of the PalmasNet Internet project. Banco Palmas has worked with local ISPs such as WireLink to obtain heavily discounted goods and services in support of the bank’s social mission. Many agencies in the current local and state government have shown interest in being involved with or supporting the PalmasNet project, including the Secretaries of Education, Planning, Science and Technology, Human Rights, and the Office of the Vice Mayor of Fortaleza. These partnerships
have allowed Banco Palmas to expand its capacity for implementation of projects, through funding and technical assistance, as well as allowing organizational access to its partners’ resources. Furthermore, government partnerships have raised the profile of the PalmasNet initiative and the work of Banco Palmas, which further increases the organization’s ability to forge partnerships in the public and private sector.

**Technical Expertise**

Banco Palmas pioneered the model of social currency and community banking. The organization is a key leader in the field of alternative banking models and possesses depth and breadth of knowledge in banking operations. It serves as the primary reference source for a nationwide network of community banks.

Beyond its banking operations, Banco Palmas, through its PalmasLab initiative, is conducting research and collecting data from the community, and is one of the only institutions which is gathering person-level data from community members. This unique data source can be extremely useful if it is analyzed and used to inform the organization’s strategic plans and projects. Additionally, Banco Palmas’ participatory research methods, developed in conjunction with the Massachusetts Institute of Technology, allow for community perspectives to inform the organization’s projects. This research and data collection also permits Banco Palmas to measure changes in the community over time.

**Human Resources**

Banco Palmas maintains a small but dedicated staff in the PalmasLab, which administers the PalmasNet project. The management level is extremely limited, with one full-time staff member providing strategy and oversight to all of the projects under the auspices of PalmasLab, including PalmasNet. While limited, staff have worked with the bank for many years and are knowledgeable about operations and the community, and are committed to the mission of the bank itself. Technical assistance on the Internet project is provided primarily through external consultants, as well as a lead engineer, who is primarily dedicated to software and backend development. PalmasLab also relies on a small staff of interns who are a group of high school and university age young people from the community. The interns are committed to the organization and its mission, and are an asset in helping the organization retain its connection with young people in the community. The second level of human resources at Banco Palmas are the “community consultants,” approximately 20 individuals who receive training at Banco Palmas and work in the neighborhood on different initiatives, including outreach and client recruitment for e-dinheiro.
The basic structure of PalmasLab staff available to support the PalmasNet initiative is summarized in Figure 1.

*Figure 1. Simplified Organizational Chart for PalmasNet Human Resources*
As Table 1 shows, the team found that Banco Palmas has strong intangible resources to support this project, including reputational assets. Financial assets are sufficient to begin program implementation, but are not necessarily guaranteed for the long term. Human resources consist of a small but dedicated team of staff and interns.

Table 1. Summary of Findings: Organizational Resources

<table>
<thead>
<tr>
<th>ORGANIZATIONAL RESOURCES</th>
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<tbody>
<tr>
<td><strong>Tangible Resources</strong></td>
</tr>
<tr>
<td>Financial Assets</td>
</tr>
<tr>
<td>- MAPFRE funding: one year guaranteed, two years likely</td>
</tr>
<tr>
<td>- Revenue from use of e-dinheiro application</td>
</tr>
<tr>
<td>- In-kind support: low/at cost bandwidth, fiber optic cable, and technical assistance, donated time of experts.</td>
</tr>
<tr>
<td>Physical Assets</td>
</tr>
<tr>
<td>- Office space and meeting room in Banco Palmas Office</td>
</tr>
<tr>
<td>- Newly renovated community space</td>
</tr>
<tr>
<td>- WiFi enabled hotspots</td>
</tr>
<tr>
<td>- Fiber optic cable connection</td>
</tr>
<tr>
<td>- Radio tower, computers, routers</td>
</tr>
<tr>
<td>Intangible Resources</td>
</tr>
<tr>
<td>Reputational Assets</td>
</tr>
<tr>
<td>- Significant brand recognition, local, national and, international, that aids partnership building</td>
</tr>
<tr>
<td>Technical Expertise</td>
</tr>
<tr>
<td>- Developed social currency and community banking model</td>
</tr>
<tr>
<td>- Community research and data collection</td>
</tr>
<tr>
<td>Human Resources</td>
</tr>
<tr>
<td>Management</td>
</tr>
<tr>
<td>- Small but highly experience management-level staff</td>
</tr>
<tr>
<td>Staff</td>
</tr>
<tr>
<td>- Interns and community consultants committed to the organization and connected with the community</td>
</tr>
</tbody>
</table>

Organizational Capacity Assessment

The team used an adapted Organizational Capacity Assessment (OCA) tool to assess Banco Palmas’ organizational capacity to effectively develop and administer an Internet project. This OCA encompasses six assessment categories: mission and vision; strategy, growth, and development; organizational skills; human resources; infrastructure; and culture.

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Mission and Vision

Since 2012, Banco Palmas has operated PalmasLab, an initiative designed to function as a laboratory of innovation and research in support of the work of Banco Palmas. In practice, however, PalmasLab programs are not closely aligned with Banco Palmas’ traditional role in the neighborhood. PalmasLab has created training for programmers and is now introducing the PalmasNet project. While aligned with Banco Palmas’ social objectives, these new programs are not an extension of the bank’s original mission of community banking and solidarity finance and constitute a different focus for the bank.

Banco Palmas has a clear understanding of its organizational mission; however, the clarity of its vision is constrained by the number of different initiatives it has undertaken. Banco Palmas views the use of technology as both an expansion of its financial services and a tool to increase the level of community mobilization within Conjunto Palmeiras. This goal has shifted the bank from its traditional role as a provider of financial services in Conjunto Palmeiras to developing and delivering a variety of new technological services. The introduction of e-dinheiro, the mobile money platform, and the PalmasNet initiative have changed its focus and diluted the focus of their core business.

Asier Ansorena, the project manager of PalmasNet, has a clear vision for the project. WiFi hotspots and Internet to homes will create the means for increased access to information and increased community activism, with the goal of increasing services within Conjunto Palmeiras. The goals for the PalmasNet initiative, however, have not yet been fully articulated or incorporated into an actionable plan for the PalmasNet team.

Strategy, Goals and Growth

Banco Palmas has identified the goal for PalmasNet as increasing community mobilization and expanding financial services, however, any clear action for achieving these goals has not been established. As previously mentioned, Banco Palmas’ strategic partnerships have been essential for funding the PalmasNet initiative, as well as reducing the cost of developing a fiber infrastructure. For the PalmasNet project, Banco Palmas has developed partnerships with existing ISPs in Conjunto Palmeiras to deliver Internet connectivity to homes and has developed plans to deliver Internet in public spaces. The structure of the ISP association is still not clearly defined. Questions remain as to who will join the association, the day-to-day operations and maintenance, customer distribution, and revenue sharing. Despite questions of future action, the public WiFi provision has already started to be implemented, with five hotspots established in Conjunto Palmeiras.

Banco Palmas has expressed its desire to use the PalmasNet initiative to build upon previous community activism. It views the Internet as a tool to mobilize the community, to enable the
community itself to address its most pressing problems. While the bank’s management expresses community-driven activism as an important strategy, the goals and methods for achieving this have not yet been addressed. A strategy to develop content, promote PalmasNet, and deliver Internet connectivity to homes is still under development. The strategy for PalmasNet lacks clarity, time frame, or any associated metrics. These issues will be addressed further in the report.

Banco Palmas has established a clear strategy of community development by providing traditional financial services through the community banking model. However, Banco Palmas has not established clear goals or clear quantifiable targets to measure their productivity or effect on the community. Previous graduate consultants from Columbia University have provided Banco Palmas with tools to evaluate their community impact; however, Banco Palmas has not actively used these monitoring and evaluation tools. Its limited staff and resources make it difficult to collect and analyze data from the community.

Banco Palmas has been able to expand and replicate its community bank model throughout Brazil. However, that has not carried over to other initiatives. Due to the fact that Banco Palmas is dependent on partnerships and external resources, replicating existing programs is difficult to do on a large scale. The promotion of e-dinheiro and locally developed apps within Conjunto Palmeiras has been limited, due to the lack of personnel available to plan and promote the products. Similarly, it has not yet articulated a replication strategy for the PalmasNet initiative. If PalmasNet is successful within Conjunto Palmeiras, it would be difficult to replicate it throughout other areas of Fortaleza or other periphery communities in Brazil, due to limited resources and dependence on partnerships for funding, technical assistance, and implementing capacity. Additionally, competition with large telecoms and ISPs in Brazil may present problems for increasing the size of PalmasNet’s coverage.

**Organizational Skills**

**Planning**

Banco Palmas has multiple programs that can complement each other. However, Banco Palmas does not actively plan to integrate these initiatives. Banco Palmas provides a microcredit service that could integrate with the new e-dinheiro initiative, however those two have been kept separate. This lack of integration requires high-level planning that could benefit programs, such as e-dinheiro, that are struggling to gain traction.

**Fund-raising and Revenue Generation**

In addition to funds raised through the community bank, Banco Palmas raises revenue through the e-dinheiro app, where 50% of profits are returned to Banco Palmas. However, e-dinheiro has not been actively promoted within Conjunto Palmeiras or integrated with other Banco Palmas services, leaving Banco Palmas with marginal revenue from their existing programs. Banco Palmas
envisions an association of ISPs to deliver paid Internet service to resident’s homes. Banco Palmas wants to partner with ISPs that are already operating within Conjunto Palmeiras, so that PalmasNet will not drive existing service providers out of business. However, using an association model for PalmasNet would require all profits be returned to the association, limiting the revenue-generating capacity of the initiative.

*External Relationship Building and Management*

Banco Palmas depends on various partnerships to fund their initiatives. They have consistently been able to build relationships with different universities to bring outside expertise, and have been able to partner with local businesses, while using the reputation and mission of the Banco Palmas to receive materials at reduced prices.

*Local Community Presence and Involvement*

Started as a community-based organization, Banco Palmas prides itself on its roots in the community. Yet in field interviews, the bank staff expressed concerns that the organization has grown more technical and become distant from the neighborhood, and that community members - particularly youth - are less engaged than previous generations. However, Banco Palmas is still well-known in the community and still recruits many volunteers from the neighborhood. They are actively engaged in initiatives to best assess and respond to community needs. Specifically with the PalmasNet project, Banco Palmas is working with groups of young people to gather feedback on the structure of the project, and collecting data on Internet service provision in the community.

*Influencing Policy-making*

It is the goal of Banco Palmas to use community mobilization to improve the quality of services in the neighborhood. One of the potential effects of increased mobilization is being able to lobby the government of Fortaleza for effective services. In the 1970s, many fishing communities were forced from the coastal areas of Fortaleza and were relocated inland, to what is now Conjunto Palmeiras. Due to the forced relocation, the neighborhood was initially left without basic infrastructure, such as water, roads, and electricity. However, in the 1980s and 90s, the community leaders were able to effectively mobilize the residents of Conjunto Palmeiras for increased services from the government. Currently, the city government is willing to meet with Banco Palmas, because of its reputation, but has not committed additional funds or services to Conjunto Palmeiras. Banco Palmas wants to use the legacy of the previous community mobilization to influence the government of Fortaleza to improve sanitation and other local services.

*Management of Legal and Liability Matters*

Banco Palmas has the assistance of an attorney who reviews contracts and helps guide them through any issues pertaining to legal or contractual relationships and regulatory issues.
Communication Strategy
Banco Palmas has one full-time communications officer, one part-time intern, as well as community consultants who promote Banco Palmas products throughout the neighborhood. The communications officer maintains a Facebook page that promotes their work within the community and new initiatives. The project manager, Asier Ansorena, meets with outside organizations to develop partnerships and identifies and applies to upcoming proposals.

Human Resources
Passion, Vision, Experience and Standing
The senior management of Banco Palmas has accumulated years of experience and institutional knowledge in the community bank. Banco Palmas staff, the majority of whom are interns, do not have deeply specialized skill sets. The staff and interns share a strong vision for the social development of Conjunto Palmeiras and are highly committed to their work at Banco Palmas.
Banco Palmas relies on outside contracted help for more technical work, which helps reduce cost, but is difficult to maintain for extended periods of time.

There is, however, a dearth of technical experience and a large amount of dependence on the program manager. While the staff is highly motivated and closely integrated in the community, most lack experience in their respective fields. In addition, many of the innovation initiatives, including PalmasNet, are dependent on the project manager’s involvement to continue. Due to the management structure of PalmasLab, time management and workflow management are difficult for interns, many of whom stated that they did not have specific roles or responsibilities in the organization, that they did not know their function, or they did a little of everything. This situation reduces productivity within Banco Palmas. Overall, the team assessed human resources to be a strength of Banco Palmas, but also limited due to the lack of technical expertise and dependence on senior management.

Culture, Values and Shared Beliefs
Staff members have a shared culture that is rooted in their belief of the social benefit Banco Palmas provides residents of Conjunto Palmeiras. Contracted workers, who are brought in to address the technical aspects of the PalmasNet initiative, also share in these same values, creating a positive work environment.

Summary of Findings
In summary, Banco Palmas’ organizational strength lies in its ability to leverage its reputation into partnerships with universities, the government of Fortaleza, and local businesses. However, its organizational weaknesses lie in the growing number and diversity of its projects, which have been
difficult to manage with a limited number of staff. With the growing number of Banco Palmas projects, some have the potential to integrate with pre-existing services, however the bank has not yet taken advantage of this opportunity. In addition, performance measurements are sparingly used to measure the services provided by the bank or the bank’s impact on Conjunto Palmeiras. Using performance measurements would allow the bank to identify where it is most effective, in order to prioritize its resources. Finally, strategic goals are frequently changing, making it difficult for staff members to work independently. Having a clear strategic goal would make staff members less reliant on the senior management at Banco Palmas and allow the bank to maximize the time of the staff.

Table 2. Summary of Findings: Organizational Capacity Assessment

<table>
<thead>
<tr>
<th>BANCO PALMAS ORGANIZATIONAL CAPACITY</th>
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<tbody>
<tr>
<td><strong>Strengths</strong></td>
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<tr>
<td>Human Resources</td>
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<tr>
<td>○ Experience, passion</td>
</tr>
<tr>
<td>Culture</td>
</tr>
<tr>
<td>○ Shared beliefs and values</td>
</tr>
<tr>
<td>Aspirations</td>
</tr>
<tr>
<td>○ Mission, overarching goals</td>
</tr>
<tr>
<td><strong>Weaknesses</strong></td>
</tr>
<tr>
<td>Strategy, Growth and Development</td>
</tr>
<tr>
<td>○ Goals, performance targets</td>
</tr>
<tr>
<td>Organizational Skills</td>
</tr>
<tr>
<td>○ Revenue generation, public relations, strategic and operational planning</td>
</tr>
</tbody>
</table>

The team scored each of these capacities, listed in table 2 relative to one another, the results of which are presented in Figure 2. The scoring model used to assess Banco Palmas’ organizational capacity is based on the McKinsey Capacity Assessment Grid, which identifies areas that are strengths and those that need improvement. This matrix was shortened to address the relevant areas of Banco Palmas that were relevant to the PalmasNet initiative. Scoring in this assessment was based on the team’s field work and research.

Figure 2. Relative Organizational Capacities
Conclusions of the Internal Analysis

Based on our field research, we assessed Banco Palmas’ organizational resources and capacity. Banco Palmas’ work in the community over the last 18 years has allowed it to build a reputation as an innovative organization. Its dedicated management team fosters a strong culture dedicated towards improving the lives of the community within Conjunto Palmeiras. In addition, the bank has leveraged its reputation to forge partnerships that increase its physical assets at minimal cost, including installing 2km of fiber optic cable in partnership with WireLink, and introducing a mobile money app with e-dinheiro.

Banco Palmas’ capacity is limited, however, by its organizational skills and ability to clearly define its strategy. PalmasLab initiatives provide a variety of services for the residents of Conjunto Palmeiras, but the diversity and scope of these projects departs from the overarching mission of the bank. The lack of a clearly articulated strategy leads to significant reliance on senior management to oversee day-to-day operations of the organization. The limited staff and financial resources make it important for the bank to maximize its resources, including the time of staff.

Banco Palmas’ capacity in other organizational skills, such as planning and performance measurement, is another weakness of the organization. As new projects are brought on, measuring the effectiveness and success of each program would help Banco Palmas prioritize which projects are worthwhile to pursue. The effectiveness of this approach could be seen most clearly with potentially revenue generating programs, such as e-dinheiro. Establishing clear plans and performance measures would allow PalmasLab focus on programs that are successful, or make adjustments to underperforming programs.
External Analysis and Community Needs Assessment

The team assessed the external environment and how it may impact the PalmasNet project now and in the future. Five external factors were analyzed utilizing the PESTL analysis framework: political, economic, social, technological and legal factors. These macro-environmental factors affect the Internet environment in Conjunto Palmeiras and Fortaleza and the viability of the PalmasNet initiative.

Political Factors

Based on the field trips the team made to Fortaleza, the current local political environment is favorable to the implementation of PalmasNet. Banco Palmas and its president have well-established relationships with universities and organizations internationally and enjoy prestige among local public officials, the latter demonstrating openness and ability to collaborate on the project. The president of Citinova Foundation, the local Secretary of Science, Technology and Innovation, is currently developing an Open Data Portal to foster transparency, civic society participation and the development of data-driven policies. As Citinova is particularly interested in collecting data about urban mobility in the periphery of Fortaleza and e-dinheiro is trying to become one of the methods of payment for city buses, it is likely to find synergy between Citinova and Banco Palmas’ initiatives (PalmasNet, PalmasLab and e-dinheiro).

The city government has also been implementing the project Fortaleza 2040, a strategic plan for the development of the city that involves broad participation of its citizens through face-to-face meetings and surveys via Internet. The city has interest in the PalmasNet initiative since it could decrease the cost of collecting community-level data in Conjunto Palmeiras.

In October and November of 2016, there will be municipal elections that may affect the city government’s priorities and its relationship with Banco Palmas. Currently, the bank has a favorable relationship with the incumbent mayor. So far, only one election poll has been conducted and showed that in September of 2015 the mayor was ranked fifth with 9% of the votes, whereas the leading candidate had 18% of votes. If the current administration is re-elected, it is likely that the city government will continue its support of the PalmasNet initiative.

In summary, the current political environment is favorable but the impending local election produces high levels of uncertainty looking forward to 2017.

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Economic Factors

Brazil has faced economic recession the last few years, reflected in the following indicators for year 2015: decreased GDP (-3.8%) and increased inflation (10.7%), and growing unemployment (6.8%) and interest (14.25%) rates. Economic recession combined with political instability has led to substantial and generalized decline in private investment and reduction of income. Conjunto Palmeiras is the district with the lowest average income out of 119 city districts in Fortaleza (R$ 304.10 for men and R$ 179.76 for women) and 67.84% of its residences have income no greater than one-half the minimum wage.

Low income level is the main obstacle to providing paid broadband Internet service in Conjunto Palmeiras. Despite the prevalence of low-income residents, there is a demand for fixed broadband Internet service to its households. A portion of the residents already subscribe to small local ISPs, which operate only in Conjunto Palmeiras and have hundreds of clients, and to large ISPs that operate on a national level. The ISP market in Brazil is highly concentrated and its six major players as of 2011 have more than 80% of the market share. The entry of a new Internet service provider in the Conjunto Palmeiras market providing more affordable and faster service, such as that envisioned by Banco Palmas, could bring new clients that have been shut out of the fixed Internet broadband market for financial reasons. It is reasonable to predict, however, that big Internet service providers that operate in Conjunto Palmeiras would react to the PalmasNet initiative by predatory pricing and/or improving the quality of their services to retain or attract new customers.

