

Bringing Wireless Broadband to Remote Areas

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Abstract: The term *digital divide* describes how the lack of digital infrastructures divides rural territories from well-served areas; it is still the core of the debate on ICT investments as solutions for socio-economic growth and as a condition for technology transfer and development. Many factors such as cost of infrastructures, low population density and classical business models make up the barriers constituting this problem. In this paper, we describe how an innovative business and social approach – working on the local territory together with local administrations – makes it possible to solve many issues thus giving a new digital life to rural areas. The result is a model suitable for rural regions and NMSs in Europe and the Mediterranean area, where the system proposed – Wikitel WDSL – is just one technical solution but the structured and inclusive approach, oriented to users and local stakeholders, is a guarantee for transferability.

1. Introduction

Access to the information economy in remote areas is notoriously difficult. A gap in technology is a lack of the opportunities offered by information and communication technologies (ICTs), especially when they are unevenly distributed among citizens. The term “digital divide” is an implicit push to bridge this gap, with the most frequent approach focused on technology *tout court*: provide more computers and mobile phones.

The debate on the digital divide also brings up the question of whether large investments in ICT can automatically lead to better living conditions, including those still in a state of poverty, or whether instead this kind of technology needs a developed socio-economic context to have an impact. Here it is not possible to answer, though certainly there is not a strong dependency between opposite positions. The limit of the problem is known and is part of the contradictory process: ICT can have a significant positive impact as an instrument of sustainable development, but without considerable investments it is very difficult to imagine how growth and socio-economic development can be achieved [1]. The need to make information more accessible and provide services via digital means is also well represented at the political and social level. If the Internet is to be the big solution for the problem of marginality, this must be considered in all of its aspects:

- Geographical marginality, which can be solved through digital infrastructures.
- Economical marginality, i.e. how rural areas evolve in terms of their social and economical models.
- Social marginality, which represents the difference in opportunity for interaction between persons in rural or well-served areas.

The most appropriate strategy for local actors is thus a tailored, structured and inclusive approach involving multi-stakeholder partnerships for bridging the digital divide. Only an

integrated, multidisciplinary system of players can take the actions required to embed technological convergence (devices, infrastructures, ICT solutions) within the socio-economic environment. Such a model can take due account of the above-mentioned debate – ICT investments before socio-economic development or vice-versa – while keeping in mind the main objective: supporting marginalized areas to lift them out of the gap [2].

In this context, Sicily can be considered as a relevant case study due to the mixture of cultures and economies within which the digital divide occurs. Sicily is the largest region in Italy, with a morphology that varies from the sandy and rocky coasts to the internal mountainous areas (including Etna, the still-active volcano) or the very extensive wheat fields and vineyards. Together with this variety of landscape are the numerous municipalities with different and specific individual situations from the morphological point of view. Many characteristics are shared with rural regions in particular in the southern New Member States (NMSs) and the Mediterranean area: social and economic division, marginality, poor-rich antithesis in terms of areas and individuals.

This opens up the double challenge of offering the same “digital opportunities” other regions have in terms of connectivity:

- To be “always on” for day-to-day activities;
- To gain “proximity status” (with respect to well-served municipalities or areas) independently of geographic, economic and social conditions.

In this situation CRES (Centro per la Ricerca Elettronica in Sicilia), a public-equivalent Sicilian ICT Research Centre in electronics and microelectronics, has defined its challenge as “bringing Wireless Broadband to Remote Areas, especially those ignored by the big Internet Service Providers”

2. Objectives

The aim of this paper is to describe an integrated social approach to addressing the digital divide, using our experience in Sicily as a case study. The initial strategy and actions carried out have the objective of realizing a value added service for the benefit of our region: local municipalities, SMEs and citizens. According to the model of deep co-operation with all the actors potentially affected, together with the technical experience and consequent results, one of the most significant achievements that will be illustrated is the path followed to transform “practice” into a “good practice”.

By discussing our concrete experience in the field, we hope to share insights that can be of use to other technology providers and regional development actors working in remote and disadvantaged areas. More than discuss the technological aspects concerning the proposed system (Wikitel [1] WDSL), the objective is to give rural regions, in particular those of New Member States and the Mediterranean basin, a workable and sustainable business model where innovative solutions are adopted not exclusively on the basis of technical features but following rather a process through which the community’s needs are expressed and addressed.

