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A Typology for Community Wireless Network Business Models

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ABSTRACT

Community Wireless Networks (CWNs) are community-driven solutions that provide ubiquitous and affordable or free wireless Internet access in order to improve the well-being of the community. The escalation of this innovation and diversity of its business models have raised many concerns about the viability and sustainability of such a young innovation. Specifically, CWNs can be implemented using diverse business models that vary with respect to different social settings, and adopting the proper business model is the key to success for these nonprofit projects. This paper proposes a typology through which we conceptualize and classify these models and discuss their advantages and disadvantages considering their social settings. We have identified the value offering, financial aspects, business partners, infrastructure management, and target customers of these models. This work would help practitioners to choose the most suitable business model for their community and researchers to investigate the social and economic implications of this innovation.

Keywords

Business models, community wireless networks, municipal wireless networks, digital divide, WiFi

INTRODUCTION

Numerous Community (or municipal) Wireless Networks (CWNs) have been established all over the world for the purpose of bridging the digital divide, improving the business environment, and/or improving the well-being of the community at large. CWNs are wireless networks owned, built, and operated either by the community, a municipality, a nonprofit entity, or any mix of owners (Mandviwalla *et al.* 2006; Bar and Park 2006; Vos 2005; Ford 2005). The proliferation of these systems is driven by three main factors: community contributions, recent developments of wireless standards, and the free frequency (e.g., 2.4 GHz) that make wireless communications an effective alternative to DSL cables. Therefore, these systems have grown to be at the center of attention of underserved and remote communities, the mobile workforce, telecommunication companies, municipalities, and technology vendors.

The escalation of such a disruptive innovation and diversity of its business models has raised many concerns about their viability and sustainability (Mandviwalla *et al.* 2006; Chuang 2006; Abdelaal and Ali 2006; Cisco 2007). These concerns include: Will they serve municipalities, residents, or businesses? How should the system be implemented, operated, and maintained? Should they be funded by tax monies, grants, loans, donations, or revenues of advertising? Will the service be free? What are their social and economic implications?

In order to answer these questions, we need to know the value proposition, stakeholders, target customers, and the financial aspects of different types of CWNs. Previous concepts are captured in the attributes of the business model concept. Therefore, the main purpose of this study is exploring the most suitable CWN business model given specific social settings. Choosing the appropriate business model that can guarantee long-term funding sources and expertise to operate and expand the network is a key challenge facing such nonprofit entities (Meinrath 2007; Mandviwalla *et al.* 2006; Abdelaal and Ali 2006). The business model concept is an abstract that identifies the value offering by a particular firm and illustrates how that firm generates revenue (Osterwalder and Pigneur 2004). It outlines the contributions of different business partners in creating and distributing a specific value to a particular segment of customers in order to generate sustainable revenue streams.

LITERATURE REVIEW

Osterwalder and Pigneur (2004) developed a business model ontology that identifies the main elements of business models derived from consolidating and refining earlier research attempts to identify these elements. This ontology is conceived as a tool that helps managers to capture, understand, design, communicate, analyze, and change the business logic of the firm. A

few attempts at classifying CWN business models have already been made in the work of Mandviwalla *et al.* (2006), Chuang (2006), Vos (2005), Camponovo *et al.* (2003), and Schroth (2003). Camponovo *et al.* (2003) explored different business models for private, community, wide area, and WiFi hotspots in the Swiss market. The authors classified them based on whether the service is for commercial purposes and how extensive the service is. Meinrath (2007) classified CWN business models into the following categories: single-payer municipal model; free access and fee-for-services; free for residential and fee for commercial-government; off-peak versus peak; nonprofit ISP; educational purposes; and request for proposal (RFP). Ohlhausen *et al.* (2006) classified CWN business models into six categories: nonprofit, cooperative, contracting out, public-private partnership, municipal, and government loan-grant. Mandviwalla *et al.* (2006) classified the management and funding models of CWNs into the following categories: government-owned and operated, government-owned and privately operated, public utility, cooperative wholesale, and private consortium-owned and operated. The authors highlighted the main differences between these different models in terms of ownership, policies, and finances. In addition, they addressed the interests of different stockholders and the main applications of CWNs. Chuang (2006) classified CWNs business models into the following categories: community network, public utility, private consortium, and cooperative wholesale. McMahon (2007) investigated 40 case studies of publicly-owned broadband networks. The author classified their business models into municipal utility (wholesale or retail model), public-operated for public use only, public-private partnership (wholesale), public-private partnership (co-location sites), anchor tenant, free Internet, and local government (not used for utility). The study found that the main partners in the investigated case studies were ISPs, downtown associations, equipment suppliers, nonprofit entities, school districts, and other units of government. Abdelaal and Ali (2006) purposed a framework for public-private hybrid business model that facilitates the collaboration of different community stakeholders to establish their own CWN. For more information about potential contributions and benefits of different stakeholders, we refer readers to Abdelaal and Ali (2006) and Mandviwalla *et al.* (2006).