The free provision of Internet connectivity in public hotspots is likely to be met with great demand and may actually increase demand for additional free services.

Social Factors

Fortaleza is the fifth most populated capital of Brazil (pop. 2,452,185) and the fifth most unequal city in the world. Conjunto Palmeiras has a population of 36,599 inhabitants (17,807 men and 18,792 women), and the highest number of inhabitants per house in Fortaleza (4.02 on average).

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The high population density is a positive factor as it reduces the cost of Internet infrastructure deployment.

There is high demand for Internet service in Conjunto Palmeiras. There is also widespread usage of mobile phone technology in the community. Based on observational data, residents, especially younger people, have an avid interest in Facebook, YouTube and Netflix. This data is in keeping with national trends: Brazil has, respectively, the second and fourth largest number of Facebook and Netflix users worldwide, and cable companies have lost one million clients in Brazil since 2014 because of Netflix.\textsuperscript{15} The long distance that separates Conjunto Palmeiras from downtown, as well as the poor quality of Internet connectivity in public schools, has limited student’s demand for accessing a myriad of educational and entertainment content available online. Additionally, data collected from the field showed that people are reluctant to use mobile phones outdoors because Conjunto Palmeiras is one of the most violent neighborhoods of Fortaleza.

Complex social factors affect the PalmasNet project. While there is high demand for Internet services, issues such as community violence may inhibit mobile-based Internet use in public areas.

**Technological Factors**

Due to its location on the northeastern coast of the Brazil, Fortaleza is a hub of undersea fiber optic cables that connect South America with Europe, Africa and the United States. Moreover, in the last few years the city and state governments have invested public funds to deploy an extensive network of fiber optic cables throughout city. This network contributes to the provision of affordable and high-speed Internet service, especially since fiber is the best technology available in the market. All other equipment required for the provision of Internet service, such as routers, is available for purchase in the country. Besides the availability of equipment and fiber optic cables, the falling cost of technology makes the technological environment favorable for the development of the project.

**Legal Factors**

Brazil is a federation of states, municipalities and the Federal District. The federal government has the sole authority to legislate over Internet issues. The country has a legal Internet framework, known as Marco Civil da Internet, which absolves ISPs of liability for third party content that is carried over their networks. There are low regulatory barriers to entry in the market of Internet service provision. ANATEL is the federal agency responsible for the issuance of licenses that allow ISPs to operate. The price of the license depends on the geographic area of service delivery:

national and regional licenses cost R$9,000, state R$1,200 and local R$400. The agency also charges a supervision and installation fee of R$ 1,340.80. Small ISPs, defined as those with no more than 50,000 clients, are exempted from complying with a great array of non-financial regulatory obligations.

The taxation climate for technology is not favorable in the country. There are three different taxes that affect Internet service provision: two federal - PIS (0.65%) and COFINS (3%) - and one state (ICMS - whose rate varies from state to state). In state of Ceará, where Fortaleza is located, the rate has been raised this year from 26% to 28%. Therefore, taxes represent almost 32% of the price paid by Internet users from Conjunto Palmeiras. Given this context, despite the absence of regulatory barriers, taxation imposes a heavy burden on low-income customers.

Summary of Findings

Figure 3 below is a summary of the foregoing analysis. It incorporates the five dimensions of the PESTL analysis that outline the main factors shaping Banco Palmas’ environment.

Figure 3. Summary of Findings: External Analysis

<table>
<thead>
<tr>
<th>Political</th>
<th>Technological</th>
</tr>
</thead>
</table>
| • Political support  
  - Data-driven municipal policies  
    ✓ City government open data portal  
    ✓ Fortaleza 2040 project  
  - City government officials favorable to IP, interest in collecting data and connecting with foreign universities  
  - However, elections are coming | • Availability of technology  
  ✓ Fortaleza is a fiber optics hub in South America and has an extensive fiber optics network  
  ✓ Equipment is available in Brazil  
  • Falling cost of technology |
| Social | Economic |
| • High demand for affordable content  
  ✓ Brazil is the 7th country in Internet usage  
  ✓ Youth interested in Facebook, YouTube and Netflix contents  
  ✓ Lack of internet connection in public schools  
  • High population density and mobile penetration in CP  
  • CP is a violent neighborhood with a high crime rate | • Economic recession and CP being a low-income area  
  • Reaction of big ISP’s to IP initiative  
  ➔ If the service is for free then the Economic component is much less of a barrier |
| | Legal |
| | • Low regulatory barriers to entry  
  • Small ISP are exempted of a series of non-financial regulatory obligations  
  • However, the tax climate is not favorable |
The External Environment and Future Trends

Based on the findings from the external analysis, the team conducted a Pivot Variable Analysis (Figure 4) that identifies key trends from the PESTL analysis that are likely to impact the PalmasNet project in the future. It identified two key variables, based on their level of uncertainty and their potential impact on the project. The analysis determined potential scenarios that Banco Palmas might face in the future of the PalmasNet initiative, and how the organization might anticipate and address these challenges.

Figure 4. Pivot Variable Analysis

Government support is key to organizing and installing Internet infrastructure given that it is, by nature, a public service project. If Banco Palmas manages to leverage its current level of collaboration with the government, it would be advantageous for fundraising. It will also help the bank receive discounts for the project and will strengthen its sustainability. In addition, if the government strategy is to develop Internet-based initiatives, it will benefit Banco Palmas’ goal of becoming an ISP for the Conjunto Palmeiras area. However, this scenario is highly uncertain with the local elections coming later this year, and many current partnerships might need to be renewed depending on the results.

How large, major Internet Service Providers are going to react to this project is also very uncertain: they might not be interested because the area is too small of a market or they might want to enter the market if they realize that Banco Palmas has been successful. If these large ISPs enter the market, it will have an important (and potentially negative) impact on the viability of PalmasNet.
Large ISPs are more likely to achieve economies of scale and bring prices down, the latter being a key success factor in the area. Furthermore, their expertise and financial capacity as competitors is certainly a major threat to Banco Palmas. Based on the previous analyses, there are four scenarios outlined in Figure 5 that can be anticipated to shape the project’s future environment:

Figure 5. Scenario Analysis of Four Potential Outcomes

<table>
<thead>
<tr>
<th>Four possible scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strong Government Support</strong></td>
</tr>
<tr>
<td><strong>Strong Competition from ISPs</strong></td>
</tr>
<tr>
<td>1. PalmasNet’s success is likely to rely on barriers to entry in Conjunto Palmeiras</td>
</tr>
<tr>
<td>3. PalmasNet is likely to be successful in Conjunto Palmeiras in the long run</td>
</tr>
</tbody>
</table>

In scenario 1, PalmasNet benefits from strong government support but faces strong competition from major ISPs. In such a situation, success will rely on its ability to create barriers to entry for major ISPs in Conjunto Palmeiras. It could leverage government support or exclusivity contracts.

Scenario 2 is a worst case scenario. Government support is weak and competition from ISPs is strong. The only solution here for Banco Palmas to resist this unfavorable environment is to create strong partnerships very early on with small and medium ISPs and leverage its brand success in Conjunto Palmeiras.

Scenario 3 is the best scenario for Banco Palmas. It can expect strong government support and weak competition from major ISPs. In such a situation, the external environment will not present any major hurdles to the development of PalmasNet. As such, the success of PalmasNet will only rely on Banco Palmas’ own ability to sustain the project.

Finally, in scenario 4, PalmasNet would not benefit from a strong government support but will not face strong competition from ISPs either. PalmasNet will not face major threats in future, but the problem will not rely on any guarantee - such as government support - which questions its future sustainability.
Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

Based on the data derived from the Internal and External Analyses presented above, this section assesses Banco Palmas’ ability to manage the diverse and complex environment in which it operates and its capacity to develop PalmasNet. SWOT stands for Strengths, Weaknesses, Opportunities, and Threats. Table 3 summarizes the findings of the previous analyses.

Table 3. Summary of SWOT Analysis

<table>
<thead>
<tr>
<th>SWOT ANALYSIS</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
</table>
| Strengths     | ● Ability to establish partnerships thanks to strong brand recognition  
                ● Partnerships with small ISPs and city government  
                ● Contacts with local government  
                ● Owns technological infrastructure and physical assets that can be leveraged for PalmasNet  
                ● Actively engaged and well-known within the community  
                ● Sustainable mission, based on a strong culture and shared-values |
|               | ● Low capacity to influence policymakers  
                ● Dependence on a small number of financial partnerships  
                ● Revenue generation is limited  
                ● No ability to significantly scale up due to a lack of personnel  
                ● PalmasLab staff is limited in number and lack experience in the tech sector |
| Opportunities | ● Favorable technological environment with important investment at the city level  
                ● Falling costs of technology  
                ● City government officials are in favor of Banco Palmas’ Internet projects  
                ● Low regulatory barriers to entry  
                ● Banco Palmas will not have to comply with a deterring number of regulatory obligations to become an ISP  
                ● High mobile penetration and familiarity with Internet among younger generation |
|               | ● The local economic outlook is dull and a paid service can be hard to deploy  
                ● Conjunto Palmeiras is a violent area and community members complain it can be a hurdle to any outside use of the Internet  
                ● The outcome of the coming election can completely change the relationship between the local government and Banco Palmas, putting into question some of Banco Palmas’ strengths  
                ● The reaction of major Internet Service Providers is hard to anticipate and can have negative consequences on PalmasNet |
Banco Palmas appears to possess an adequate level of assets to start PalmasNet and take advantage of the numerous opportunities in its environment. The population knows and trusts Banco Palmas. In addition, Banco Palmas has received the support of city government officials, has its own technological infrastructure, and there are no major barriers to enter the Internet service business.

However, as the scenario analysis shows, there are concerns about the ability of Banco Palmas to operate PalmasNet in a sustainable way. The reaction of major ISPs and government are the key variables and they are difficult to anticipate.

Banco Palmas needs to strengthen its lobbying capacities with city government in order to implement barriers that limit entry for large ISPs. For example, Banco Palmas can use its unique technical infrastructure to make market entry difficult, as no new competitor will begin with a comparable infrastructure. Signing exclusivity contracts with local municipalities or smaller ISPs might also help sustain PalmasNet. Finally, Banco Palmas urgently needs to face the problem of violence in the Conjunto Palmeiras area in order to grow PalmasNet. If it is not solved, the program is likely to miss the potential of outdoor Internet use.
Benchmarking Global Internet Services and Practices

To supplement the team’s field research, the team conducted an extensive analysis of global Internet services and practices applicable to the PalmasNet project. These areas include service provision, intranet and community portals, and online content development. The results of the benchmarking study are summarized below; the full benchmarking study can be found in Appendix III. These findings, coupled with the team’s analyses of Banco Palmas’ institutional capacities, form the basis for the development of sustainable recommendations for Internet service provision in Conjunto Palmeiras.

Internet Benchmarking Report: Findings and Implications

The benchmarking study undertaken by the team initially began with more than 20 projects from around the world, which eventually were narrowed these down to ten targeted projects. The projects included in this study were:

- **ZittNet (Nigeria):** Wireless Internet over satellite provided connection to homes, with a pay-as-you-go financing model
- **Mesh Sayada (Tunisia):** A mesh network built, operated, and maintained by local community residents, with information sharing within the community
- **SandyNet (USA):** Fiber connections to the home, built by a small team of local residents with loan financing from the municipal council
- **Digital Empowerment Foundation (India):** A non-profit dedicated to providing wireless Internet access, coupled with a series of digital literacy trainings and empowerment projects
- **TV White Space (South Africa):** A trial of using unused television frequencies to beam Internet into schools in South Africa
- **Project Isizwe (South Africa):** A project to provide free public WiFi hotspots in communities, financed by municipal governments
- **SkyBand (Malawi):** A for-profit Internet company that uses a satellite connection to bring Internet to homes and businesses
- **Rhizomatica (Mexico):** A project that provides GSM phone service over radio, relying on community financing and management, and a pay-per-use model
Guifi.net (Spain): A fiber connection links users in a mesh network, and the project promotes open, free, and neutral Internet

Altermundi (Argentina): A mesh network that relies on community financing and participation to build and maintain the network in small towns

Figure 6. Location of Benchmarked Internet Projects

The benchmarking study illuminated the ways in which access to basic Internet services can catalyze the development of a fully connected neighborhood. The research sought to create a knowledge base around similar initiatives that have been implemented in other areas, to identify successful models and best practices and assess their potential for replication in Conjunto Palmeiras. It addressed three key questions:

- What are the technologies to be used?
- What will be the financing and operation/management arrangement of the project?
- What is the business model and social services provided by the project?

To answer these questions, the study found that community context is key. Any implementing organization must identify the available resources in the community and the organization’s capacity to leverage those resources. Additionally, having clear organizational goals for the project allows for those goals to be prioritized when making decisions on technology, financing, management, and business/social services. Each of the projects included in the study answered these questions in unique ways, based on characteristics of the community, and the social goals of
each project and organization.

In terms of technology, the study looked at projects that were connected to the global Internet via both wired (typically fiber optic) connections and wireless (typically satellite) connections. The technology used to connect to the global Internet was primarily driven by the geographic proximity to existing Internet infrastructure: some projects could link with existing fiber networks, while others required satellite connections to reach rural or remote areas.

Projects also utilized a variety of innovative methods for bringing Internet into homes and public spaces. These methods included: broadcasting over radio frequencies, including unused radio frequencies or television frequencies (“white space”), or wired connections like fiber to the premises, as well as examining different network organizational designs (“topologies”) including decentralized designs like mesh networks as well as more centralized designs like star topology. The combination of wired and wireless connections and network designs are all highly dependent on the characteristics of the community: rural and urban areas, local technology know-how, and regulatory issues for using unused spectrum frequencies.

All the projects needed to address both one-time or start-up costs, as well as the costs of managing and maintaining the networks over time. A majority of projects in this study were incorporated as nonprofit organizations. Some projects began with grant funding or loan funding to cover initial costs, and then were able to charge users based on pay-as-you-go or subscription models. This strategy was most successful in areas with diverse income profiles, and less successful in low-income communities. Internet users’ willingness to pay in non-profit models had uneven results. Sustainable projects in low-income communities relied less on user fees and more on municipal funding, business clients, or continued grant funding.

Several projects used an alternative, community-based model for financing and management. This model, principally found in the mesh networks, focused on peer-to-peer collaboration and community ownership, and a main component of this model was building capacity within the community to sustain the network. Community members funded the majority of start-up costs by pooling financial resources to purchase equipment, and help with installation. Participating community members were offered training and workshops to help administer and maintain the networks themselves.

The community involvement aspect was a key part of the social impact goals of the mesh network Internet connectivity projects. Other direct social services provided in these projects primarily focused on digital literacy and inclusion, information sharing, education, and market access. Each intervention was tailored to the needs of the individual communities.
Hosting Online Content: Intranet and Portals

Several Internet projects utilized expanded Internet access to increase communication and information sharing within their respective communities. One way to achieve this goal is to host content online, through an intranet or captive portal. To determine the needs and requirements to develop intranet or captive portal opportunities for Banco Palmas, the team reviewed the differences between the two approaches, as well as identified what is needed to construct each. The team also examined what is required to have an engaging and effective site that would promote collaboration and communication within Conjunto Palmeiras.

Intranet vs. Portals

An intranet is a “network based on TCP/IP protocols (an Internet) belonging to an organization, usually a corporation, accessible only by the organization's members, employees, or others with authorization. An intranet's web sites look and act just like any other web sites, but the firewall surrounding an intranet fends off unauthorized access.”\(^\text{16}\) The purpose of an intranet is to protect confidential documents, while making them easily accessible to all members who should have access. To make an intranet, there needs to be a single network, server, and content relevant to the organization.

Building a network without a router is a different form of “intranet,” known as a local network. A local network has no connection to the Internet and is good for linking computers within a confined space, for the purpose of sharing documents. However, when creating a local area network using this setup, it is necessary to set both of them to have an IP address in the same subnet.\(^\text{17}\)

A portal, on the other hand, is a specially designed website that can be used as a means of gathering information and sharing intellectual capital across the neighborhood. Within a portal, one can link multiple resources and provide the opportunity for original content sharing from community contributors, if desired. A portal is a good first point of contact for people unfamiliar with the services offered by an organization, as it streamlines all resources into one location. The cost of managing a portal is limited. The biggest lift, in creating a web portal, is in its initial creation. The one major advantage of intranet is that it provides access to content without being connected to the Internet. However, intranet would only allow for access to documents held on the network’s server. It would not allow for linking to online content, nor access to other external resources.

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Community Portal Case Studies

As described above, there are many examples of intranets: universities, government employers, and private sector employers. However, third parties do not have access to these intranets. Presented below are examples of portals which act as website landing pages to direct communities to a variety of relevant resources.

**Chicago Smart Communities**

The Smart Communities in Chicago are participants in a program aimed to improve digital literacy, job prospects, and increase human development for residents. Each of the five Smart Communities has a portal, which contains community information that is both provided by and for the community. The portals are built on a common software platform, but are customized with a different design tailored to each specific community. The websites are purposefully simple so that local contributors can easily manage them. Local leaders and administrators aggregate data and source material from community members to create digital community newspapers. Each portal includes: news that covers everything from arts to crime, directories of businesses and social service agencies, and event listings.

**Englewood Portal**

The Englewood portal (Figure 7) has pages for News, Directory, Calendar, Resources, community development plans, and government resources. It includes live updates through Twitter that mention the Englewood Portal. Including tweets is a good way to have up-to-the-minute, low-cost information sharing.

![Englewood Community Portal](image)

*Figure 7. Englewood Community Portal*

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**Humboldt Park Portal**

The Humboldt Park Portal (Figure 8) has a very similar landing page to the Englewood portal. The figure below is an example of a “how to” page, structured so that community members themselves can upload content directly to the site.

![Humboldt Park Portal](image)

*Figure 8. Humboldt Park Community Portal*[^19]

**School District Portals**

Schools and school districts frequently use a portal system to help provide links and resources that are tailored specifically for students, faculty, and parents. The portal allows for both a passive interaction, through the access of resources, as well as active interactions through the ability to upload original content directly.

Waynesboro Area School District
This school district portal is very similar to the previous smart communities’ portal shown above; however, this portal provides tailored information for the students and parents of the Waynesboro district school.

![Waynesboro Area School District Community Web Portal](image)

Figure 9. Waynesboro Area School District Community Web Portal

Manheim Township School District
Unlike the Waynesboro portal, the Manheim Township district portal (Figure 10) requires a login. Using a login can protect sensitive information or information that the school or parents don’t want the public to have access to, such as dates of events and other school functions.

![Manheim Township School District Sapphire Community Portal](image)

Figure 10. Manheim Township School District Sapphire Community Portal

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Online Content Development

Once Banco Palmas has identified whether it wishes to create an intranet site or a portal, it is necessary that it carefully consider content creation. The mechanism of content creation applies to both intranet and portal sites. An analysis of what makes users dislike intranet was done by Website Magazine. It identified the following reasons:

- Stale and outdated information
- Poor search functionality and navigation
- Frustrating or nonexistent communication tools
- Terrible document management capabilities
- Weak or difficult content publishing and sharing
- Inability to segment the community

There are two major components to developing quality online content: identifying audience, and creating content.

Identifying Audience

It is essential to define and understand the target group for the website/portal. Defining the “who” part of the exercise is crucial in defining the “what” and “how” of the project. In order to maximize usage, it is important to design a service directly for the audience Banco Palmas wishes to serve.

Although conceptually defining the community as “everyone in Conjunto Palmeiras” might seem more aligned with the goals of Banco Palmas, it will be difficult to create content that engages such a wide variety of people. Therefore, we need to define the target audience by demographics.