3. Methodology

Thanks to the FP6-IST program, CRES has taken part in the ANEMONE [2] project, which realized a “large-scale testbed providing support of mobile users and devices and enhanced services by integrating cutting edge IPv6 mobility and multihoming initiatives together with the majority of current and future wireless access technologies”. During the project’s lifespan (the project ends in October 2008) CRES decided to take a proactive role in transforming a research experience into a market reality, giving opportunities to local actors to be part of a good “territorial” practice. Teleinform, a very small company controlled by CRES, was transformed into a registered Internet Service Provider and restructured as a

commercial company to sell basic and added value products under the unique registered brand Wikitel.

Teleinform's mission thus became to bring wireless broadband to those areas that the large providers consider unprofitable from the standpoint of a traditional cost/benefit business model. The strategy builds on CRES's public role to work "in the field" together with the local municipalities so that connectivity becomes a tool, a service enabler, and not the end goal of the business model. In the end the Wikitel Internet product is seen as a small piece of a more complex puzzle.

This approach has determined the tuning of a fully user-driven model. The specifics of this model vary according to the different characteristics of the rural areas and their marginality, but the same systematic approach is applied in each case:

- Creating synergies between local government and citizens
- Making the right connections with the local environment
- Finding the necessary balance between socio-economical and technical issues and solutions
- Deploying a multi-disciplinary team with a broad range of competencies, mixing ICT expertise with experience in rural development and technology transfer for SMMEs (Small, Medium and Micro Enterprises).

At this point, the natural but not always obvious step is to find a structured and inclusive solution for areas where traditional market conditions fail. Here, the term "solution" does not indicate a technical one like Wikitel, but must rather capitalise on the experience and results of managing business and rural development together with technicians, local administrators, citizens and micro firms.

The local municipal government is normally selected as the first client to acquire connectivity and/or added value services, who can then spark off a chain reaction progressively involving SMEs and citizens. In the digital divide areas addressed, most municipalities lack an internal system administration service or other IT management facilities. The innovative approach that ensues, compared to the typical strategy of telecom monopolies, consists in a vertical service offer which spans from the pure connectivity and/or LAN infrastructure, to the more complex services (e.g. VPN, Virtual Private Networks) that connect different offices of the Public Administration under the same administrative domain, remotely control firewall and Internet access policies, and so forth.

The total cost of ownership for the municipality is reduced, thanks to the fact that a) some infrastructures can be reused, and b) the overhead due to operational and logistic issues (e.g. the technician is already on site for other tasks) can be dramatically reduced; this last point is of particular importance in the more remote and marginalized areas. This creates an opportunity for CRES/Teleinform to enrich its platform offer with the associated professional services, considering to some degree the entire remote community as part of its customer portfolio. The initial investment with the municipal government can thus be seen in a medium to long-term perspective.

The methodology used to involve local governments has followed two approaches:

1. A "door to door" marketing campaign covering the Sicilian region, contacting the technical office/staff of the Mayors;
2. Participation in a public tender to carry out a connectivity project granted by regional funds for local e-governement (Agenda 2000, POR 2000-2006, measure 6.05 [3]).

In addition to our focus on the municipal governments, there are other "privileged filters" for the local community such as the Areas for Industrial Development, whose aim is to accelerate the growth of local SMEs via special areas; they thus require broadband as part of the infrastructure facilities they offer for businesses.

In any event, initial contacts and the successive partnerships with local governments and agencies are just the starting point of a more systematic approach to involve other

actors. Municipalities, more than “official” service points especially in rural or small areas, are considered as the natural hubs that concentrate and deliver “solutions” to those citizens who rise to the role of technology users. This hub function follows from a positive sense of responsibility in local administrators, but although it can suggest a way to the local population, it is unable to make contact with the specific needs of people. The “why is my computer not connecting” or “how can I save money using the Internet” remain *technician to citizen* problems. So in the end, the direct involvement of users, citizens and business owners is the key to the success of technology transfer in digital divide contexts. The approach proposed carries with it a social and economic impact as well, starting from the local municipality or agency and ultimately involving all the actors in the territory in an integrated process of technology upgrading and local development. In fact, the requirement for the multi-disciplinary team mentioned above derives from the need for a comprehensive knowledge of the area concerned, from both the social and technical points of view.

3.1 Business Case Description

In this section we describe our protocol for involving municipalities and then users, within the general approach described above. The concrete examples based on field experiences in five cases offer important insights supporting our conclusions and recommendations.