Previous literature has poor conceptual treatments, mixed classifications, and unclear definitions. In addition, some studies are difficult to put into the context of business models (e.g., RFP, government loan-grant). We believe that is due to the following reasons:

- (i) CWNs represent a contemporary innovation and most of its implementation models are in trial stages.
- (ii) CWN literature has been influenced by scholars from different disciplines (e.g., information systems, sociology, organizational behavior, economics, and politics) and advocates who may lack the necessary theoretical background. For example, some advocates call these systems “*municipal wireless networks*” to stress the right of municipalities to own and run their own networks (Chuang 2006; Bar and Park 2006; Mandviwalla *et al.* 2006; and Vos 2005), while others call these systems “*community wireless networks*” to stress the necessity and the right of the community to own, deploy, and manage these networks (Meinrath 2007). We adopt the latter concept due to the heavy influence of the social settings and the community on the objectives, the implementation, and the finances of these systems.

The drawbacks of prior research motivated us to further investigate this area.

A PROPOSED TYPOLOGY FOR CWN BUSINESS MODELS

We use the ontology of business models developed by Osterwalder and Pigneur (2004) to propose a typology that conceptualizes, attributes, and classifies emerging business models of CWNs. We investigate their components, advantages, disadvantages and provide examples in this regard. Specifically, we identify their different value offerings, financial aspects, target customers, and managerial structures, in order to explore viable alternatives for providing affordable wireless access to different communities. We situate this discussion in an ongoing debate about the viability and sustainability of CWNs (Mandviwalla *et al.* 2006; Vos 2005; Abdelaal and Ali 2006). We have chosen Osterwalder and Pigneur’s business model abstraction because it focuses on a single enterprise that targets a particular segment of customers considering the surrounding environment. In addition, we have used the concepts of different conventional business models (e.g., community, public utility, advertisement) as defined by Rappa (2004) to define and attribute similar CWN business models. Figure 1 shows the proposed typology and the correlation between the discussed CWN business models and different communities (or target customers). Table 1 elaborates on the elements of each model. Table 2 summarizes the advantages and disadvantages of each model and provides examples of CWNs that fit into this model. Following is a conceptual treatment of these models and their main components, advantages, and disadvantages as shown in Figure 1, Table 1, and Table 2.

Public Utility

In this model a municipality (e.g., city, county, state) owns, funds, and manages the project using tax money or a debt instrument (Chuang 2006, Vos 2005). Municipalities either establish a special department or hire staff to manage the project

or lease it to a network operator. In addition to its suitability for large cities that have economies of scale, this model is suitable for small and remote communities that lack commercial incentives for telecommunication companies to deploy infrastructure or where a market-centric model is not viable (Abdelaal and Ali 2006; Mandviwalla *et al.* (2006). Rappa (2004) identified the following requirements of a utility model: service necessity, reliability and ease of use, limited utilization of the capacity; economies of scale, and exclusive rights to provide service in a given area. The public utility model has been implemented in the United States in Corpus Christi, Texas; Moorhead, Minnesota; and Saint Cloud, Florida. However, cities may charge residents low fees (e.g., Chaska) to cover operation costs. The main advantages of this model are:

- (i) Stability of funding sources and low risk
- (ii) Better service quality and reliability
- (iii) Serving the entire city and bridging the digital divide
- (iv) Using the facilities for public services such as utility meter reading and emergency service (Cisco 2007; Vos 2005)
- (v) Investing the generated money in the community
- (vi) Reducing service costs by having a tax-exempt status
- (vii) Using public buildings and venues with good visibility such as light poles, public libraries, schools, and parks to install the system facilities.

However, this business model faces severe opposition from telecommunication companies and other civic groups (Chuang 2006; Vos 2005; Ford 2005). They argue that it is neither efficient nor legal, particularly in the U.S., for municipalities to own and operate such a business. In addition, it has less opportunity to engage the community and empower the civic society through volunteerism.

Ad-supported

In this model a content provider or distributor (e.g., Google, MetroFreeFi) provides free wireless service in return for sending advertising messages to the user's screen or for the purpose of exposing its brand. Google has a WiFi network in Mountain View, California, U.S. for the same purpose. The joint Google/Earthlink project in San Francisco, California, offers a low-speed service for free and a high-speed one for a fee. Google supports the free service from advertising revenues. EarthLink obtains revenues from upgraded services and leasing bandwidth to other ISPs. Advanced Micro Devices (AMD) Inc. negotiates with owners of public locations (e.g., coffee shops, restaurants) to install free WiFi hotspots in return for displaying its logo. In addition, the Long Beach, California, and Hamburg, Germany, projects provide such services. In a poll run by muniwireless.com, 54% (out of 230) agreed that a business model based on advertising can fund CWNs. We believe that the ad-supported model may be viable only in large cities and commercial districts that have economies of scale and high demand. The advertising model works best when the volume of traffic is large enough or highly specialized (Rappa 2004). However, this model may not work for rural and underserved communities due to their small size and limited purchasing power. In addition, it may attract very few players such as Google, MetroFreeFi, and AMD. Moreover, the service may have low quality because it is free.