Figure 11. Defining Banco Palmas’ Target Group


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Close to 45% of Internet users in Brazil fall between 15 to 34 years old and the Internet is accessed by both the genders equally (50.1% male and 49.9% female). This should be noted and understood as it applies to Conjunto Palmeiras.

Creating Online Content

There is a need to focus on making the website/portal/intranet content, according to Google guidelines, “useful and informative, more valuable and useful than the content in other sites, credible, high quality and engaging.”23 Given Banco Palmas’ focus on fostering community participation, the particular challenge is ensuring receptiveness and, more importantly, participation from the community in content generation.

The communities should be seen as owners, who are technologically empowered and who control the content. To this goal, Banco Palmas could train the identified target group to identify, produce and control the digital content. Training can be conducted by interns or community consultants. The target community members ages 18-30 needed to be trained to generate low-cost and high-quality video and written content. The task of setting up a website that is truly participatory in nature, as well as the concept of “for and by the community,” demands that community capacity to run and manage the website is built within the project from the outset.

A clear and logical structure to the website is essential to maintain the quality and the user base. For the site to be an inclusive community portal, it has the option to include: community news, directory of services, job postings, school/government announcements, user forum, user generated content - articles/videos/photos, calendar of events, or a mobilization page to mobilize participants for a local particular event.

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RECOMMENDATIONS

The recommendations for the strategic implementation of the PalmasNet project build on the team’s extensive internal and external analyses, and its benchmarking and Internet research. It provides recommendations designed to help Banco Palmas achieve its goal of improving Internet access in Conjunto Palmeiras, and aims to be cognizant of the bank’s organizational capacity and its ability to face the current macro-environment.

The recommendations are in two parts. The first part elaborates the criteria used by the team to evaluate the applicability and feasibility of potential recommendations. The second part presents recommendations for implementing the PalmasNet initiative. It specifically focuses on three key areas: free public WiFi hotspots, an Internet portal and online content, and paid Internet service to homes.

Key Success Criteria

The short-term goal of PalmasNet is to improve Internet access in Conjunto Palmeiras by providing the community with faster, cheaper and more reliable access to the Internet. Beyond this goal, PalmasNet’s objective is to achieve developmental impact in the community. In the long run, Banco Palmas should aim to achieve the following goals through PalmasNet:

- Increase community engagement and mobilization through the creation and provision of Internet-enabled community spaces, and of Internet content and applications
- Establish Banco Palmas’ convening role as an organizer and catalyst for expanded Internet access and services in Conjunto Palmeiras, through partnerships with local stakeholders and the community

Considering these two goals, the team developed a series of criteria which will be used to assess solutions. Whenever applicable, the criteria are further detailed and translated into what they would mean for Banco Palmas based on the SWOT analysis presented on page 27.

Criteria for Increasing Community Engagement

Target Engaged and Disengaged Populations

To increase community engagement there are two types of populations to consider: community members that are already engaged with the community and those who are not. The best approaches
will encompass answers to both groups’ needs, and will increase the level of community engagement for community members that are already committed to the community and prompt those who are not engaged to engage more.

**Lower Barriers to Use**

All technology components should be intuitive with very low accessibility barriers for users. Several accessibility barriers have been identified:

- *Familiarity with the technology*: community members should be familiar with the technology used in the solutions proposed. As pointed out in the SWOT analysis, the community knows how to use the Internet, which is something Banco Palmas should leverage.
- *Familiarity with the type of content*: ideally, interfaces that would accompany the technology should not be entirely new to users. They should build on pre-existing formats and portals that users are familiar with.
- *Ease of use*: the technology should be user-friendly and easy to use.

**Leverage the Banco Palmas Brand**

Content generated by PalmasNet should include significant exposure for the Banco Palmas brand. As pointed out in the SWOT analysis, Banco Palmas is well-recognized within the community. Community members will be more likely to increase their Internet usage with a trusted brand, therefore any new content should clearly showcase the Banco Palmas brand.

**Make Solutions Scalable**

Sustainable solutions must be able to reach an increasing number of people with a limited commitment of additional resources. In other words, the cost per engaged user should be constant or decreasing over time. Barriers to scalability can be financial, legal or time-related.

**Criteria for Establishing Banco Palmas as a Catalyst for Community Internet**

**Financial Sustainability**

As pointed out in the SWOT analysis, Banco Palmas depends on a small number of financial partners and its ability to generate revenue is limited. In order to strengthen Banco Palmas’ convening role in the long term, effective solutions will generate income in a sustainable way. Financial sustainability may also require forging partnerships with new donors or companies, while asserting its role as an advocate for better community Internet.
Address External Threats

The principal identified threat facing the PalmasNet project is competition from large ISPs who may want to enter the market. As mentioned in the SWOT analysis, it is uncertain whether or not major telecoms and ISPs will show an appetite for this market. However, if they do, consequences can be dramatic for PalmasNet. Banco Palmas’ role as a catalyst for expanded Internet access will increase interest in the community, leading to increased competition. Increased demand for Internet usage may attract large ISPs who will lower prices, to the point where PalmasNet’s small ISP partners will be unable to compete. Consequently, solutions should meet a number of criteria that will hinder potential market entry by large entities. These include:

- **Developing partnerships.** Partnerships allow Banco Palmas to leverage complementary assets from different actors and merge them into a set of unique assets that competitors are not likely to possess. For example, it could partner with media companies to strengthen its brand recognition or partner with political organizations to negotiate tax reductions. Ideally, partnerships should entail exclusivity agreements to accentuate the barriers to market entry. The more partnerships the solution will require, the weaker competitive intensity will be.

- **Decreasing competitor replicability.** Low replicability will make it harder for competitors to duplicate Banco Palmas’ role in providing Internet to the community. One way of lowering replicability is to ensure Banco Palmas’ unique assets are critical in the deployment of the solutions. Banco Palmas and its ISP partners have a longstanding relationship with the community and have built a level of trust. In addition, the bank is well regarded in the community for the social aspect of their work. Designing solutions that incorporate these two assets will make it harder for external actors to replicate the work of PalmasNet. In turn, this will increase market entry barriers for competitors.

Additional Success Criteria

Feasibility of Solutions

Suggested solutions must fall within the scope of Banco Palmas’ capacity. They should play to the identified strengths of the organization and recognize weaknesses. Specifically, solutions should be financially viable, and they should not go beyond Banco Palmas’ technological capacities. However, they should leverage Banco Palmas’ ability to make partnerships in order to overcome those weaknesses.
Match Solutions with Organization’s Mission

Banco Palmas aims to foster economic development in the Conjunto Palmeiras area by leveraging community engagement. Synergies between PalmasNet and the other programs Banco Palmas has been developing should be attempted. For instance, the bank could help improve access to financial services to poor residents of the communities through online banking or crowdfunding.

Summary of Key Success Criteria

The criteria identified above were used to develop potential solutions for PalmasNet. In summary, key solutions should be easy to use for the community, scalable, and leverage the Banco Palmas brand. Further, financial sustainability, replicability and feasibility will strengthen Banco Palmas’ position in the area and increase the project’s sustainability. Ideally, the best solutions will engage with other programs Banco Palmas has developed.

Table 4. Summary of Key Success Criteria by Organizational Goal

<table>
<thead>
<tr>
<th>KEY SUCCESS CRITERIA</th>
<th>Engage the Community</th>
<th>Establish Role of Banco Palmas</th>
<th>Additional Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Low barriers to accessibility</td>
<td>• Financial sustainability</td>
<td>• Feasible with organizational capacity</td>
<td></td>
</tr>
<tr>
<td>• High exposure for the Banco Palmas brand</td>
<td>• Addresses external threats, through strong partnerships and low competitor replicability</td>
<td>• Matches with organizational mission</td>
<td></td>
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<tr>
<td>• Highly scalable solutions</td>
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PalmasNet: A Community-Driven Internet Initiative

Implementing the PalmasNet initiative revolves around three key areas: free public WiFi hotspots throughout the community, an online community portal which hosts resources and content created by Banco Palmas and members of the community, and paid Internet service to homes, provided in partnership with small local Internet service providers (ISPs). The recommendations have been developed using the criteria elaborated in the previous section. They ensure that the recommendations are feasible for Banco Palmas, support the goals of community engagement, and establish Banco Palmas as a convener and catalyst for improved Internet service provision.

Public WiFi Hotspots

Creating free WiFi hotspots enables Banco Palmas to expand Internet accessibility in Conjunto Palmeiras. Low-income level is a main barrier hindering usage of Internet in Conjunto Palmeiras. Despite the large penetration of mobile phones in the community, most users cannot afford to pay the prices charged by cell phone companies to provide mobile broadband Internet access. Most of Conjunto Palmeiras’ residents have prepaid plans that allow them to receive calls, send and receive text messages, and access some online content. This limited access mean they cannot take full advantage of all the resources that their mobile devices offer.

Due to limited access to affordable Internet, demand for Internet is high in the neighborhood. Brazil is currently the sixth largest Internet market in the world, and a survey conducted by Banco Palmas, as well as research conducted during field visits, suggests that the population of Conjunto Palmeiras follows trends in Internet usage similar to the rest of the country. The demand for access to social media platforms and popular Internet applications such as WhatsApp and Twitter would be met through the provision of free WiFi hotspots. There is also a high demand for video content through websites such as YouTube and Netflix.

PalmasNet has already begun implementing free public WiFi hotspots in five locations in the community, as the result of a pilot project launched in April 2016. PalmasNet plans to build on these existing hotspots and open additional hotspots within Conjunto Palmeiras. Lessons learned from the pilot will help to guide the implementation of additional sites.

Challenges to WiFi Hotspot Creation

There are two principal challenges to successful implementation of WiFi hotspots in Conjunto Palmeiras: low awareness of digital resources and/or low digital literacy, and high crime rates that

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24 Statista, “Number of Internet users in selected countries as of May 2015.”
affect public usage of mobile devices. Teenagers and young adults in Conjunto Palmeiras know how to use mobile phones and are familiar with the Internet environment; however, most of them use the Internet only to a limited extent, primarily for social media, communication, and entertainment. Overall, residents have little awareness of the breadth of content available online that could positively impact their lives and the community as a whole. The second significant barrier to the implementation of WiFi hotspots in Conjunto Palmeiras is its high crime rates, which may prevent the community from using mobile phones outdoors. Both of these barriers must be addressed in the creation of successful WiFi hotspots.

**Fostering Community Cohesion**

WiFi hotspots can be used to stimulate face-to-face meetings, regain the sense of community that characterized the beginnings of Conjunto Palmeiras, and foster collective action. Residents of the neighborhood should be reminded that past achievements and the ability to influence public policy stemmed from community mobilization, and that it is possible to regain the cohesion that has been weakened or lost in the past few years. Hotspots should be used not only to foster connections across virtual space but also for the promotion of events to enable enhanced interactions among Internet users and increase community bonds. Banco Palmas has already recognized the potential of Internet to enhance community cohesion in low income neighborhoods and will host a “Campus Party” in June 2016, an event that takes place in cities worldwide dedicated to the promotion of innovation, creativity, science, entrepreneurship and entertainment among young people. These types of events exemplify the crucial combination of offline and online interactions that public WiFi hotspots can catalyze, which in turn support the goal of increased community engagement.

**Providing Access to Relevant Internet Content**

Banco Palmas should take advantage of hotspots that will presumably attract many residents to provide users with guidance on how to use websites and apps whose contents may enhance their lives, including access to government services, educational resources, employment opportunities, and culture and entertainment.

Based on field research conducted by the team, Conjunto Palmeiras’ residents have limited awareness of the vast resources that national, state, and city governments offer online. This includes information on public services, complaint forms, and direct channels to participation in city planning. Knowing how to navigate the website of the federal agency responsible for social benefits programs, for example, would be of great value for the community, as it contains information on existing programs, procedures to obtain benefits, and scheduling of appointments online. Government agency portals that may be seen as a mere convenience for citizens in general can have a significant impact in low income communities such as Conjunto Palmeiras, where
residents may be unaware of their rights or may face high costs to obtain services in person that could be accomplished more easily online.

The wide array of educational content available online should also be promoted in PalmasNet hotspots. With the hours spent in school extremely limited, the quality of education in Conjunto Palmeiras is a major issue facing the community. The successful after-school programs run by PalmasLab demonstrate that students are motivated to learn when they are provided with good teachers and learning materials. There are many websites that offer free access to educational content produced in Brazil, as well as content produced abroad and translated to Portuguese.

Considering the socio-economic profile of Conjunto Palmeiras and the economic conditions facing the country, residents may also be interested in accessing job-seeking websites, the popularity of which has been increasing in Brazil in the last few years.

Finally, free WiFi hotspots could be used to exhibit movies and cultural content available online. Holding screening events would be great entertainment alternatives for a community that may not be able to afford cinema tickets and which does not have access to the free cultural events that typically take place downtown or on the beach. Public movie exhibitions open to the community should be encouraged in order to decrease the burden on bandwidth caused by personal video streaming, which would decrease bandwidth costs while promoting offline community interactions.

**Determining the Location of Hotspots**

The location of WiFi hotspots is one crucial component to maximizing the social benefits of expanded Internet access, and effectively providing the types of services described in the previous section. So far, PalmasNet has deployed five hotspots in public locations and the team recommends Banco Palmas consider public consultation in the location of additional outdoor hotspots, the creation of indoor hotspots to facilitate face-to-face interaction, and placement of hotspots in schools and businesses.

*Outdoor Hotspots.* The high crime rate in Conjunto Palmeiras must be taken into consideration in choosing the location of hotspots. The community will make the most of free WiFi service if the hotspots are located in places where users would feel safe and not at risk of being victims of theft or other crimes. To meet this criteria, hotspot locations should be determined based on a consultative process with potential users and members of the community.

*Indoor Hotspots.* As Banco Palmas is interested in using Internet connectivity to foster collective action and community development, WiFi hotspots should also be created in indoor spaces, such as unused public and private buildings, as well as spaces that currently serve as formal or informal
community meeting places. Indoor hotspots would facilitate face-to-face interactions among users and could be used to host events encouraging productive Internet use, Internet culture, digital literacy, and conversations around community issues.

**Hotspots in Schools.** Banco Palmas should also consider partnering with local schools to create a hotspot inside schools in Conjunto Palmeiras. Instead of bringing some students to PalmasLab, Banco Palmas would be able to reach all students at school and use school facilities to offer courses to larger audiences. Additionally, Banco Palmas could provide training and professional development activities for digital learning tools and other online education resources to public school teachers. If the creation of a hotspot in municipal schools is not possible, other forms of cooperative agreements could be set up with the city government to increase the quality of learning in municipal schools by using Internet-based educational resources. This agreement could entail something as simple as the city government financing the printing of online resources for use in schools in Conjunto Palmeiras.

**Businesses as Hotspots.** Locating hotspots in businesses can encourage the use of the e-dinheiro application. A combination of three factors makes Conjunto Palmeiras a perfect environment for the development of cashless financial services and products: widespread use of mobile phones, high crime rates, and a high percentage of unbanked residents. Although e-dinheiro does not require an Internet connection, as it can be used via SMS, the app version offers a friendlier and more intuitive interface for users. The deployment of hotspots in popular retailers has the potential to incentivize the use of e-dinheiro.

**Hotspot Maintenance**

The maintenance of WiFi networks requires regular oversight by qualified staff. Banco Palmas should hire a company or individual with the requisite skills to maintain the hotspots, or should provide training to build the local capacity for network maintenance. The latter alternative has the advantage of reducing operational costs of hotspots and increasing the human capital of the community. If network maintenance will rely on volunteer labor, it is necessary that Banco Palmas manages its relationship with volunteers to guarantee their availability and technical capacity, so that hotspot network quality can be maintained.

**Partnerships for Implementation**

The provision of free WiFi in strategic locations in Conjunto Palmeiras is a service aligned with Banco Palmas’ mission and with the PalmasLab and e-dinheiro initiatives. However, it may not in itself improve the quality of life in Conjunto Palmeiras. Banco Palmas must take one step further and assume a lead role in establishing cross-sector partnerships to overcome the challenges posed by low digital literacy rates and crime in the neighborhood.
The reputation of Banco Palmas is an asset that enables the organization to build partnerships with public and private organizations to help address these challenges, by providing training on how best to use Internet resources, or providing space for the location of indoor hotspots. Given the partnership established with Citinova, the Secretary of Science and Technology that will provide part of the fiber infrastructure and bandwidth, it is reasonable to envision a hotspot located in one of the municipal schools of Conjunto Palmeiras. During field visits by the research team, the Secretary of Science and Technology of Fortaleza also mentioned the possibility of providing the use of a building located in Conjunto Palmeiras free of charge for the implementation of Banco Palmas initiatives. Through strong partnerships, Banco Palmas can keep costs low and adopt measures to create WiFi hotspots that encourage using the Internet as a tangible tool to promote social and economic development.

Evaluation

To evaluate the success of free WiFi hotspots and possible causes of failure, the following indicators should be constantly monitored: Internet connection speed, network coverage, number of general users, and number of e-dinheiro customers.

Community Portal and Online Content

The second component of the PalmasNet initiative is the creation of a community portal to host online content produced by PalmasLab. A community portal will provide Conjunto Palmeiras with a streamlined and easy-to-use tool to access the bank’s resources and community-specific content. To successfully create a useful portal, it is necessary to address two aspects: identifying the target audience and developing relevant content.

Audience Identification

In order to create successful online hosted content, Banco Palmas needs to define its target audience. To achieve this objective, Banco Palmas needs to address the following questions:

Who is our target audience?
The target audience is typically defined by demographic characteristics: age, gender, or life stage. For example, Banco Palmas could define the audience as either young adults in the 18 to 30 age bracket, or Conjunto Palmeiras working residents in the 30 to 45 age bracket.
What is the behavior of our target audience?
The next step is to define the behavior or lifestyle of the defined target audience. Are they digitally literate? What is their level of current access to the Internet? How many hours do they spend online? What is their disposition towards various social issues?

What are the needs and concerns of our target audience?
It is vital for Banco Palmas to understand the needs and concerns of its target segment. Banco Palmas should try to understand the issues that most concern the target group. If given access, what are the barriers these individuals will face in being active in the community portal? What are the “hooks” that usually attract them online? Would easy access to needed information be enough to attract and retain users to the site?

Online Content Creation
To create relevant online content, Banco Palmas needs to consider the following key points:

Identifying influencers and thought leaders in the community
These groups or individuals can be used to understand the content of interest for the target audience who will be portal users. Influencers can include government agencies, community and business leaders, association members, and leaders from Banco Palmas.

Identifying quality content contributors
Quality content contributors are people who can generate content in the initial phase which caters to the topics of interest identified by influencers. For this phase, Banco Palmas can partner with local university students and/or professors, local government officials, interns and community consultants, and local leaders, for example Claudia Leitao and Edlisa Peixoto. These contributors can generate the initial content which will meet the needs and interests of the target audience.

Identifying a training plan for community content production
Identifying ways in which the community can be trained to generate content independently in the future is key to the sustainability and the continued relevance of the community portal. A training plan may include running specialized training sessions catered to the various groups that interact with the bank, particularly women and young adults.

Setting up processes and rules for content moderation
In order to maintain a high-quality website, particularly with contribution from the community, there needs to be one designated site moderator to ensure quality control and appropriateness of content on the site. This person can be a trained member of Banco Palmas’ staff.
Evaluation

Banco Palmas can use Google Analytics to monitor, track and optimize visits to its community portal. The tool can be used to measure the total number of visitors to the site, observe the bounce rate (the number of visitors who leave before they navigate to other pages in the portal), and to observe conversion (the number of visitors who performed a desired set task on the portal, such as taking a survey or signing a petition). We recommend that Banco Palmas uses Analytics to look for trends in visits and to check for the popularity of certain content to guide content creation in the future.