Following a preliminary contact with the technical staff, a team of experts carries out an on-the-spot inspection and, at the same time, makes a rough technical audit of the potential client’s needs in terms of infrastructure and services. The on-spot-inspection is at the core of the whole procedure, to be certain of feasibility. In many cases, for instance, the municipality is organized in several buildings which need to be connected with each other. With this first step, the team has a precise idea of the devices and network apparatus to install and can proceed to make an economical offer which describes how the network will be realized and which services will be delivered. In general, a small municipality suffering from the digital divide asks for:

- Broadband connectivity.
- A private network linking different blocks.
- Connectivity extended to the municipal library, schools (depending on the local municipal government) or other entities directly or indirectly under their administrative domain (e.g. a Pro-loco or tourist information point).
- Replacing existing telephone contracts (PSTN/ISDN) with a better cost/performance solution.

If the offer is considered appropriate to meet the needs, the team installs the required devices and apparatus and the municipality is connected to the Internet. If the contract is assigned by public tender, the team realizes what is described and required in the proposal. In both cases, a main objective is obtained: overcoming the digital divide.

When the last step with the municipality has been concluded, the harmonizing phase between the local government and citizens and SMEs begins. The municipality carefully orchestrates this phase with its technical staff, organizing a public conference to illustrate the adopted technologies and services. The message is clear: if the municipality is “on” the challenge can be taken up by all the others.

At this point, the baton can be handed over to the CRES/Teleinform team, who activates the strategy for citizen and SME involvement. The approach to date has proven very simple but effective, and includes the following steps:

1. CRES/Teleinform contacts a local retailer of personal computers, mobile phones or more in general devices related to ICT technologies;
2. The retailer is offered a percentage for every client who subscribes to the Wikitel system;

3. If the retailer agrees, he/she is informed about the different types of offers/contracts for Wikitel and receives promotional material to inform clients;
4. When a client decides to subscribe, he/she establishes a relationship with CRES /Teleinform for all technical and economic aspects.

During this final phase, CRES/Teleinform audits the client to tailor possible user-driven solutions for specific services. In certain cases, the retailer is involved to install additional equipment.

3.2 *Costs and Benefits of the Proposed Model*

The business case description addresses the problem of bringing wireless broadband to remote areas. It adopts a general model (container), giving it life with different scenarios (content) that can vary according to specific socio-economic, geographic and technical conditions. In order to transfer the results and adapt them to another context, the following information is required:

- Characteristics of the area (geography, economy, development policies);
- Nature of the local stakeholders (local government, technical competitors, SMMEs);
- Description of services that can potentially promote growth.

In order to evaluate economic sustainability, the following principles are applied:

- The developers make the investment in the TLC infrastructure, in order to obtain and maintain ownership;
- The users pay for services and maintenance of the infrastructure, but not for the infrastructure itself.

If this protocol is followed it is possible to identify costs and benefits for both the developer and users. The former bears the cost of the infrastructure but gains the opportunity to theoretically expand business without limits in terms of potential users; it also bears the initial cost for services. The users instead pay for services and system maintenance but are then free from other related problems (choosing the best technical solution, operational problems, etc.) and take advantage of having the infrastructure only “on demand”. This reciprocity is undoubtedly a benefit for the whole area: the presence of the TLC infrastructure can increase productivity, generate economic growth, and create jobs and employability, thus improving the quality of life for all.

3.3 *Elements to Validate the Proposed Model*

The Wikitel system is already on the field, thus representing a commercial “solution”. A first indicator to evaluate its success is the number of municipalities and private clients connected, as shown in the table below.

Kind of client	%
Local government	16%
Business	28%
Family	56%
Total	100%

Table 1: Wikitel Installations since 2006

Interestingly, the customers are not migrating due to the fact the product seems to be good enough to contrast the xDSL technology. Most of the customers are not considering the higher price a problem thanks to the customer care service that looks to them superior to the xDSL approach. On the other side it must be noted that the customers that moved to the xDSL are the ones who want to “pay as less as possible” more than considering the overall quality of the product (technical features, customer care, etc.). In all the 3 “oldest

territories”, i.e. those municipalities where the service has been introduced at the beginning of the commercial launch and the xDSL is now available, the number of customers who have migrated is still under the 10%.

The municipalities seem to be the less sensible to the price gap, because the connectivity is bound together with professional services that make the offer more interesting and complete.

4. Technology Description

The technological aspect is based on the experience gained during past R&D projects in wireless networks. The process “from idea to product” can be summarized as follows:

- CRES works, often in collaboration with Teleinform, on the prototype of a service, product or device;
- The prototype is then re-engineered by Teleinform and/or CRES to make it cheaper, more robust or simply to make it more attractive to end users;
- Teleinform then defines the commercial strategies and business models for the final product/service.