![Figure 12. Screenshot of Sample Google Analytics Page](image)

Paid Internet Service to Homes

The third component of the PalmasNet initiative facilitates the provision of high-quality, low-cost Internet service to homes and businesses in Conjunto Palmeiras. As a community-based organization, the team concluded that Banco Palmas is not well-positioned to incorporate itself as an independent and stand-alone Internet service provider, especially given the existence of local Internet service providers operating in the area. As bank staff have correctly identified, creating competition with local providers may be counterproductive to the goals of community-driven development. However, Banco Palmas has an identified strength in forging partnerships with stakeholders in the Internet sector in Fortaleza. It is recommend that Banco Palmas focus on the
goal of establishing a critical role for itself as an organizer and catalyst for Internet service in its initiative to provide high-quality and low-cost Internet service to homes. The team offers several key considerations for implementing paid Internet service to homes.

**Developing a Model for Service Provision**

Banco Palmas is currently in the process of deciding on a model for providing Internet service to homes in Conjunto Palmeiras. The current design involves using an association of local ISPs who would use the fiber optic cable link provided by Banco Palmas. The fiber optic cable allows the local ISPs to provide a faster, more reliable service to homes in the area. Banco Palmas is still in the process of identifying its partners for this association. It would be best served to partner with one or more local ISPs who have a proven track record of reliable service and positive reputation with their customers. Key considerations when developing a model for service to homes and managing an organization made up of local ISPs should include providing reliable service and focusing on customer needs.

**Providing Reliable Service**

*Competition in Conjunto Palmeiras.* Any Internet service that is offered by PalmasNet needs to be competitive with the current Internet options available to the residents of Conjunto Palmeiras. When introducing PalmasNet into Conjunto Palmeiras, Banco Palmas needs to gauge the competition in the area to ensure that pricing and Internet speeds are competitive. While PalmasNet plans on integrating some of the existing ISPs into their service, there is still an existing market that PalmasNet will have to compete against. In order for PalmasNet to attract community members who actively use the Internet, it will have to price its service competitively, and at comparable speeds. Most residents in Conjunto Palmeiras are familiar with Banco Palmas through the community bank or other neighborhood initiatives. This brand recognition could provide an advantage over other ISPs when attracting new customers. However, customers will ultimately choose an ISP based on the price and quality of service they receive.

*Reliability of service.* Based on the research conducted in Conjunto Palmeiras, reliability was one of the main concerns of Internet users. In order to provide a reliable service, PalmasNet should partner with local ISPs that have a proven track record in providing uninterrupted service. PalmasNet can identify these reliable partners by looking at the technology being used by their potential partners and their ability to identify lapses in service and address these problems.

*Theft of connection.* Internet usage in Conjunto Palmeiras is currently plagued with piggybacking users, who use their neighbor’s WiFi but do not pay for it themselves. This may have a negative effect on PalmasNet, depending on how the payment structure is established. If PalmasNet charges
a flat monthly rate, piggybacking will likely be a problem. An alternative to this payment model is a pay-per-use model, where the subscriber would be responsible for paying for the data that has been used. Subscribers can protect their Internet connection by using LAN security measures, such as Wired Equivalent Privacy (WEP) and WiFi Protected Access (WPA). Based on the new penetration of Internet access in Conjunto Palmeiras, it is likely that some customers will be unfamiliar with installing WEP or WPA protections. When helping build digital literacy within Conjunto Palmeiras, Banco Palmas may consider educating customers on how to protect their Internet connection.

**Focusing on Customers**

*Tailoring Service to Customers.* When providing an Internet connection to homes and businesses, it is imperative to consider the needs of the customers. Banco Palmas needs to consider what is affordable to the customer and what Internet speeds are required to meet their demand. Banco Palmas has already begun to address these issues through a survey of Conjunto Palmeiras that measures their current Internet usage. The survey explores the current landscape of Internet coverage, what devices people use to access the Internet, and what content is accessed. The information from the survey will help Banco Palmas tailor PalmasNet toward its potential customer base in Conjunto Palmeiras.

*Promotion of Palmas Net.* Internet usage in Conjunto Palmeiras is currently skewed towards younger members of the community, who mostly use the Internet for recreation and social networking. In order to increase the number of Internet subscribers, PalmasNet will have to reach new customers who may not have extensive experience with using the Internet. The existing community presence of Banco Palmas, including the new WiFi hotspots, is an asset for promoting the PalmasNet service, but building a sustainable customer base may require bringing in community members who do not currently use the Internet. Reaching this group will require a promotional strategy of explaining the benefits that Internet access can provide. PalmasNet can appeal to community members who already use the Internet by offering Internet access at competitive speeds and prices.

*Customer Feedback.* After PalmasNet begins providing service to Conjunto Palmeiras, it will be important to receive feedback from the community. Feedback from customers can be a great way to identify gaps in service and address customer concerns. The most efficient way to receive customer feedback is from a simple survey that can gauge whether PalmasNet is meeting customer needs. Customer feedback is a continuous communication loop between the customer and service provider. PalmasNet should solicit feedback on their initial rollout, as well as on whether adjustments made are improving the service. Collecting and addressing customer feedback requires a significant amount of time and labor from Banco Palmas or implementing partner staff.
**Base Customers.** In a low-income neighborhood such as Conjunto Palmeiras, customers may be late in paying their bill. Non-salaried employees may receive their income erratically, and working with these customers is important in maintaining a large customer base. Having a core base of customers who pay their bills on time, however, is important towards creating a reliable revenue stream. Banco Palmas has continuously been able to form strategic partnerships with different members of the Fortaleza community. Associations, schools, and government offices in Conjunto Palmeiras may provide a source of reliable customers that can provide a stable source of revenue for PalmasNet. Creating partnerships with these organizations may provide PalmasNet with base customers to provide financial security to the initiative.

**Implementing Partnerships with Local ISPs**

Independently managing the provision of paid Internet service to homes may present challenges for the organizational capacity and resources of Banco Palmas. In order to provide the best Internet service to homes, the team recommends that Banco Palmas forge partnerships with small and mid-sized ISPs currently operating in Conjunto Palmeiras. This strategy will allow Banco Palmas to utilize the existing management infrastructure of these ISPs, and thereby capitalize on existing community resources and expertise. This management arrangement allows Banco Palmas to use its identified strength in building partnerships among diverse stakeholders, and establish itself in a convening role among ISPs and the community. This strategy would also likely result in better quality service provision and lower costs, since ISPs already have the management and maintenance staff and infrastructure in place, as well as the technical expertise. Banco Palmas also is in a position to provide local ISPs with access to its fiber optic infrastructure.

Although there are clear potential gains for each of the PalmasNet stakeholders, it will be necessary to manage carefully the relationship between Banco Palmas, local ISPs, and the community to guarantee the goals of high-quality, low-cost Internet service and expanded access. Managing the relationship between Banco Palmas and Internet service providers will be a major challenge in achieving the goals of the PalmasNet project.

Banco Palmas has considered the creation of an association of Internet service providers, to help organize the Internet market in the neighborhood and ensure that high-value service is provided. Based on research conducted by the team, association models for Internet service providers have been difficult to implement due to diverging interests, multiple stakeholders, and market competition between and among ISPs. Based on preliminary data collected during field visits, the team determined that more information was necessary in order to make concrete recommendations for creating Internet associations and managing the relationship between the bank and ISPs. As the development of any association of ISPs will be an ongoing process as PalmasNet is established,
below are some guiding questions to consider when developing partnerships with local Internet service providers in the community.

**Customer Acquisition**
- Who will be responsible for acquiring new customers?
- Will existing customers remain with their current service provider?

**Revenue and Cost Sharing**

**Revenue Sharing**
- How will pricing be determined for all customers?
- How will revenues accrue to all association members?
- From which part of the offered services will Banco Palmas draw a profit, to ensure financial sustainability of the initiative?

**Cost Sharing**
- How will maintenance costs be shared among participants, to capitalize on economies of scale in providing maintenance?
- How will customer acquisition costs be shared among participants, to capitalize on economies of scale in promoting the service?
- How will ISPs share the cost of accessing Banco Palmas’ fiber optic infrastructure?

**Legal Contracting**

Will Banco Palmas enter into a legal or contractual relationship with participating ISPs?
- What will be the terms of the contract, for both pricing, service quality, maintenance?
- How will Banco Palmas prevent ISPs from exiting the association?
- How will new ISPs who want to join be incorporated into the association?
- What is Banco Palmas’ capacity to draw up binding legal contracts?
- Will ISPs treat these contracts as binding agreements?
- What measures are available for Banco Palmas to ensure compliance?

**Organizational Design**

What will be the role of Banco Palmas in an association of Internet service providers?
- Will Banco Palmas have equal weight in decision-making, or will they serve in an executive role?
- Will the association have a horizontal structure (all equal participants), or a vertical hierarchy (some participants carrying more weight than others)?
- How will equitability be insured among all members?
- How will decisions be made and taken among all participants?
- How will conflicts among participants be resolved?
In considering the optimal design for an association of Internet service providers, it is vital for Banco Palmas to acknowledge that Internet service providers in Conjunto Palmeiras have the primary concern of establishing and growing their businesses. Lowering the operating costs and increasing the number of customers unites the profit-oriented motivations of these corporations, if managed in a collaborative and non-competitive way that can also guarantee that service provided to customers is high quality. These goals can be achieved through the appropriate legal and contractual relationships between Banco Palmas and local ISPs. Banco Palmas may need to undertake a convening role in the association to guarantee an effective partnership between all associates.
Conclusion

The PalmasNet initiative seeks to address an endemic problem in urban peripheries, where Internet access is often lacking and prohibitively expensive. Conjunto Palmeiras and its surroundings account for over 100,000 people, many of whom lack access to basic Internet services. In most areas where the Internet has been made available, it has proven highly beneficial. Internet access enhances communication between people, enables fast exchanges of information that makes life easier on a daily basis, and fosters economic growth by allowing new businesses to grow and driving employment. Conjunto Palmeiras is positioned to benefit from expanded Internet access.

In keeping with its goal of improving social and economic conditions in Conjunto Palmeiras, Banco Palmas has undertaken an ambitious project to bring fast and affordable Internet service to the community. The project is consistent with Banco Palmas’ tradition of seeking to improve the lives of residents through community engagement, and moves Banco Palmas into a position of being able to take advantage of 21st century tools for social interaction and community organizing.

While this report outlines the many advantages that Internet services can bring to a community, it also outlines the challenges that Banco Palmas faces in achieving this objective. Funding, technical capability, fostering cooperation with local ISPs, maintaining focus on the strategic growth of the initiative, and uncertain macro-environmental factors are some of the challenges that Banco Palmas must address if it is going to be successful.

Despite these challenges, the project and Banco Palmas possess a number of beneficial qualities and advantages. These include a dedicated project manager, an organization with a respected reputation locally and internationally, significant community demand for affordable and faster Internet services, and the bank’s ability to form partnerships with a variety of key stakeholders, including local government and private sector organizations. The sustainability of the PalmasNet model will rely on Banco Palmas’ ability to build on its strengths, pursue key partnerships, and focus on growth and development of the initiative.

We are confident that such a project has the potential to bring significant advances for Conjunto Palmeiras’ residents, well beyond basic access to the Internet. These include improvements in health, education, employment, income, civic engagement, and the overall well-being of the community.
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Appendices

Appendix I: Analyzing the Internet Market in Fortaleza

Appendix II: Scoring Notes for Organizational Capacity Assessment

Appendix III: “Connecting the Next Four Billion: Benchmarking Internet Connectivity Projects for Expanded Internet Access”
APPENDIX I

Analyzing the Internet Market in Fortaleza

Defining Target Audience and their Preferences

In an effort to better inform Banco Palmas on the type of content it should create and also to inform the bank of their target audience behavior, the team looked at the site visit data from Google AdWords for Fortaleza. This analysis helps give an overall perspective of the Internet space: where the Internet users are, and what they are doing online. This data is an indirect measure of what the Internet space in Fortaleza is like since the data reflects only the number of views captured by specific Google AdWords partner sites (sites in which ads are placed). However, as Google is the biggest player in the online advertising field, the websites under its umbrella are quite exhaustive and the analysis of these sites is generally representative of online behaviors. Data presented here are at the citywide level for Fortaleza, as data specific to Conjunto Palmeiras is not available.

Looking at Google’s AdWords for Fortaleza shows the most popular websites as well as the type of visitors. The demographics presented below represent the user profile of all the visitors to Google Ad network sites in the month ending March 2016. The visits are mainly from the age group of 18 to 34 and the users are predominantly mobile users.

The data is AdWords impression data for display placements. The number of times ads on pages has been rendered to users. This is an indirect measure of Internet visits.

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25 The data is AdWords impression data for display placements. The number of times ads on pages has been rendered to users. This is an indirect measure of Internet visits.
Content that Engages Online Users in Brazil

Data from a global Internet survey conducted by AT Kearney show that Internet users in Brazil are motivated to go online to explore new subjects, and by the flexibility to choose entertainment and to access products and make purchases, as well as connecting with family and friends.26

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The keywords tool available in the Google AdWords platform allows for analysis of the most popular searched terms in Fortaleza. An example of the AdWords platform is presented below. This tool shows what topics are more salient or of interest to Internet users in Fortaleza. For example, quick search by us for the category “Finance” presented below showed that there are 115,380 monthly searches for the term “Receita Federal.” Having this data allows for tailored generated content to terms of interest for the user base.
APPENDIX II

Scoring Notes for Organizational Capacity Assessment

The scoring model is from The McKinsey Capacity Assessment Grid, used to identify areas that are strengths and those that need improvement. This matrix was shortened to address the relevant areas of Banco Palmas that were relevant to the PalmasNet initiative. Scoring in this assessment was based on the team’s field work and research. Evaluations of capacity are on a scale of 1 to 4. Averages are calculated to give equal weight to each sub-category.

1 - Clear need for increased capacity
2 - Basic level of capacity in place
3 - Moderate level of capacity in place
4 - High level of capacity in place

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<thead>
<tr>
<th>Aspirations</th>
<th>Average: 2.5</th>
<th>Evaluation Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mission</td>
<td>3 - Moderate level of capacity in place</td>
<td>Clear expression of organization’s reason for existence which reflects its values and purpose; held by many within organization and often referred to</td>
</tr>
<tr>
<td>Vision - Overarching goals</td>
<td>2 - Basic level of capacity in place</td>
<td>Vision translated into a concrete set of goals; goals lack at least two of following four attributes: clarity, boldness, associated metrics, or time frame for measuring attainment; goals known by only a few, or only occasionally used to direct actions or set priorities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Average: 1.8</th>
<th>Evaluation Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall strategy</td>
<td>2 - Basic level of capacity in place</td>
<td>Strategy exists but is either not clearly linked to mission, vision, and overarching goals, or lacks coherence, or is not easily actionable; strategy is not broadly known and has limited influence over day-to-day behavior</td>
</tr>
<tr>
<td>Goals/perform ance targets</td>
<td>1 - Clear need for increased capacity</td>
<td>Vision translated into a concrete set of goals; goals lack at least two of following four attributes: clarity, boldness, associated metrics, or time frame for measuring attainment; goals known by only a few, or only occasionally used to</td>
</tr>
<tr>
<td>Program relevance, and integration</td>
<td>3 - Moderate level of capacity in place</td>
<td>Core programs and services well defined and aligned with mission and goals; program offerings fit together well as part of clear strategy</td>
</tr>
<tr>
<td>-----------------------------------</td>
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<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Program growth</td>
<td>1 - Clear need for increased capacity</td>
<td>No assessment of possibility of scaling up existing programs; limited ability to scale up or replicate existing programs.</td>
</tr>
<tr>
<td>Program Development</td>
<td>2 - Basic level of capacity in place</td>
<td>Limited assessment of gaps in ability of existing program to meet recipient needs, with little or limited action taken; some ability to modify existing programs and create new programs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Organizational Skills</strong></th>
<th><strong>Average:</strong> 2.08</th>
<th><strong>Evaluation Criteria</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning - Monitoring of landscape</td>
<td>2 - Basic level of capacity in place</td>
<td>Basic knowledge of players and alternative models in program area but limited ability to adapt behavior based on acquired understanding</td>
</tr>
<tr>
<td>Planning - Strategic planning</td>
<td>1 - Clear need for increased capacity</td>
<td>Limited ability and tendency to develop strategic plan, either internally or via external assistance; if strategic plan exists, it is not used</td>
</tr>
<tr>
<td>Planning - Operational Planning</td>
<td>1 - Clear need for increased capacity</td>
<td>Organization runs operations purely on day-to-day basis with no short- or longer-term planning activities; no experience in operational planning</td>
</tr>
<tr>
<td>Revenue Generation</td>
<td>2 - Basic level of capacity in place</td>
<td>Some internal revenue generation activities, however financial net contribution is marginal; revenue-generation activities distract from programmatic work and often tie up senior management team</td>
</tr>
<tr>
<td>Partnership and alliances development and nurturing</td>
<td>3 - Moderate level of capacity in place</td>
<td>Effectively built and leveraged some key relationships with few types of relevant parties (for-profit, public, and nonprofit sector entities); some relations may be precarious or not fully “win-win”</td>
</tr>
<tr>
<td>Local community</td>
<td>3 - Moderate level of capacity in place</td>
<td>Organization reasonably well known within community, and perceived as open and responsive to community needs;</td>
</tr>
<tr>
<td>Human Resources</td>
<td>Average: 2.5</td>
<td>Evaluation Criteria</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Passion and vision</td>
<td>3 - Moderate level of capacity in place</td>
<td>Inspiringly energetic; shows constant, visible commitment to organization and its vision; excites others around vision</td>
</tr>
<tr>
<td>Experience and standing</td>
<td>3 - Moderate level of capacity in place</td>
<td>Significant experience in nonprofit management; many relevant capabilities from other field(s); significant evidence of social entrepreneur-like qualities; some national recognition as a leader/shaper in particular sector</td>
</tr>
<tr>
<td>Dependence on CEO/executive director</td>
<td>2 - Basic level of capacity in place</td>
<td>High dependence on CEO/ executive director; organization would continue to exist without his/her presence, but likely in a very different form</td>
</tr>
<tr>
<td>Senior management team</td>
<td>3 - Moderate level of capacity in place</td>
<td>Team has significant experience in nonprofit or for-profit management; team represents most constituencies (nonprofit, academia, corporate, government, etc.); significant relevant capabilities and track record from other fields; good track record of learning and personal development; highly energetic and committed</td>
</tr>
<tr>
<td>Staff</td>
<td>2 - Basic level of</td>
<td>Some variety of staff backgrounds and experiences; good capabilities, including some ability to solve problems as they</td>
</tr>
<tr>
<td>Volunteers</td>
<td>2 - Basic level of capacity in place</td>
<td>Good abilities; mostly reliable, loyal, and committed to organization’s success; volunteers managed but without standards and little accountability</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Culture</strong></td>
<td><strong>Average: 2.5</strong></td>
<td><strong>Evaluation Criteria</strong></td>
</tr>
<tr>
<td>Shared beliefs and values</td>
<td>4 - High level of capacity in place</td>
<td>Common set of basic beliefs and values (e.g., social, religious) exists and is widely shared within the organization; provides members sense of identity and clear direction for behavior; beliefs embodied by leader but nevertheless timeless and stable across leadership changes; beliefs clearly support overall purpose of the organization and are consistently harnessed to produce impact</td>
</tr>
<tr>
<td>Shared references and practices</td>
<td>1 - Clear need for increased capacity</td>
<td>No major common set of practices and references exists within the organization (such as traditions, rituals, unwritten rules, stories, heroes or role models, symbols, language, dress)</td>
</tr>
<tr>
<td>Performance as shared value</td>
<td>1 - Clear need for increased capacity</td>
<td>Employees are hired, rewarded and promoted for executing a set of tasks/duties or for no clear reason, rather than for their impact; decisions are mostly made on “gut feeling”</td>
</tr>
</tbody>
</table>
APPENDIX III

Connecting the Next Four Billion

Benchmarking Internet Connectivity Projects for Expanded Internet Access

Banco Palmas | Columbia SIPA
Workshop in Development Practice 2015-16

Olivier Bennaim, Erin Britton, Sarah Brovman, William Dreisbach, Bhavapriya B. Jothimohan, Maira Lourenço

23 March 2016
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Executive Summary

This benchmarking study seeks to illuminate the ways in which access to basic Internet services can catalyze the development of a fully connected neighborhood. The objective of this research was to create a knowledge base around similar initiatives that have been implemented in other areas, to identify successful models and best practices and assess their potential for replication in Conjunto Palmeiras.

This study began with an analysis over 20 projects from around the world. To highlight key differences, ten studies were targeted and full case studies were conducted. The projects included in this study are:

- **ZittNet (Nigeria):** Wireless Internet over satellite provided connection to homes, with a pay-as-you-go financing model
- **Mesh Sayada (Tunisia):** A mesh network built, operated, and maintained by local community residents, with information sharing within the community
- **SandyNet (USA):** Fiber connections to the home, built by a small team of local residents with loan financing from the municipal council
- **Digital Empowerment Foundation (India):** A non-profit dedicated to providing wireless Internet access, coupled with a series of digital literacy trainings and empowerment projects
- **TV White Space (South Africa):** A trial of using abandoned television frequencies to beam Internet into schools in South Africa
- **Project Isizwe (South Africa):** A project to provide free public WiFi hotspots in communities, financed by municipal governments
- **SkyBand (Malawi):** A for-profit Internet company which uses a satellite connection to bring Internet to homes and businesses
- **Rhizomatica (Mexico):** A project that provides GSM phone service over radio, relying on community financing and management, and a pay-per-use model
- **Guifi.net (Spain):** A fiber connection links users in a mesh network, and the project promotes open, free, and neutral Internet
- **Altermundi (Argentina):** A mesh network that relies on community financing and participation to build and maintain the network in small towns
Research into these projects sheds light on the ways in which Internet projects are being implemented globally. To create a strategic plan for implementing an Internet initiative, each project needed to answer three principles strategic questions:

- What are the technologies to be used?
- What will be the financing and operation/management arrangement of the project?
- What is the business model and social services provided by the project?

To answer these questions, community context is key. Any implementing organization must identify the available resources in the community and the organization’s capacity to leverage those resources. Additionally, having clear organizational goals for the project allows for those goals to be prioritized when making decisions on technology, financing/management, and business/social services. Each of the projects studied here answered these questions in unique ways, based on characteristics of the community, and the social goals of each project and organization.

In terms of technology, this study looked at projects that were connected to the global Internet via both wired (typically fiber optic) connections and wireless (typically satellite) connections. The technology used to connect to the global Internet was primarily driven by the geographic proximity to existing Internet infrastructure: some projects could link with existing fiber networks, while others required satellite connections to reach rural/remote areas.

Projects also utilized a variety of innovative methods for bringing Internet into homes and public spaces. These methods included: broadcasting over radio frequencies, including unused radio frequencies or television frequencies (“white space”), or wired connections like fiber to the premises, as well as examining different network organizational designs (“topologies”) including decentralized designs like mesh networks as well as more centralized designs like star topology. The combination of wired and wireless connections and network designs are all highly dependent on the characteristics of the community: rural and urban areas, local technology know-how, and regulatory issues for using unused spectrum frequencies.

All projects needed to address both one-time or start-up costs, as well as the costs of managing and maintaining the networks over time. A majority of projects in this study were incorporated as nonprofit organizations. Some projects that began with grant funding or loan funding to cover initial costs, and then were able to charge users based on pay-as-you-go or subscription models. This strategy was most successful in areas with diverse income profiles, and less successful in low-income communities. Internet users’ willingness to pay in non-profit models had uneven results. Sustainable projects in low-income communities relied less on user fees and more on municipal funding, business clients, or continued grant funding.
Several projects used an alternative, community-based model for financing and management. This model, principally found in the mesh networks, focused on peer-to-peer collaboration and community ownership, and a main component of this model was building capacity within the community to sustain the network. Community members funded the majority of start-up costs by pooling financial resources to purchase equipment, and helped with installation. Participating community members were offered training and workshops to help administer and maintain the networks themselves.

This community involvement aspect was a key part of the social impact goals of the mesh network Internet connectivity projects. Other direct social services provided in these projects primarily focused on digital literacy and inclusion, information sharing, education, and market access. Each intervention was tailored to the needs of the individual communities. The case studies presented here analyze in more depth the variety of social services provided in each project.

This case study consists of two parts. Part I contains a cross-sectional analysis of the recurrent issues and themes in each analyzed project. Part II consists of the individual case studies of the ten projects. Overall, this study provides a framework for analyzing the key questions facing organizations who wish to implement an Internet connectivity project.
Part I: Analysis

The team’s benchmarking analysis examined more than 20 initial projects, narrowing these down to ten targeted projects based on several key criteria: the technologies utilized, applicability of business models or service delivery, and the availability of comprehensive data on indicators for these projects.

We analyzed the selected projects in three principal areas: technology, financing and management, and business model and social services provided by the projects.

Technology

Two primary aspects were considered: the link between the Internet backbone and the Internet service provider (ISP), and the connection the ISP utilizes between its link and individual premises.

Backbone-to-ISP Connection

Most projects analyzed used either a fiber connection or wireless technology to connect local service providers to existing Internet infrastructure.

Fiber Technology: Fiber optic cable has been rapidly replacing cable (coaxial/copper cable), due to increased speeds and less leakage over long transmission distances. Fiber is a highly preferred connection method and fiber backbone cable networks are rapidly expanding around the world; however, these can be prohibitively expensive in the developing world.27

Wireless/Satellite Technology: Wireless satellite technology is increasingly utilized in remote or rural areas that do not have proximate connections to fiber optic cables. Speeds via satellite typically can reach up to 20 Mbps.

These technologies were generally more prevalent than both coaxial/copper cable backbone (as well as a fourth alternative, mobile networks (e.g. 3G), due to the increased quality of service available from wireless and fiber technologies.

ISP-to-Customer Connection

Backhaul refers to the intermediate connection between the consumers and the global network. There are two general categories of backhaul technology: wired (copper or fiber connections to

27 For more information on the use of fiber technology to connect to Internet backbone, particularly in comparison to coaxial/copper cable, see Appendix A on Options for Network Cables.
The projects had some of the earliest and most innovative implementations of wireless backhaul. These projects included Wi-Fi networks connected to both fiber and wireless/satellite connections, and spectrum technologies, which use unused radio or television frequencies to broadcast Internet signals to receivers, and mesh networking.

One project utilizing fiber connections also utilized wired backhaul to bring fiber cable directly to the home. Other projects, not included in this study, used fiber connections and wired backhaul, either bringing fiber directly to the premises, or used coaxial/copper cable or Ethernet to connect premises to the local fiber connection. (This type of connection is found generally in places with existing coaxial infrastructure in buildings, such as many urban areas in the United States.)

Wired backhaul is not frequently found in wireless/satellite links. Satellite connections are generally used in areas not currently served by proximate fiber or cable because of issues of remoteness or low population density. These problems also incentivize the use of wireless backhaul over wired. Accordingly, no projects utilizing this technological combination were included in this study.

<table>
<thead>
<tr>
<th>Technological Taxonomy of Projects</th>
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<tbody>
<tr>
<td><strong>Fiber Connection</strong></td>
</tr>
<tr>
<td><em>Wired Backhaul</em></td>
</tr>
<tr>
<td><strong>SandyNet</strong></td>
</tr>
<tr>
<td>Uses Fiber to the Home or Fiber to</td>
</tr>
<tr>
<td>Premise (FTTH or FTTP)</td>
</tr>
<tr>
<td>Speed: 100 Mbps</td>
</tr>
<tr>
<td><strong>Project Isizwe</strong></td>
</tr>
<tr>
<td>Provided Wi-Fi connections, creating free public hotspots.</td>
</tr>
<tr>
<td><strong>Service Provider</strong></td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>DEF India</td>
</tr>
<tr>
<td>ZittNet</td>
</tr>
<tr>
<td>Guifi.net</td>
</tr>
<tr>
<td>AlterMundi</td>
</tr>
<tr>
<td>Rhizomatica</td>
</tr>
</tbody>
</table>

### Wireless Backhaul versus Wired Backhaul

Wired backhaul technologies predominated in many markets where ubiquitous existing coaxial cable lines made their conversion to Internet service easy and low cost. In contrast, developing markets have pioneered wireless backhaul as a lower cost alternative to bringing cable to the premises. In addition to being less expensive with respect to the required hardware, the installation and deployment of wireless connections is easier than for wired. For low to moderate computing needs, wireless backhaul provides adequate megabytes per second, though on average they are slower than wired connections. Overall, the study found that speeds for projects using wireless backhaul were not significantly slower than target (~15 Mbps) speeds for megabytes per second.

Wireless backhaul technology can vary dramatically, both in terms of quality and in implementation, and is heavily dependent on the local context. For spectrum technologies that use broadcast technologies, it is important to consider whether line-of-sight issues will impede the
transmission of radio signals. (Some technologies, such as TV white space transmission, avoid the problem of line-of-sight.) In most contexts, spectrum frequencies are highly regulated, and it is necessary to purchase or obtain rights to utilize unused or underused radio/TV frequencies. Interference on crowded frequencies can also be a hurdle to wireless Internet connections. Wireless connections in some instances require increased maintenance over time than wired connections.

In summary, wireless backhaul technologies are often favored due to their lower startup costs, but are often seen as an initial or temporary step prior to transitioning to wired connections to the premises. In areas where wired connections are unfeasible due to low population density, or where tall tower infrastructure exists, wireless can be a good alternative to cable. In areas with obstructions to the line of sight, wired connections may provide better service, though some wireless technologies such as TV white space also help solve line-of-sight challenges. In areas where copper cable theft is prevalent, wireless connections can help lower hardware replacement costs.

Financing and Management

Start-Up Costs

Three dominant models for start-up project financing emerged: loan-funded, grant-funded, and community-funded.

Some loan-funded projects had earned income in their business model, and short-term loans were paid back over time through service revenue. One project, SandyNet, was financed through a bond from the municipal council, which was to be repaid over time. Loan payback projections over a set period of time were used to create financial models to determine thresholds for financial viability. These included repayment of the loan as well as operating and maintenance costs. Profits were reinvested in operations and technology upgrading.

Organizations who financed startup through grants included non-profits offering free Internet services, as well as some which have developed a paying customer base. Of the initially grant-funded projects, most have developed financial sustainability strategies over time. One notable free Internet project, Project Isizwe, began as a self-funded venture, and has developed into a public-private partnership where municipalities contract with the organization to provide Internet services in town and cities. This model has been successfully replicated in other locations.

Other projects received initial grant funding to begin operation, and subsequently used earned income to cover maintenance and upgrading costs. These projects, which included ZittNet and DEF India, faced challenges of financial sustainability and meeting costs due to the low demand for services, low rates of pay back, and underestimated maintenance costs. One potentially confounding factor is that grant-funded projects typically targeted underserved or low-income communities that by their very nature present financial challenges relative to more developed
markets. Levels of initial buy-in from the community prior to project implementation were unknown in these cases.

Community-funded models obtained financial buy-in from their inception from community members. Mesh networks, such as Guifi.net, Mesh Sayada, and AlterMundi, and the GSM network Rhizomatica, raised startup costs from contributions from community members that covered the initial investment in infrastructure and hardware. Community buy-in was significant and corresponded with the high-demand for Internet services. Community members also volunteered labor in the initial setup of these mesh networks.

The one for-profit corporation analyzed in this study, Skyband, has experienced significant growth over a considerable period of time. It began with an initial grant and has worked to develop a market that currently is primarily from the business/corporate sector (70% of its customer base), with a remainder being residential customers. This company offers a suite of product and service offerings, which have allowed the company to make increased profit margins without having to engage in the difficult task of attracting more customers.

**Maintenance and Management**

Most wireless networks require significantly more maintenance than wired connections. A hidden cost and a major challenge for many of the projects was developing the organizational capacity for continual maintenance and upgrading to insure quality service provision. Two primary models were identified in the study: maintenance by organization staff, and maintenance by community members.

Some projects employed a small staff that was tasked with maintaining equipment and responding to consumer complaints. This staff was responsible for the initial setup of infrastructure and attracting new users to the network. The litany of tasks often resulted in a part-time or full-time job for a small team of individuals with deep technical knowledge, adding to costs for the network. ZittNet and DEF India struggled to cover the increased costs of staff, whereas Project Isizwe, SandyNet, and Skyband, were more successful in sustaining or scaling their models.

The mesh network models, including Mesh Sayada, Guifi.net and AlterMundi, provided extensive training to individuals in the community on the setup, maintenance and troubleshooting of hardware. Since individual homes that served as nodes would be involved in the setup and creation of the network, the training of the local population was key for the operations of the mesh networks. Individuals wishing to join the network would cover the costs of new hardware and installation. In addition to decentralizing the setup and maintenance, the mesh network models incorporated the social values of the organizations regarding peer-to-peer collaboration, communitarian networks, and local ownership and capacity building. In addition to providing one-off setup and installations, the organizations run workshops and trainings in the community to engage more people with the technology. These models also incorporated open software that helps
to configure each node in the community network. In addition to community training, the organization retains a small staff that is available to expand the model in other localities, and interface with similar Internet service movements globally.

**Business Models and Social Services**

Apart from the one for-profit corporation analyzed (Skyband), business models for projects were classified as either non-profit social businesses or community collectives.

The study also analyzed association-type models for service provision. Due to the lack of successful associations for Internet service provision, no cases were included in the study. Research and findings on association models is presented below, included challenges and lessons learned.

**Non-Profit Social Business Models**

The majority of projects in this study were incorporated as nonprofit organizations. These were either existing NGOs that expanded into Internet service provision, or organizations that were created specifically to provide Internet service. These organizations provided service either for free or for below market costs to users, while still aiming to make a profit. Any net income was reinvested in the operations of the organization.

Organizations that charged for service employed both pay-as-you-go and subscription models. The success of the model depended heavily on the ability of users to pay for services. Some organizations had difficulty making a profit since users were either late on payments or missed them altogether. This overestimation of the willingness to pay of user often presented serious challenges to the sustainability of the project, and was principally encountered in low-income communities. Projects in communities with a more diverse income profile fared better, as did projects where services were offered for free and the organization received financing from the city government or other funding sources.

**Community Collectives**

Community collective models (typically employing mesh networks) were fairly successful business models that provided services at cost. While technically incorporated as nonprofit organizations, these collectives are distinct from other NGOs due to their origin in the community. Individuals who wish to participate cover all startup costs and finances maintenance and expansion. These models principally operate in small towns and rural areas underserved by traditional Internet service providers where a community collective may be the only option for obtaining reasonably priced Internet service.
The community collective model’s primary focus is peer-to-peer collaboration and community ownership. A main component of this model is building capacity within the community to sustain the network, and organizations offer training and workshops on both the technical aspects of the network and topics relating to the Internet as a tool for social justice. A small part-time staff is retained by the organization to facilitate the network. These projects have enjoyed considerable sustainability, and have been replicated in other small towns across the world.

**Associations**

An association model provides numerous opportunities for tax relief and price reductions in the market. An association provides bargaining power and gives small providers the opportunity to have access to technologies they could not otherwise afford. For example, in Uganda, a group of local ISPs purchased bandwidth as to reduce the price. A 2010 survey found that more than 283,000 associations operated in Brazil. The tax structure in Brazil encourages the formation of associations.

ISP associations have faced challenges in successfully implementing their models, and most ISP associations and cooperatives have not produced successful results principally due to complicated revenue sharing models, and the lack of incentives for private sector companies to relinquish profit opportunities. The key issues that ISP associations are required to address include:

- how new Internet customers will be recruited
- which ISP would be responsible for providing service to new customers
- how to incentivize profit reinvestment in the association
- pricing and revenue sharing models

**Internet-based Social Services**

The majority of projects contained some social element to their services. These included providing digital content on expanded networks, training local individuals in technology use and maintenance, or providing support and wraparound services to help users best leverage expanded Internet access. In all cases, these support services were cited as highly successful components of the Internet projects.

Social services in these models primarily focused on digital literacy and applications to education.

- Digital literacy - training for end users on use of technology

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• Education - providing Internet services to schools, and instruction on accessing educational resources

A key finding was the importance of having a digitally literate population to sustain a consumer base for Internet service. This condition was key for users to access and social content provided by organizations. Other areas where social services were coupled to Internet services included telemedicine and women’s empowerment.

In community-based networks, the organization generally provided community information and communication tools through the use of a captive portal - a landing page that all network users would be directed to when they accessed the Internet. These pages contained maps and notices of events in the community, as well as news of upcoming training and workshops provided by the organizations. These organizations were also able to set up Voice over Internet Protocols so that users could call other networks users, which was a useful service in rural areas underserved by phone connectivity.

Conclusions and Recommendations

Various methods, both technological and in terms of management and business models, have been developed to bring Internet services to people and locations where they are still not yet available, or not available at adequate speeds and affordable costs. The breadth of experiences, challenges and successes has yet to be fully documented in a comprehensive way, particularly since the movement for better, faster, and more accessible Internet is highly decentralized and being implemented by small organizations working in areas across the globe. The unifying factor in these experiences is a recognition, either tacit or explicit, of the vast social benefit provided by increased Internet access.

The principal finding of this study is that the type of Internet service provided is highly dependent on the context of the individual community. The primary axes of analysis for this context are:

• Technological infrastructure and location relative to existing infrastructure
• Community buy-in and demand for Internet services

These two elements are the driving factors for the major decisions made by the projects, both in terms of technology and management models. Determining a financially sustainable model is a principal challenge for an organization, and must be based on the cost of initial investments as well as the cost of continual maintenance and upgrading of the network. The price that can be charged to users depends heavily on the demography of the area and the local demand for Internet access; in the projects studied that took place in communities with high demand for Internet, individuals and community members played a key role in financing startup costs and operations, while in communities with lower demand for Internet services organizations were challenged in meeting operational costs.
Projects that had a high level of community participation benefited from public involvement in the project. In the case of Rhizomatica, the community helped design the infrastructure, which increased transparency in setting the price of Internet. The Mesh Sayada project in Tunisia, on the other hand, was able to keep costs down by relying on the community to donate labor and spaces in private homes for routers to grow the network. These models are developed for small communities that wanted to keep their costs low and provide a very basic level of Internet connectivity. Other projects, which served a larger community, saw their costs increase due to unexpected maintenance and high infrastructure costs. Zittnet wanted to reach customers in more remote locations, which resulted in higher set-up costs. In order to provide a service their customers could afford, Zittnet provided them with a pay-as-you go pricing model.

Analyzing the context of a community is the key step in the process of developing an Internet connectivity project. The community analysis allows an organization to assess:

- The resources of the community and the organization’s capacity
- An appropriate business strategy for the initiative
- Social services to be offered which may increase the demand for Internet services.