The Wikitel WikiAir product is based on unlicensed 5Ghz frequencies for both the backbone and access networks. Future technology upgrades (e.g. single or multiple upgrades to licensed frequencies) to provide end users with new services are possible with little effort and in a very short time.

The Wikitel product family is however just the beginning of a medium/long term strategy that includes two main elements – the access medium (e.g. copper, unlicensed/licensed wireless, fibre, etc.) and the set of added value services – where the value is not in either element alone, but in their integration into an attractive and personalized vertical product.

5. Developments

The proposed model for addressing the digital divide lends itself to transferability in geographical areas and contexts that are completely different from Sicily, due to its ability to adapt to different cultural and social contexts. What should be respected is the operational protocol, as the determining factor of the proposed system.

The choice of such a model, however, depends on a socio-economic analysis of the territory concerned and its reference market. One prerequisite is the existence of conditions of peripherality, rurality and/or low population density, making investment “uneconomical” according to the view of a large Internet Service Provider, but interesting for a connectivity solution such Wikitel. Another positive condition is for example the express wish to have an single supplier for phone and data services.

Every element of technology used is already on the market, thus avoiding any need for special equipment. The cost of these elements is therefore independent of the territory in which the technology will be used. The infrastructure cost will instead depend on the morphology of the territory (harsh conditions), the population density and the required level of service quality. Again, in some cases we have considered all or part of infrastructure costs as a medium/long term investment in order to enlist new customers.

The key determinant of the model’s transferability remains the way in which the territorial players have been involved: local government, enterprises, agencies, economic actors and citizens. The better the co-operation, ideally leading to co-design of the services offered, the better the development and success of the system as a whole.

6. Results

Our experience in applying the proposed model has led, in the first instance, to reaching the primary objective: bringing broadband to remote areas. This occurs not in isolation, but as a function of the broader impacts achieved through important multiplier effects such as increased cooperation between public and private bodies, joining their efforts to transform a territorial challenge into a real and effective participatory process.

One of the central success factors here is gaining the support of the Mayor and his technical staff. Their direct involvement in quickly overcoming the numerous difficulties that arise – e.g. administrative acts concerning permission to install apparatus or environmental impact assessments – is fundamental. The awareness that local government is “on” further stimulates administrators to take on a role in participatory processes towards e-government and e-democracy.

Their support is also crucial for realising the infrastructure in a short time and delivering benefits while enthusiasm is still high. To this end, we take a pragmatic approach towards realising the “last mile”, reducing where possible new pylons to the minimum by renting existing ones from other concerns (TV, radio) in exchange for services, in order to shorten the time to full-scale operation.

6.1 Lesson Learned

Through our experience, we have learned that the introduction of broadband in rural areas and the resulting opportunity for all users to be on-line leads to new patterns of consumption for local families, unaccustomed to paying for Internet-based services. This additional cost in the family budget leads to two important considerations for formulating the service offer:

1. A less performing service is preferred if it is more economical; advanced technological elements (e.g. symmetric vs asymmetric, downstream and upstream bandwidth, etc.) are difficult to understand especially for end users more than for technical skilled organizations (e.g. software companies, public administrations, or local technology resellers).
2. The lack of experience on the part of users should not provide an excuse for unreadiness; enterprises, local administrators and citizens, once they are “on”, will immediately ask for additional services, and the provider must be ready to satisfy these requests or its credibility will be irreparably undermined.

7. Conclusions

The work carried out within the Wikitel project in Sicily demonstrates how a business model that considers the requirements coming from the territory can be sustainable if two key factors are taken into account. First, it is very important to understand and contextualize the local community’s needs through interactions with the local Public Administration, SMEs and citizens. Secondly, the ability to customize a complete service offer to meet these specific needs is the key to reaching a fruitful collaboration with local actors.

New research activities in the 7^o Framework Programme will speed up the introduction of next generation services and technologies that, according to our experience, will be successful if they take into account not only the technical features, but also business models that are able to scale down from large corporations to small groups of users and from urban scenarios to rural areas.

Despite the awareness that the territories we have worked with have few other options, being cut off from the “big providers” and marginalized by their geographical and socio-economic conditions, we have never fallen to the temptation of identifying a single, top-down model to “solve” the digital divide. Instead we have worked to stimulate, through a

participatory, multi-level process (local government - citizens - enterprises), a model of rational experimentation through the co-design of infrastructures and services. The real achievement for the local municipalities and every participant who has joined the initiative, is today constituted by their ownership of what they have chosen and not what the market has imposed on them.

References

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