Based on these factors, an organization can begin to build a strategic plan and vision for implementing an Internet connectivity project in their community. Assessing the resources of the community can help connect the service with the customers by providing a price to customers that is affordable and flexible. Managing the cost may be attainable through low-costs for infrastructure and pay-as-you-go pricing options.

An appropriate business strategy reflects the demand for Internet and the ability of the customers to pay. SandyNet is an example of a project started from the local community, when demand for Internet was high and Internet provision was low. Skyband, on the other hand, identified an area with unreliable Internet access and provided a more reliable service for a profit.

Social services were important when serving the social goals of the ISP or trying to develop interest in the Internet. Projects like Mesh Sayada included training on maintenance and digital justice to help increase the interest in the program, involved the community in the planning of the network. This approach helped the community feel a sense of ownership in the project. The social aspect was important in the DEF India project to help provide the Internet and empower women in India. This project helped increase demand, empower women, and engender a sense of community-owned and managed digital infrastructure.

The projects analyzed were able to tailor the technology and community buy-in to their customers. Based on these factors, a new ISP should analyze these two factors to connect with customers and develop a sustainable business model. These projects provided a basic level of speed and limited the startup costs. Assessing the demand for the Internet and building community buy-in was instrumental in the development of ISPs in the benchmarking study.
Part II: Case Studies

ZittNet (Nigeria): Wireless over satellite provided connection to homes, with a pay-as-you-go financing model

Mesh Sayada (Tunisia): A mesh network built, operated, and maintained by local community residents, with information sharing within the community

SandyNet (USA): Fiber connections to the home, built by a small team of local residents with loan financing from the municipal council

Digital Empowerment Foundation (India): A non-profit dedicated to providing wireless Internet access, coupled with a series of digital literacy trainings and empowerment projects

Cape Town TV White Space (South Africa): A trial of using unused television frequencies to beam Internet into schools in South Africa

Project Isizwe (South Africa): Provides free public WiFi hotspots in communities, maintained by the project team, and financed by municipal governments

Skyband (Malawi): For-profit Internet company which uses a satellite connection to bring Internet to homes

Rhizomatica (Mexico): A project that provides GSM service over radio, relying on community financing of start-up costs and a pay-per-use model

Guifinet (Spain): A fiber connection links users in a mesh network, for individuals, communities, or organizations, and promotes open, free, and neutral Internet

AlterMundi Argentina: A mesh network that relies on community financing and participation to build and maintain a network in small towns
ZittNet: A rural Internet service provider

Company Name: ZittNet, via Fantsuam Foundation
Country: Kafanchan area, Nigeria
Operating: 2001 to present
Technology: Pay as go - Satellite to Home using Communication Mast
Business Model: Non-profit

Zittnet is the first not-for-profit wireless ISP established in Nigeria. Zittnet was a project by Fantsuam Foundation. Zittnet’s aim was to improve access to communication and to foster development in the Kafanchan area of Nigeria by establishing a rural wireless community ISP.

Country Context

Before Zittnet launched, Kafanchan, situated 200km from Abuja in Central Nigeria, was a thriving town with the population of 83,000. The town was thriving in Nigerian Railway boom but then with the Nigerian railway breakdown the 80% of the population relied on the railway was forced to get back to agriculture. Though there were no government regulations on wireless and VoIP, Kafanchan in 2005 suffered from poor connectivity and power issues. There was no fixed telephony and GSM had just been launched in the area. Kafanchan was cut off from the rest of the world due to lack of cheaper connectivity options.

Project Background

Fantsuam foundation, the parent foundation of Zittnet project had been working in the region promoting development. ZittNet project was developed by Bidi Bala in 1996 with the aim of promoting participation and global knowledge among the people in the region. The project was started to address issues of education and employment29. Zittnet’s creation was logical too.

29 Heather Girling, Bidi Bala and the creation of Zittnet, Nigeria, 2008.
Fantsuam foundation started using computers in their organization and after seeing the demand for computers they started giving refurbished laptops to interested people. But, these laptops often broke down prompting Fantsuam to train people to fix them. Thus, Fantsuam became a Cisco certified academy but then, the academy had to be connected to Internet using VSAT. This is when Fantsuam decided to share the connectivity with the local community as well through ZittNet

**Technology**

*Star topology WiFi network – a centralized wireless network that connects various network nodes using a communication mast.*

Given the low density of users in Kafanchan and also their geographical spread, a mesh network was not a feasible option. Therefore the projected deployed Star topology WiFi network. The topology of the network had two access points in the communication mast at Fantsuam’s premises. One access point hosted a 90 degree sectoral antenna and the other provided an omni-directional coverage to the surrounding (Picture: ZittNet 2007).

ZittNet in 2007 was also planning to expand the wireless backbone by setting up two wireless repeaters. These repeaters were expected to provide coverage to surrounding towns and long distance connectivity to Abuja.

But the biggest challenge for Zittnet was not just the connectivity but the power supply in the region as well. Kafanchan received on 3 hours of power supply every day and the rest of 21 hours was spent outside home without electricity. The other issue was also the low voltage that was only sufficient to power a light and some TVs. To overcome these hurdles Fantsuam designed and installed a hybrid power back up system consisting of a deep-cycle battery bank and solar panels. The hybrid system was charged using three sources – from the NEPA (National Electric Power

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30 Dadamac, Zittnet - Rural Connectivity at Fantsuam, Blog post
31 Louise Berthilson, ZittNet – Fantsuam Foundation's Community Wireless Network Case study, IT+46.
Authority) when electricity was available, through solar panels during the day and generators when no other sources of power were available.

**Business Model and Services**

Due to infrastructure constraints, the option that was available to Kafanchan was connection through satellite. But, given the high cost of operating a fixed cost connectivity, Zittnet has shifted to a Pay-As-you-Go model. In 2006, using the satellite subscription ZittNet had 128/64 kbps dedicated bandwidth at a cost of 1800 USD/month. Given the high cost, Fantsuam shifted to the “HookMeUp” provided by Koochi Communications, which offers Pay-as-you-go plan over broadband VSAT.

The “HookMeUp” system offers a dedicated 512/526 kbps which is shared by Fantsuam and its external clients. Fantsuam acts a reseller of Koochi vouchers and a supplier of wireless infrastructure to the end users. Zittnet had 8 clients across health, Internet café, hotel etc. Fantsuam also charges each of its department on usage. The fees from various projects and income from the client left with surplus which was enough to cover staff and spare parts.

![Table 1: Pricing model of Zittnet.](image)

<table>
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<tbody>
<tr>
<td>30 min</td>
<td>5</td>
<td>1 day</td>
<td>0.8</td>
<td>1.600</td>
<td>112.000</td>
</tr>
<tr>
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<td>0.096</td>
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<td>3500</td>
<td>6 months</td>
<td>416</td>
<td>0.096</td>
<td>83.200</td>
</tr>
<tr>
<td>12 months</td>
<td>7500</td>
<td>12 months</td>
<td>728</td>
<td>0.084</td>
<td>67.947</td>
</tr>
</tbody>
</table>

**Financing and Management**

The initial funding for ZittNet came from IDRC (the International Development Research Centre of Canada). The organization IT +46 provided Zittnet with the technical support and built capabilities within the Zittnet team in the areas of wireless communications, bandwidth management, solar energy, power backup systems and VoIP deployments.

Post the set-up, ZittNet was dependent on the income from its 8 clients. ZittNet underestimated the importance of factoring in equipment maintenance and other supplementary costs when drawing a payment plan. This resulted in ZittNet facing huge financial crunch when there were calamities, equipment failure or when one of the clients failed to pay. So far maintain a steady stream of revenue has been the biggest challenge for ZittNet.

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32 Louise Berthilson and Alberto Escudero Pascual, IT46, “Internet in Africa? - (A)bort, (R)etry, (F)ail”, IDRC.
ZittNet is managed and maintained by local staff who have been trained outside Fantsuam Foundation.

**Lessons Learned**

*Addressing hidden costs of hardware.* Access to hardware was a primary challenge for this project. In addition to the costs associated with obtaining equipment, the quality of the equipment was also not reliable, necessitating frequent replacements.

*Difficulties in expanding the wireless network.* Due to high infrastructure costs, combined with difficulty in obtaining new clients (and therefore generating income to cover costs), ZittNet was challenged in providing sufficiently high-speed connections. Since most buildings in the area are not tall and because increasing the height of the central broadcasting mast is expensive, Fantsuam is forced to depend on other players such as the radio station and a college for space and broadcast infrastructure.

*High attrition of trained work forces.* Fantsuam is dependent on national and international volunteers to run its operations. The national volunteers are trained by the Foundation. Given the high quality of training provided by Fantsuam many national volunteers tend to leave the foundation post training for better jobs. To overcome this challenge, Fantsuam is aiming to recruit retired professionals.

*Adaptability in business model development.* Forging sustainable partnerships to provide reliable bandwidth from upstream provider has been a difficult task for ZittNet. Fantsuam has tried three different business models and three different providers to adapt to market conditions; however, these adaptations have not yet successfully worked to create a financially sustainable model.

*Overcoming environment barriers to service provision.* The natural and built environment posed major challenges for ZittNet’s operations. To start with, most client homes were single-story buildings with weak roof structures that made mounting equipment a challenge. Also, vegetation in the form of thick mango trees blocked the line of sight, making it difficult to transmit signal. ZittNet also did not foresee lighting strikes, which destroyed equipment.
Mesh Sayada

**Company Name:** Joint project between CLibre and Open Technology Institute

**Country:** Sayada, Tunisia

**Operating:** 2013 to present

**Technology:** Wireless mesh network

**Business Model:** Community Initiative

**Country Context**

In response to the holdover of laws restricting information and access to the Internet from the autocratic government of Zine el-Abidine Ben Ali, the city of Sayada, Tunisia responded by using community labor and resources to create wireless access to locally-hosted content. After Ben Ali’s ouster in 2011, access to the Internet was still against the law, however the town of Sayada created a town website, a Wikimedia site for the town, and published the municipal budget. However, few people in the town of Sayada had access to these websites, in response the organization of CLibre helped the city set up mesh-network technology to increase access to the newly available information.33

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Project Background

In 2013, the Open Technology Institute (OTI) and CLibre, a Tunisian association for free digital culture, joined together to build wireless hotspots throughout Sayada to improve the access to locally hosted content. OTI, a public policy think tank that focuses on “freedom and social justice in the digital age,” leads the Commotion project, which it has implemented in other communities, providing digital training and developing wireless networks. OTI provides a Commotion Construction Kit, which provides a guide for local communities to plan, design, install, and configure community wireless networks using OTI’s Commotion Wireless technology (described below).

One of the hallmarks of the project is the community involvement aspect, which focused on training and pooling community knowledge and resources. Over the course of four days, the people of Sayada, along with some additional assistance from neighboring towns, the community planned and built the mesh network in Sayada. Additional expertise was gathered from surrounding neighborhoods, with members of the Ubuntu Tunisias Association arriving from a neighboring city, Sousse, to help set up the community server and create the network portal page.

During the four-day workshop, OTI administered training and helped guide the implementation of the network. As part of the training, the people of Sayada discussed the digital justice and solved puzzles regarding line of sight problems. Additional training was given to young students about the three types of routers, basic wireless propagation principles, how to identify important community anchor institutions and spaces, and concepts of network design. As a group, the members of the community created a plan to place the routers throughout Sayada in order to provide the best service and best connectivity. By taking the routers into the street and measuring their effectiveness, the members of the project were able to space out the routers in an effective manner.

As part of the community effort to keep the cost down, the rooftop of citizen’s homes were used to mount the routers and spread the hotspots throughout the town. In addition, resident of Sayada with complementary skills, such as construction, helped organization residents into building the support structure. Overall, this helped remove the cost for labor and kept the cost of the program to a minimum. The project resulted in providing 70 percent of the population with hotspot coverage, using eleven rooftop sites and 12 routers.

Technology

Mesh Network Technology: Mesh technology is different than a typical Internet Service Provider. While traditional networks rely on a small number of wireless hotspots, a wireless mesh network

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is spread out among dozens or hundreds of wireless mesh nodes that communicate with each other to share the network connection across a large area. The nodes automatically choose the quickest and safest path in a process known as dynamic routing.  

One of the benefits of a mesh network is only one node needs to be physically wired to a network connection. That one wired node then shares its Internet connection with all the nodes within its range. Those nodes then share their connection with the nodes closest to them. As the nodes increase, the further the connections spread. Mesh networks, generally speaking, work best in dense areas as each individual node has a range of 30 to 300 feet, depending on the environment. While the project in Sayada did not include a link to the Internet due to the laws of Tunisia, a link could to the Internet could be provided in a different setting. The table below provides an example of how mesh networks help expand the reach of the Internet through a mesh network using nodes.

Wireless mesh networks have many advantages including their adaptability, as they are able to deal with any obstructions that might be blocking the line of sight by automatically finding the fastest and most reliable path to send data. They also require little supporting infrastructure, making them a low-cost option and less susceptible to outages. Mesh networks have proven most useful during natural disasters, when standard Internet and cell phone networks were disrupted. Mesh networks were able to continue working due to their adaptability and less reliance on a large infrastructure.

However, one of the detractors of a mesh network is the high latency when data is routed through a number of nodes. “If information from a server has to make five or six hops to get to a user, it could noticeably increase the amount of time that it takes for a site to load.” In addition, Apple has only recently made mesh networks available on their phones in 2014, through Wi-Fi or

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41 Albright, Dann. "Are Mesh Nets the Future of The Internet?"
Bluetooth. On the other, mesh networks using Android phones are only available if the mobile phone’s security settings are disabled.42

**Business Model and Services**

*Service:* Because of the restrictive nature of Tunisia and the tight controls of Internet access, the Mesh Sayada project increased access to information provided by a local server. The server provided an Open Street Map of Tunisia, Wikipedia in French and Arabic, a collection of 2,500 free books in French, an application for collaborative document editing, and an application for secure chat and file sharing.

The Mesh Sayada project provided free hotspots throughout the town for 70 percent of the 23,000 residents of Sayada. Speeds provided by the mesh network ranged by each router, with the fastest router throughput at 13.4 mbps, the slowest router at 850 kbps and an average of the eleven rooftop routers at 4.6 mbps.43

Almost as important a service, the Mesh Sayada project provided training on important topics, such as using digital solutions to help solve community problems and technical training for young residents.

**Financing and Management**

*Financials:* Because of the volunteer labor and the use of local expertise, the entire cost of the program was only $2,500 USD. This cost includes the wireless routers, local server, and installation hardware. The cost of the program was also reduced by the donated rooftop space and the support of Tunisian technologists to set up the local server.

The cost of the routers amounted to $950, in addition to the $125 in the cost of Ethernet cable. The largest cost was for the local server, which amounted to $1,000.44

Financing for the initial start-up and maintenance was provided by United States Agency for International Development, as part of a larger $4.3 million effort to help communicate more freely and securely under oppressive environments.45

*Management:* This project started as a joint venture between OTI and CLibre. CLibre is a local organization that pioneered the local server in 2011, after the fall of the Ben Ali government. As a local pioneer, CLibre has administered the program since its initial implementation.

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Lessons Learned

Community involvement in planning helped increase awareness and education. The Mesh Sayada project was a success in its community approach and getting community members of Sayada to become more involved with the project. While the workshop did not have as many attendees the first day, the number of participants went up each day as word of mouth spread throughout the community.

Effective access and local content led to increased interest in neighboring towns. In addition, the number of Mesh Sayada members on Facebook has grown to 300\(^46\), with the website serving as a link for interested members from neighboring municipalities. Communities across Tunisia have expressed their interest in building similar community-governed wireless networks. CLibre is now taking the lead in helping neighboring communities develops their community-owned communications infrastructure.

\(^{46}\) Gunn, et al. Case Study: Mesh Sayada; Building a Community Wireless Network.
SandyNet

Company Name: SandyNet
Location: Oregon, United States of America
Operating: 2003 to Present
Technology: Fiber to Home
Business Model: Community Managed ISP

SandyNet is an Internet service provider that has made Internet a utility in the city of Sandy, Oregon. SandyNet is a unique ISP that is owned by the citizens of Sandy and is operated by the City of Sandy. SandyNet stands out as an example of local community self-reliance. What distinguishes this project from other community projects is both the scale of the project as well the years the project has been sustained. The project currently has 1500 subscribers (homeowners and small businesses) and has been successfully maintained and operated for the past 12 years.

Country Context

As per the World Bank, in 2014, America ranked 18th in Internet usage across countries with 87.4% of Americans having accesses Internet. The worrying fact is that a large number of people have less or no choice who their Internet provider is. As per federal communication council, nearly one-third of the users had no choice on the provider, while 37% had a choice between 2 providers and 33% had more than 3 providers to choose from. This lack of competition severely limits the quality of Internet access residents can avail.

Project Background

SandyNet was born out of a need. In 2001, the city officials in Sandy started worrying about the state of Internet connectivity for their residence and businesses, when the local telephone company failed to provide a DSL line to the city Hall. To tackle the issue the municipality started providing DSL to local residents and business using the phone company’s basic infrastructure. But, they soon realized the importance of wireless system and started investing in it in 2003 by forming SandyNet. It started out with 175 customers on wireless (with some DSL) and has today grown to 1500 customers.\(^50\)

Technology\(^51\)

*Fiber with advanced home router system that used MU-MIMO (routers with the ability to connect multiple Wi-Fi devices at the same time).*\(^52\)

In 2013, SandyNet contracted OFS, a company experience in fiber networks for deploying the fiber. In 2014, SandyNet launched a pilot FTTH (Fiber to the House/Premise) project and the success of the project and the subsequent interest in it demonstrated strong demand for the fiber in the city. In October 2015, decided to upgrade its technology and utilize the MU-MIMO technology which will send the Wi-Fi signals to multiple MU-MIMO devices simultaneously. This is expected to improve user Gigabit broadband experience.\(^54\)

Business Model and Services

SandyNet is described as a pioneer in Gigabit connection provider. With the average Internet connection at Sandy is said to be 5 MBPS, SandyNet can deliver speeds up to 200 times faster than the average speed. SandyNet services both Residential as well as small local business customer. They provide both fiber and Phone service. The cost for the services are as given below.

<table>
<thead>
<tr>
<th>Residential Pricing:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internet &amp; Phone</strong></td>
</tr>
<tr>
<td>100 Mbps (upload/download)**</td>
</tr>
<tr>
<td>Unlimited Nationwide calling</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>Upgrade to Gigabit + $20/month</td>
</tr>
<tr>
<td>No Contract, No Data Caps</td>
</tr>
<tr>
<td>$59.95 per month</td>
</tr>
</tbody>
</table>

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\(^50\) Christopher Mitchell and Hannah Trostle, SandyNet Launches FTTH Services, BBC Aug 2015.
\(^51\) For additional information on the technology employed by SandyNet, see Technicians’s blog:
\(^52\) SandyNet to Use Calix GigaCenter Multi-User MIMO for Superior Wi-Fi, Reuters. 2015.
\(^53\) City of Sandy, Official Website http://www.ci.sandy.or.us/History-of-SandyNet/
\(^54\) SandyNet to Use Calix GigaCenter Multi-User MIMO for Superior Wi-Fi, Reuters. 2015.
Financing and Management

SandyNet uses its net income to improve the service. SandyNet operates on a breakeven basis. Sandy improves its equipment, funds capital investment and service debt through the net income earned. Sandy did not have the option of rolling out the fiber buildout in Phases because of the citywide demand and the impact it will have on the election results. SandyNet originally decided to utilize the public-private partnership model but then the negotiations with private player fell through. Hence the city decided to finance its own project and build it using a contractor. The city council issues revenue bonds of $7.5 Million to cover the construction cost. The revenue to repay the debt is generated by those who subscribe to Sandy’s network. They did extensive financial modelling and arrived at a 35% take rate to pay off the debt. But today SandyNet has achieved a take rate of 60%.

The team that manages SandyNet is has no more than 3-4 people work for SandyNet full time, with a couple of interns to manage the facility. SandyNet’s strength is its core team – a technically strong program director, technology savvy city mayor, an IT analyst and a technical support executive. SandyNet during its initial years used the local expertise available. It contracted local college students who had the technical inclination as Interns. Using locally available technical experts proved to be advantageous for SandyNet. SandyNet proved beneficial to the city of Sandy in the following ways:

- Internal cost savings as a result of fiber network implementation has been substantial – such as phone connections using VoIP
- Reduced travel cost because of the opportunity to work from home
- Better business because of connectivity for local business owners
- Improved real estate value in the city directly because of the connectivity speed.

Lessons Learned

Maintaining open and frequent communication with subscribers. SandyNet benefitted from open communications with the customers and the local government (who was funding the project). This communication was especially important during the phase when the fiber is being laid and during the launch of the pilot, in order to gauge the reception within the community of the project. SandyNet uses Facebook to communicate with users and understand user feedback and concerns.

Willingness to experiment while being technologically sound. SandyNet has constantly evolved as a project. Even while laying the fiber, they wanted an alternate approach to normal design by trying use the sewers to bring fiber to the city

Completing the project quickly and on schedule. SandyNet wanted to avoid frustrating users, and therefore focused on implementing the project as quickly as possible. In one of the interviews, the
city officials mentioned how when the pilot was launched in a certain part of the city the rest of the city felt left behind. In addition, the whole process of laying fiber caused disruption to homes and neighborhoods. To tackle both these issues, SandyNet actively used social media to communicate their plans and learn about the disturbances faced by the residents. They also focused on getting the project finished as early as possible.
Digital Empowerment Foundation

Company Name: Digital Empowerment Foundation
Location: India
Operating: 2002 to present
Technology: Wireless using unlicensed spectrum
Business Model: Not-for-profit organization

Country Context
India has around 635,000 villages organized into 250,000 panchayats, the lowest government and administrative unit in India. In 2006 the government launched the National e-Governance Plan with the purpose of providing at least 8Mbps broadband. So far, less than 20% of the panchayats are connected to the National Optical Fibre Network (NOFN).

Digital Empowerment Foundation (DEF) is a New Delhi not-for-profit organization founded in 2002 whose mission is providing marginalized communities access to information and knowledge using digital tools. The foundation focuses its activities on rural areas and adopts a multi-stakeholder approach with the collaboration of public, private and international entities such as the Indian government, telecom companies, Google and UNESCO.

Project Background
DEF offers three primary services: Community Information Resource Centers, wireless access for communities, and women’s empowerment programming.
1. Community Information Resource Centers (CIRC)

Centers with Internet connectivity, computers, and all basic digital equipment to provide capacity building and digital literacy, enable civic participation, and offer telemedicine and health services. The courses are free of charge or charge a small fee.

The organization has 140 centers in 70 different locations. Each center has 3-4 employees. One of the centers offers digital classes for students and teachers of public schools.

2. Wireless for communities

The project was launched in 2010 in partnership with the Internet Society (ISOC) with the purpose of solving the “last-mile” problem and providing low-cost broadband Internet connection using unlicensed spectrum (2.4 GHz and 5.8 GHz spectrum bands) and wireless technology. Besides, by establishing community-owned and managed digital infrastructure, the project aims to develop the skills of community members. The first pilot was launched at Chanderi, a city with a population of approximately 32,000 inhabitants, no public computers and high levels of digital illiteracy. Since then, the project has been expanded to 14 different locations.

So far, 120,000 people have been benefited. In 2013, the Wireless for Communities (W4C) project received Public Affairs Asia’s Yahoo Gold Standard “Internet for Good Award”.

3. Wireless Women for Entrepreneurship and Empowerment (W2E2)

Program launched in 2014 in three locations (Chanderi, Tura and Angara) to use the Internet for gender inclusion, to promote Internet-based social enterprises among women, and foster women-led businesses become sustainable.

Technology

DEF India uses line-of-sight wireless technology combined with unlicensed spectrum (2.4 GHz and 5.8 GHz bands) to provide broadband connectivity. The connection speed ranges from 1/2 Mbps. The link is provided by telecom companies via cable.

Financing and Management

The Internet infrastructure has been designed and built with foundation grants. The project is not financially sustainable due to little demand for service (low-income communities). The management cost is 20 to 30 % higher than the maintenance cost. They make profit only in few locations. The foundation receives resources from public, profit and not-for-profit organizations.

Business Model and Services

Given the lack of fiber infrastructure, Defindia decided to design and build the infrastructure required to provide the last mile connection to rural communities. The organization hires
telecommunication companies (Vodafone and Airtel) to have access to the link and charge for the provision of the services. Some of the training programs are offered free of charge.

DEF India provides low cost Internet connectivity to rural communities (households, businesses, schools and hospitals), computer and civic training, and a program to foster women entrepreneurship.

Lessons Learned

Costs of technology and infrastructure. The cost of bringing broadband connection to the last mile level is four times higher than the cost of taking wireless connectivity to rural areas. Additionally, finding an appropriate location for a tower to establish a point-to-point link may be challenging due to land ownership or lack of suitability for infrastructure. In villages without a stable power supply surmounted this issue by adopting solar power to run necessary equipment.

Costs of system maintenance. It was necessary to keep in stock spare parts for every device in the network should the primary equipment be stolen or damaged. This increased significantly maintenance costs. Extra equipment has to be maintained with system backup for network restoration especially because of thunderstorms during the rainy season.

Digital literacy for network maintenance and community development. Lack of computer literacy was a serious barrier to residents benefitting from increased Internet access. Providing for digital literacy requires additional training for the community members to learn how to set up, operate and maintain the network. Sustainability can be achieved by training local community members to operate and maintain the network, and increased digital literacy can help people access information hubs for empowerment and development.

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Cape Town TV White Space

Company Name: Cape Town Trial Partners
Location: Cape Town, South Africa
Operating: 2013 to present
Technology: TV White Space
Business Model: Technology Trial

Country Context

In South Africa, one in three adults use the Internet, more than the number of people who read a newspaper daily. Of the 66 percent of South Africans without Internet access, 60 percent consider it too expensive, while 87 percent do not have a computer or an Internet connection. Even for active Internet users, 38 percent restrict the amount of information they access because the Internet is too expensive. While Internet Service Providers provide Internet connectivity the prohibitive price restricts most South Africans from accessing the Internet.\(^\text{56}\)

Project Background

In response to the low Internet connectivity in South Africa, a trial program was set up to examine whether TV White Space (TVWS) technology could be used to provide cheaper and reliable Internet connection. To help test the TVWS technology, the TV White Space project aimed to provide ten schools in Cape Town with broadband services.

The project aimed to demonstrate that TVWS technology could be used to deliver affordable broadband services without interfering with the existing TV reception, as well as increase awareness for the potential of TVWS. One of the reasons Cape Town was selected was because Cape Town has the highest broadband spectrum use in South Africa.\(^\text{57}\)

Technology

TVWS Technology: TV “White Space” refers to the unused portions of television broadcasting that are allocated for licensed use, but are not assigned to a particular licensee, or are not utilized by the licensee at all times across all geographical locations. “Available spectrum in broadcast bands


\(^{57}\) Carlson, James, et al. "Studies on the Use of Television White Spaces in South Africa: Recommendations and Learnings from the Cape Town Television White Spaces Trial."
has highly desirable propagation characteristics: signals transmitted over TVWS spectrum can travel long distances and penetrate walls and other barriers.\textsuperscript{58} As a result, TVWS technology is particularly suitable for delivering Internet access in rural and under-serviced urban areas.\textsuperscript{59}

White-space links are able to provide an alternative to the expensive cable infrastructure. “TV white spaces devices and networks will work in much the same way as conventional Wi-Fi, but because TV signals travel over longer distances and better penetrate walls and other obstacles, they require fewer access points to cover the same area.”\textsuperscript{60} Data can be sent over 13km and do not rely on a single frequency to transmit, but can hop between unused frequencies to provide consistent Internet access. Potential consumer benefits of TVWS are the availability of consumer devices with significantly improved range and availability of lower cost wireless broadband equipment. However, for TVWS to become useful, a regulatory framework must exist that will help address when devices are allowed to operate and which spectrum will be unused.\textsuperscript{61}

**Business Model and Services**

While this service provided to 10 schools in Cape Town, TVWS technology in Ghana has been able to reduce the price of Internet access from $3 USD per day to $0.60 USD. The initial costs of connecting to the Internet can prove prohibitive for low-income areas, however TVWS removes much of the initial cost for potential Internet Service Providers.

The trial was able to produce Internet speeds of up to 12mbps at a distance as far as 6.5km.\textsuperscript{62}

**Financing and Management**

This project was financed by Google, in conjunction with the Independent Communications Authority of South Africa (ICASA), as part of their larger effort to demonstrate that broadband

\textsuperscript{58} Carlson, James, et al. “Studies on the Use of Television White Spaces in South Africa: Recommendations and Learnings from the Cape Town Television White Spaces Trial.”
\textsuperscript{59} Carlson, James, et al. “Studies on the Use of Television White Spaces in South Africa: Recommendations and Learnings from the Cape Town Television White Spaces Trial.”
\textsuperscript{62} Carlson, James, et al. "Studies on the Use of Television White Spaces in South Africa: Recommendations and Learnings from the Cape Town Television White Spaces Trial."
can be used over TVWS, without interfering with the current spectrum, while offering an affordable means of accessing broadband. TENET, a partner in the trial and a South African business who is committed is to securing the Internet for South African universities, currently manages the network.63

Lessons Learned

The purpose of the trial was to examine the technical issues of TVWS on the existing TV broadcast and show the relevant stakeholders in South Africa that TVWS technology will not interfere with the existing services.

*TV white space technology has a minimal effect on existing services.* The trial found that there was no reported interference with any licensed services and found the existing regulation was effective in providing an unused spectrum to facilitate the TVWS technology. Both Google and Microsoft have been expanding the footprint of TVWS, having conducted similar trials in Kenya, the Philippines, England, and the United States, all with positive results. The main barrier in South Africa, and other TVWS trials, is not the technology but the developing regulation and policy that will support the implementation of TVWS.

*Increased Internet access in schools increased effectiveness of teachers.* As a result of the broadband provided to the ten schools in Cape Town, teachers were able to use videos in their lesson plans, make Skype calls to other schools, update school websites, and send regular email updates to parents. Students could use educational videos for research. Because the service was better and faster, teachers and learners used the web to enrich the classroom experience.64

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63 Sibanda, Fortune. "Trial in Cape Town shows that TV White Spaces can deliver broadband access without interference." Google Africa Blog, November 2013.

64 Sibanda, Fortune. "Trial in Cape Town shows that TV White Spaces can deliver broadband access without interference."
Project Isizwe

**Company Name:** Project Isizwe

**Location:** Tshwane region, South Africa

**Operating:** 2013 to present

**Technology:** Public Wi-Fi and hotspots

**Business Model:** Non-profit organization/Public-private partnership

Project Isizwe is a Free Wi-Fi project for low-income populations that has been implemented in the Tshwane region in South Africa. The key asset of the project is the public-private partnership Isizwe’s management was able to build. They advocate for a consideration of Free Wi-Fi as a basic service like water and electricity.

**Country Context**

The digital divide is a major issue in South Africa. About 65% of the population do not have any Internet Access. Disparities are also stark across the country. In Western Cape, 62.1% of the population has access to the Internet. At the other end of the spectrum in Eastern Cape, only 37.4% of the population has access to the Internet. However, access to the Internet does not mean access to the Internet at home. In South Africa, most people access the Internet using mobile devices. “South Africa has notoriously high data rates, with costs ranging from $0.01 to $0.02 per megabyte,” which is unaffordable for most people in low-income areas.

**Project Background**

Project Isizwe is a non-profit organization which aims to bring the Internet to people in the poorest parts of the country, by facilitating the deployment of public Wi-Fi in low income communities.

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67 VentureBurn. “Project Isizwe: Africa’s free Wi-Fi solution giving mobile greater reach”. February 2014
Its goal is to “harness the power of the Internet in low-income communities for the purpose of education, and use it as a catalyst for change”\textsuperscript{68}. Isizwe helps governments operate and maintain Free Wi-Fi network. The pilot of the project was launched in the Municipality of Tshwane near Pretoria. People access the service with a 250mp/day cap.

**Technology**

The project relies on Wi-Fi technology. A wireless router receives the signal from the physical Internet infrastructure, decodes it and translates it into a radio signal. Then, the signal is routed to Wi-Fi hotspots installed in certain area that beam out the signal.

**Business Model and Services**

Project Isizwe is a partnership between service providers the municipality and Isizwe.

- **Municipalities** pay Isizwe to roll out the networks and provide support a few years after completion. They also pay a bulk rate for data transferred (Rd 19cts/Gb). Service providers are also involved in the project. Isizwe justifies the expenditures as follows: The World Bank estimates that for every 10% growth in broadband penetration there is a 1.28% multiplier for GDP. In other words, assuming national tax rates of 50%, as long as the deployment of public Free WiFi is no more than 0.64% of a municipality’s annual budget, the net rates & taxes from increased economic growth will fund all infrastructure and help recoup municipalities’ costs

- The project also involves service providers such as Rickus Wireless, Neotel and Hero Telecom that provide additional bandwidth at discounted rates, the hardware, installation, support and maintenance for all free Internet zones at costs that wouldn’t be possible in a regular commercial agreement

- **Isizwe** then operates the structure on a daily basis. Their non-profit structure allows for, cooperation of local and provincial governments without traditional mark-ups, which is key for their business model and the public/private partnership

Today Project Isizwe has more than 750 active sites and connects over 800,000 people, at schools, community centers or parks. On average, approximately 20,000 people access the network every day. The Free Wi-Fi system also includes « on-net » content such as Siyavula, technology-powered learning and teaching content or VOD services as well as unlimited access to educational and job searching content.

\textsuperscript{68} First-Step. “Project Isizwe Connects People for Education and Social Inclusion”. Firststep.me. https://www.firststep.me/get-educated/845-project-isizwe (Accessed March 11th)
Financing and Management

The project was self-funded in its early days with over $65,000 invested by the management up to 2014. Phase 3 of the project was launched in May 2015. It comprises 400 new sites and capacity for 2 million users at a total cost of R100 million ($9 million). In addition, over 120 jobs have been created since the launch of the project.

Lessons Learned

Service being offered must be unique and cost effective. In 2013, Isizwe was unique for Tshwane as no municipality offered public space free Wi-Fi. Today this situation remains the same and no other municipalities offers free Wi-Fi in low-income communities.

A public Wi-Fi network cannot be sold to users. To date, there has not been a proven model of a public Wi-Fi network that charges people for use. Relying on innovative funding mechanisms that allow for the provision of free public Wi-Fi was an accomplishment of Isizwe.
Skyband

Company Name: SkyBand (Formerly, Africa-Online)

Location: Malawi

Operating: 2000 - Present

Technology: Fiber to radio towers and wireless projection to home

Business Model: Fully sustainable subscription model

Skyband is the leading Internet service provider in Malawi. The company was not founded to solve any unique social issues; however, is an example of a company that has grown amidst competition to be the leading service provider nationally. The company was originally founded because the traditional copper networks were often busy and frequently broke down. Fiber-line was limited to areas where economic activity was already in existence. For reasons to be discussed later in the case, Skyband found that a wireless network would best solve the conditions they were faced with. Today, Skyband offers multiple packages for businesses and consumers.

Country Context

Malawi is one of the least developed nations in Africa by GDP and as of 2000, less than 0.13% of individuals in Malawi were using the Internet. In a country of 16.3 million people today, less than 5% of individuals regularly use the Internet.

Project Background

Malawi was a traditionally underserved country where access was limited to economic centers and there were virtually no last mile connections. Due to the relatively low investments in equipment

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necessary for wireless provision, in 2001 Skyband felt that to serve the broadest population, a wireless connection would be the most financially sustainable in the long run.

**Technology**

In determining the technology used by the company, Skyband attempted to address the largest preconditions that had inhibited growth. From the outset, they created a mechanism that would provide profitability in terms of the technology but also in terms of where the service would be available. Skyband provides a wireless infrastructure where the bandwidth goes from a satellite to customers through Skyband’s wireless network.

![Network Setup Diagram](image)

**Business Model and Services**

In 2000, Skyband focused on the economic centers of Blantyre and Lilongwe. They wanted to see a profit before committing to rural and last mile connections. The CEO Paul Shaw notes that making minimum investment will maximize return in the long run. He says “It is not practical to create an infrastructure and then wait for clients to line up to use it. Allow years for the learning curve to kick in.”

To begin with, Skyband noted that over 70% of its clients were commercial from corporate and banking sectors. They started providing e-mail connectivity, and research capability with some web hosting opportunities as well. Simultaneously, they offered products to residential customers that included discounted rates at night.

The high cost relative to income of subscribing to Internet in Africa meant that Internet service providers were often sharing a small number of subscribers with relatively low profitability. To

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increase their own income, Skyband approached the market with multiple product offering to suit all types of consumers. The following is a brief overview of a few of their current offerings.\footnote{The Wireless Institute. “The Wireless Internet Opportunity for Developing Countries.” World Summit on Information Society in Geneva, 2003.}

In addition to multiple product offerings, there is a variety of price availability. For residential subscribers, there is the option of EVO contract, a capped service with a 12 month contract from $14/month for 5GB. EVO PAYG provides connectivity up to 4Mbps through a pay-as-you go mechanism from as low as $16/month for 5GB. The nightrider package offers unlimited/uncapped data between 6pm and 7am on weekdays and all weekend long with speeds up to 2Mbps from $50/month for 10GBs.

**Financing and Management**

Skyband began with an initial shareholder investment of $100,000 which was used for capital investments as well as early maintenance costs done in-house. As of today, they are fully sustainable under their subscription model.

**Lessons Learned**

Skyband faced slow growth at the beginning and have spent over 15 years cultivating their market. One of the key takeaways is that an organization who simply installs the technology and serves as the provider is insufficient for long-term sustainability; in order to ensure growth, it is important not only to reserve resources for training customers how to use the technology but also to showcase the benefit of the ISP over the countless others in the market.
Rhizomatica

Company Name: Rhizomatica

Location: Various communities, Mexico

Operating: 2013 to present

Technology: Dial-up signal & open source networks

Business Model: Non-profit organization

The Rhizomatica project aims to create the first community-owned and operated GSM (cell phone) network in the world in the State of Oaxaca, Mexico.

Country Context

Telmex is the leading telecom operator in the Mexico. This near-monopoly was acquired by Carlos Slim to the State in late 1980s. Ever since this acquisition, “Mexicans have paid first world rates for third world service—first for landlines, and now for cell service and Internet access”73. Because of the lack of access and high prices only 65 percent of Mexicans were using cell phones in 201574.

Project Background

The following focuses on the small town of San Juan Yee, Oaxaca, where the first pilot of the project was launched.

The cell phone equipment rate of San Juan Yee is not as low as one would think. However, what is more surprising is people using them principally as cameras or mp3 players. No base stations and therefore no network is available in the area so cell phones are almost useless. People need to hike for hours to get to hill tops to receive a signal from a faraway base station.

74 Statista. “Mobile Phone User Penetration in Mexico from 2012 to 2018”. 2016
The absence of network comes from service providers being reluctant to invest in the area to build infrastructure. The population (500 residents) in San Juan Yee is too low to ensure sustainable profits and a quick return on investment. Some countries get around that economic reality by legally requiring telecom companies to build networks in rural areas, no matter how many people end up paying for a contract. Mexico doesn’t have any such laws which makes the situation worse.

Bloom, the founder of Rhizomatica, was working on mesh networks in Nigeria before starting this project. Mesh networks were frequently collapsing in Nigeria because the traffic was too heavy, so he opted for another technology to bring cell phone networks to communities.

**Technology**

The technology of the project is made of two components

- Stations with radio towers: the analog signal is translated into a digital signal and then conveyed through radio towers installed across the community.

- Stations are equipped with open source software (dubbed Open BSC, referring to the base station controllers that coordinate traffic on a cell network). With this open source software, standards are said to be open. Open standards are important as they lay the groundwork for user-driven innovation to occur. Standards are what lets users plug in devices that use the same protocols into one private network. Here, standards can be easily modified and any devices can be connected to the network as all components, codes and schematics are public.

**Business Model and Services**

The service has two pre-requisites

1. Rhizomatica requires an agreement at the community level to have the infrastructure built.

2. The service needs an Internet connection for long-distance calls

The service allows community members to make local calls within the network or with neighboring Rhizomatica networks. It also allows them to call abroad as long as the community has an Internet connection point. Rhizomatica received a concession from the Mexican government to get access to cellular spectrum.

The business model is a pay-per-use business model. Community members pay a $2 monthly fee for local calls and texts. They can also pay $0.20/minute for long-distance calls (to the US). A similar call from one of the town’s public landlines runs about $1 per minute.
Financing and Management

The community pays 120,000 pesos ($8,000) upfront for the equipment and installation (that Rhizomatica purchases from partners), which is about one-sixth of what the commercial provider Movistar charges for a similar rural installation. Ninety-thousand of the pesos go to buy the hardware, and the rest covers Rhizomatica’s time and expenses. Rhizomatica is also in charge of maintaining the infrastructure, although its management tries to train locals as much as possible so they are autonomous.

Lessons Learned

*Transparency in pricing.* People in community are attracted by the idea of having complete control over their infrastructure as it leaves room for more transparency on prices.

*Environmental barriers to service provision.* Weather conditions turned out to be an unforeseen hurdle to the stability of the network, and were not considered in the planning phases, leading to degraded service.
Guifinet

**Company Name:** Guifinet

**Location:** Founded in Spain. Provides service in a few countries

**Operating:** 2008 to present

**Technology:** Fiber and unlicensed frequency

**Business Model:** Non-profit association

**Project Background**

Guifinet Foundation is a not-for-profit organization founded in 2008 and registered as a telecommunication provider, whose purpose is to develop an open, free and neutral telecommunication network – no restrictions on content and technology - and to function as a platform of collaboration and innovation by developing network management applications, Web applications, multimedia applications, and map servers.

In 2011, Guifinet connected to the Catalonia Neutral Internet Exchange Point - CNIIEP, a link of 10 Gbps developed by a joint venture initiative of the Catalan Government and Localret (association of Catalonia’s city governments). Prices charged by CNIIEP are as follows: 75

<table>
<thead>
<tr>
<th>Connection fee</th>
<th>€ 1,954.60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly quota of operation and maintenance 100 Mbps</td>
<td>€ 288.70</td>
</tr>
<tr>
<td>Monthly quota of operation and maintenance 1 Gbps</td>
<td>€ 300.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monthly quota of operation and maintenance 10 Gbps</th>
<th>€ 867.78</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly quota of Telvent extension</td>
<td>€ 50.00</td>
</tr>
<tr>
<td>VLAN activation quota</td>
<td>€ 118.88</td>
</tr>
<tr>
<td>Monthly quota per rac unit</td>
<td>€ 34.09</td>
</tr>
</tbody>
</table>

**Technology**

Guifinet has developed a mesh network that uses fiber optics and unlicensed radio frequency (2.4 and 5.1 Ghz bands) to provide access to high speed Internet connectivity (1 Gbps and 10 Gbps) at a low price. The business model is based on management infrastructure as a commons, in which anyone can invest in the infrastructure deployment and become a user. The network is extended through donations and setup of nodes and areas.

*How to join Guifinet – “Do it yourself”*

Steps:

- add a node (a location), through Guifinet website,
- add a router in your node, through the website
- make a link between your router and an access point (super node) near your node

If there is no super node nearby, it is necessary to coordinate with the people in the area to build one or ask Guifinet for assistance.

**Business Model and Services**

Guifi.net provide free communication with other users, and free basic Internet connections such as email, social media, and chats. Hiring an Internet provider is required to have full Internet connectivity. Shared Internet connection is the major advantage of this system.

Costs for users include: Equipment acquisition, installation and maintenance. Cost is variable, depending on the equipment and how the maintenance is done (by the community model or a service provider). There is no cost for the use of the network itself.
Guifinet today

- 30,528 working nodes
- 33,952 links
- 55,635.4 total kilometers of links

**Financing and Management**

Guifi.net employs a collaborative model in which individuals, companies, and private and public organizations invest to build infrastructure and offer grants and spaces to build super nodes. The foundation also has an extensive web of volunteers and uses crowdfunding campaigns.

There is a board of directors composed of 5 to 9 members nominated for an indefinite period of time, chosen among individuals and entities that have a renowned history of activism and promotion of the values and purposes of the foundation. In order to foster diversity, members should reside in three different cities, at least one member of the board must reside outside Osona, as well as be a teacher or a professional of telecommunications technology or information technology, and there must be a five-year age gap from the youngest to the oldest member. The members of the board serve without compensation.

The board of directors appoints an executive director that shall receive a compensation for serving. The board can create commissions to provide strategic advice. By-laws available at [http://fundacio.guifi.net/data/_uploaded/file/20140929_estatuts_fundacio_guifi_net.pdf](http://fundacio.guifi.net/data/_uploaded/file/20140929_estatuts_fundacio_guifi_net.pdf).

**Lessons Learned**

*Maximizing the wireless network through the customer base.* The Guifinet network is built on the number of users, who promote and invest in the infrastructure. Guifinet attracts new users through its free coverage and low hardware costs. This approach allows Guifinet to keep their costs down while expanding their network.
AlterMundi

Company Name: AlterMundi
Location: Argentina
Operating: 2011 to present
Technology: Wireless (Mesh) Network
Business Model: Non-governmental organization/community collective

“The charter for the NGO clearly states that the main objective is to facilitate this new paradigm based on peer-to-peer collaboration as opposed to concentration and control. ... We do for ourselves a lot of what, in North America or Europe, you would just purchase as commercial solutions.” – AlterMundi Founder Nicolás Echániz

Country Context

Argentina is a country that has extensive Internet access in urban areas, with a saturation of Internet service providers, and various government initiatives to create a connected country. One such government initiative – Argentina Connected – is attempting to create a fiber network throughout the country. But as of 2013 there was little or limited access to Internet in very small towns, and no Internet service providers in towns with less than 1000 people.\textsuperscript{76} Additionally, costs for Internet are much higher in rural areas: in Buenos Aires in 2013, a 1 Mbps connection would cost a minimum of $50 for the link, while in a rural areas, it might cost $200.\textsuperscript{77} Due to the lack of Internet service provision and high costs, the founder of AlterMundi decided to bring a “free network” to


\textsuperscript{77} Cook Network Consultance, 126.
the small town of Quintana, Córdoba Province, to provide a community-managed Internet network to residents.

**Project Background**

AlterMundi grew out of the work of Buenos Aires Libre, a free network operating in the Argentinian capital. One of the founders of AlterMundi had been a member of Buenos Aires Libre, but had expressed concerned over the insularity of the network; essentially, you had to be well-versed the technology in order to participate in the network. The founder envisioned a free network that was accessible to non-technical people, based on peer-to-peer collaboration and community organization, rather than typical concentration and control models that characterize most commercial Internet service. This model was inspired by other free networks operating around the world, including the pioneering model of Guifi.net in Spain.

This model, as it was applied in Quintana, entails that individuals would learn about and work to install the requisite technology, and would constitute a point-to-multipoint network, or mesh network. This solution wouldn’t rely on a commercial Internet service provider to deliver services and technology, but would mobilize around existing community resources to create a “free” network. In addition, the network would focus on supporting community content and services that would be accessible via Internet. The founder chose to implement the project in the small town of Quintana, outside of Córdoba, Argentina. Previously, there was little to no Internet access in the small town.

**Technology**

The AlterMundi project creates a multi-node radio network. The community originally connected to a 40 Mbps stable link in a nearby town 16 kilometers away via radio. A local town member allowed AlterMundi to use the chimney of a smoke house as a radio tower, from which the connection is broadcast in the direction of Quintana. In the village, individuals who participate in the community network (in 2013, about 30 homes) install radio routers, which both receive and broadcast signal to other radio routers in the network.

The routers that are installed in roofs are manually modified off-the-shelf routers. Individuals who wish to join the network receive training from AlterMundi on how to manually modify these routers to support Power over Ethernet by soldering cables in the router, so that a single Ethernet cable can carry both the power source and the data between the router and the computer. Since a typical setup requires multiple wires and because Power-over-Ethernet routers are expensive to buy pre-made, this method both reduces the complexity of the setup of the network, while keeping

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78 AlterMundi, “Institucional,” <http://www.altermundi.net/>
costs down. AlterMundi also offers assistance to mount antennae and nodes at each participating home.

The organization had been looking at connecting to a fiber link in a town 20km away. In order to meet costs, the organization estimated it would need to connect 50 home in total in order to purchase 20 Mbps of fiber link. Eventually, the organization entered into a partnership with the National University of Córdoba, which provides a link via a series of point-to-point solar powered transmitters, to reach the rural locations in Quintana and the surrounding valley. The University’s data center also hosts the principal server for AlterMundi.

**Business Model and Services**

The current cost of this method is about $100 per node (in 2013) for the radio router antenna installation, which AlterMundi cites as not particularly cheap but the minimum cost for building a network that performs satisfactorily.\(^{79}\) Additionally, the users must also cover the cost of the link. The network is run at cost, and is not a profit-generating enterprise.

The business model of AlterMundi emphasizes training of community members with low technical knowledge to install, modify, and maintain the required technology. Initial training is provided by AlterMundi staff, who also assist in the node installation. The principle behind this model is that of a “geek-free” network, that could be set up and installed by anyone with basic mechanical skills. Towards this goal, AlterMundi also provides open documentation on their website on how to implement similar networks. They also provide the open software that automatically configures routers on a network. So far, AlterMundi style networks have been implemented in various sites across the world, under the auspices of LibreMesh and LibreMap.\(^{80}\)

Finally, AlterMundi provides some services on top of Internet access to build community networks and participation. The primary tool they use in Quintana is a captive portal, which is a website that users see when they first log on to the web. This site serves as the village information website, including a map, streaming service for local community radio, information about the NGO and the schedule for workshops and cultural events. To combat the problem of low cell phone service, increased Internet access allowed the community to have an extensive Voice over Internet Protocol (VoIP) service, where community members can communicate over Internet-based phone services.

**Financing and Management**

The organization AlterMundi was incorporated as an NGO in 2011, and is run as a community collective. As a community network, the installation of nodes is financed by each of the participants. The community came together to finance the equipment and installation of the link, and covers the cost of operations.

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\(^{79}\) Cook Network Consultants, 126.

\(^{80}\) LibreMap, <http://libremap.net/>
The organization notes that this method of community financing and collective effort was made possible by high demand from the community for Internet service, based on the availability of laptop computers from a government program. The community, which had laptops but no reliable Internet, came together to finance the project.

The AlterMundi staff work with individuals who want to install nodes. These individuals or families receive training on modifying the appropriate Internet equipment, and on installing the equipment. Periodically, AlterMundi staff hold workshops for both the technical and the communitarian aspects of the network. For example, in November 2015, AlterMundi convened a community workshop meeting to discuss doubts, problems, and solutions that could be achieved through the use of the community network.81

In 2015, AlterMundi was awarded small grants for expanding their model, including from the Shuttleworth Foundation.

Lessons Learned

Using small towns and communities. One of the principal lessons from the AlterMundi case was the importance of implementing projects in small town and areas. The founder of the organization cautions prospective community network founders from attempting to start a free network inside a big city such as Buenos Aires, citing too many entrenched interests and existing entities that will resist any disruption to the market. The founder states, “In small places, you can design your own solution and make sure it’s fully compatible with local desires.”82

Leveraging existing technology and devices. Another key takeaway from the Altermundi experience was the advantageousness of having readily accessible devices, such as laptops, in communities. Due to a government program that distributed laptop computers to children enrolled in schools, most houses had a device to access the Internet. This meant that Internet access was in demand, and when it was brought to the community, homes were ready to get online and access the content that AlterMundi supplied via the captive portal. According to the founder: “With these laptops already spread, it become possible to go into and organize a small town to join forces and buy the equipment together that is necessary for basic voice service and basic Internet. We look for viable links, do the links and pay for the needed equipment as a collective. This program, these procedures are perfectly applicable to every small town in all of Argentina.”83

82 Cook Network Consultants, 128.
83 Cook Network Consultants, 129.
Appendix A.

Options for Network Cables

The following chart compares three predominant types of cables used to connect to Internet backbone: Ethernet, coaxial (copper), and fiber optic.

*Figure 1. Coaxial (copper) cable compared with fiber optic and Ethernet*

<table>
<thead>
<tr>
<th></th>
<th>CAT-5e (Ethernet)</th>
<th>Coaxial</th>
<th>Fiber Optic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speed</strong></td>
<td>Up to 1 Gbit/s</td>
<td>Up to 10 Gbit/s</td>
<td>Up to 40 Gbit/s</td>
</tr>
<tr>
<td><strong>Major Advantages</strong></td>
<td>Industry standard; widely available and inexpensive. Used on most consumer networking equipment.</td>
<td>Shielded from electrical interference, allowing longer-range transmission.</td>
<td>High bandwidth, immune to noise and interference. Smaller cable diameter. Less signal loss.</td>
</tr>
<tr>
<td><strong>Major Disadvantages</strong></td>
<td>Susceptible to noise and interference. High data loss over relatively short distances.</td>
<td>Less common for networking equipment. More expensive to install and operate than Ethernet.</td>
<td>Cabling and electronics are much more expensive. Confusing standards, less consumer adoption.</td>
</tr>
</tbody>
</table>


Underground Infrastructure: Copper vs Fiber

Copper wires, also known as coaxial cables or “coax”, are highly conductive and use the movement of electrons to carry signals/waves. There are two types of signals: analog that has a frequency and a wavelength, and digital, that is encoded as 0s or 1s. A modem (modulator-demodulator) converts the analog to the digital so a machine can read it. This is how vocal waves can, for example, be read by a computer.
Copper can only carry a limited number of waves, limiting its data capacity, and it suffers from signal-loss issues over long distances. While copper can work for local networks, it is not well-suited for global communication infrastructure, considering that they these cables can lose 94 percent of their signal over a 100-meter distance. The two main advantages of copper are that, in many places, copper is already deployed in homes and businesses, as telephone and TV cables, and it is relatively cheap to deploy.

Many large service providers are migrating their original copper networks to fiber optic networks, due to large gains in speed available from fiber, as well as lower maintenance costs from increased durability. Since fiber optic cables use light rather than electricity to carry signals, data loss is minimal: 3% over a 100-meter distance. These cables also protect the signal from electromagnetic and radio interference. Fiber optic technology has also been called “future proof” since most upgrading is done by changing the electronic light pulse, rather than replacing the cable itself.

*Figure 2. Coaxial (copper) cable and fiber optic cable compared*

Fiber Optic Network Cables

Fiber Types
Fiber optic network cables come in a variety of types, with two major technologies and a host of different connectors and transceivers. Generally, single-mode fibers are used for long-distance transmission, and multi-mode fibers are used for shorter ranges.

**Single-Mode:** Single-mode cables have a narrow diameter, which contains the beam of light in a much tighter space. This allows for longer-distance communication, sometimes as far as between continents. If the distance to be covered is more than 3-5 miles, single mode fiber is typically chosen. Transmission systems designed for use with this fiber will typically cost more than $1000 (due to the increased cost of the laser diode).

Single-mode fiber is not generally used for in premise installations, rather “fiber to the home” is typically sent through an optical splitter cable, which splits the signal into a fixed number of fibers. Single-mode fiber, according to consultations with experts in the Columbia University Computer Science Department, however is generally the only in-practice fiber used for the backbone of a fiber network.

**Multi-Mode:** Multi-mode fiber optic cables have a wider central diameter, allowing more space to generate and collect light. This allows for cheaper, less precise electronics, making the cost of multi-mode cables and equipment much lower. Typical speeds for multi-mode fiber are up to 10 Gbps. At this speed, cables can be run up to 550 meters, shorter distances than single-mode fiber. Some sources report that multi-mode fiber can be brought all the way to the end-user; such connections offer the highest available bandwidth and are useful for high-throughput applications. If the distance to be covered is less than a couple of miles, multimode fiber will work well and transmission system costs (transmitter and receiver) will be in the $500 to $800 range.

There are very few in-practice examples of multi-mode fiber used for communications purposes, however, as it is generally used only in much smaller machinery like endoscopes.

Cable Design
Beyond the fiber itself, the design of the cable takes into account considerations such as tensile strength, ruggedness, durability, flexibility, size, resistance to the environment, flammability, temperature range and appearance. Fiber cables are constructed using a variety of different designs used to protect and shield the fiber core.
The two principal designs are loose and tight buffers. Each construction has inherent advantages. The loose buffer tube offers lower cable attenuation from microbending in any given fiber, plus a high level of isolation from external forces. Under continuous mechanical stress, the loose tube permits more stable transmission characteristics. The tight buffer construction permits smaller, lighter weight designs for similar fiber configuration, and generally yields a more flexible, crush resistant cable.

For installation of a cable, mechanical properties such as tensile strength, impact resistance, flexing, and bending are important. Environmental requirements concern the resistance to moisture, chemicals, and other types of atmospheric or in-ground conditions. Cable design will factor into the pricing of different types of fiber optic cable.

Top Fiber Providers in Brazil

1. Prysmian Group
2. SEI - Sumitomo Electric Industries http://www.seibrazil.com.br/
3. Cablena http://www.cablena.com.br
   Local distributor: http://www.lemostelecom.com.br/
5. Integra optics http://integraroptics.com/cms/

Additional Resources

Physical characteristics of Fiber

Cable Type Comparisons

Resources on Fiber in Portuguese
- TelComp, Fiber Regulation Report.
- Cablena, Guia de Fibras Ópticas Cabos Ópticos
References

Case 1: AlterMundi


Case 2: Cape Town TV White Spaces


Sibanda, Fortune. "Trial in Cape Town shows that TV White Spaces can deliver broadband access without interference." Google Africa Blog, November 2013.


Case 3: Digital Empower Foundation


Case 4: Guifinet


Case 5: Mesh Sayada


**Case 6: Project Isizwe**


VentureBurn. “Project Isizwe: Africa’s free Wi-Fi solution giving mobile greater reach”. February 2014


**Case 7: Rhizomatica**


Statista. “Mobile Phone User Penetration in Mexico from 2012 to 2018”. 2016


**Case 8: SandyNet**


Internet-service-competition-lacking/.


For additional information on the technology employed by SandyNet, see Technicians’s blog: http://gregorybrewster.com/?p=232


City of Sandy, Official Website http://www.ci.sandy.or.us/History-of-SandyNet/

Case 9: Skyband


Case 10: ZittNet


Dadamac, Zittnet - Rural Connectivity at Fantsuam http://www.dadamac.net/initiative/zittnet-rural-connectivity-fantsuam