Education-centric

In this model an academic institution plays as an anchor partner that owns, designs, builds, and operates the system for the purpose of improving the educational process, obtaining expertise for students, and improving the well-being of local communities (Meinrath 2007; Abdelaal and Ali 2005). The academic institution usually depends on students for manpower and expertise. Such projects are usually funded by grants or donations to the sponsored institutions and the service is usually free. For instance, the SparkNet (University of Turku, Finland) and Smart School (Bario, Malaysia) projects have been designed, implemented, and run mainly by students. The SparkNet project provides incentives to community members and local entities in order to host the facilities or share their access points as part of the network. The project uses open-source software and affordable hardware tools in order to minimize implementation costs. Similarly, the Smart School project provides wireless access to the rural community of Bario using a satellite system. In addition, MIT students built a free wireless network in Cambridge, Massachusetts, U.S. This model has the following advantages (Abdelaal and Ali 2005):

- (i) Providing the service for free in most cases
- (ii) The academic institutions possess the expertise needed to design, implement, and manage the network infrastructure
- (iii) The system may have a dual purpose of supporting the educational mission of the sponsored institution as well as providing digital connectivity to the community
- (iv) The use of network resources may be optimized since their usage by universities (mostly during the daytime) may be complemented by the needs of community members in the evenings

- (v) Students participating in these projects obtain valuable experience, which helps them to obtain better career opportunities
- (vi) The project could be used by students for research that focuses on the technical, social, and economic issues of such young innovation
- (vii) Academic institutions have access to financial resources (e.g., federal, state, and nonprofit) to provide the necessary funding to sponsor such outreach activities. This model may reduce any legal risks facing nonprofit entities that own such projects (Meinrath 2007).

This model is suitable for any community, particularly rural and underserved ones, as illustrated in Figure 1 where academic institutions can serve as development centers.

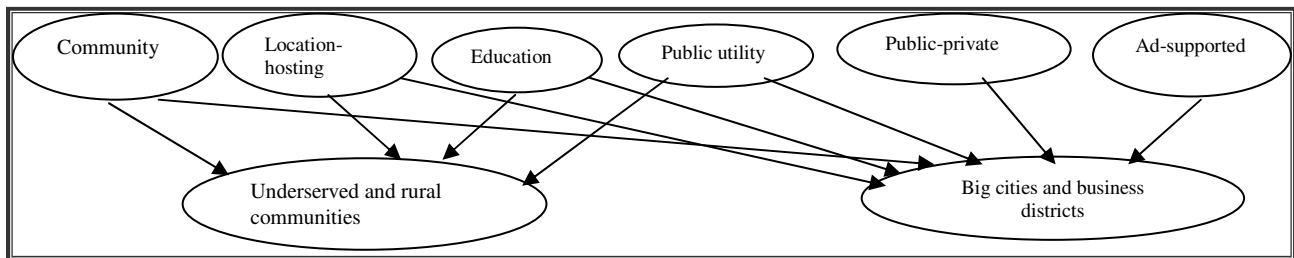


Figure 1: Matching different business models with target communities

Community Wireless Network

The community wireless network business model illustrates a collaborative partnership through which the community funds, builds, and operates the facilities to provide affordable (or free) wireless Internet access to the community at large. Usually, the project is implemented and operated by a nonprofit entity or through a natural growth and integration of WiFi spots owned by community members and local entities (Chuang 2006; Abdelaal and Ali 2006; Wilco 2004; Vos 200). The costs are usually covered by grants, donations, volunteerism, or sharing IT resources. The essence of this model is the support of local communities and volunteers whose goal is to improve the wellbeing of the community as described in the conventional online community business model in the work of Rappa (2004). Wilco (2004) believes that the spirit of this model is recognizing that every community member has the potential to contribute to this project. We believe the main driver of this project is the social capital contributed by the community. Woolcock (1998) defines social capital as “a broad term encompassing the norms and networks facilitating collective actions for mutual benefits.” Social capital, in this context of CWNs, includes donations, technical expertise, open source software, recycled equipment, location hosting, and voluntary work.

Examples of the community wireless model include the Austin Wireless and Champaign-Urbana Wireless, U.S.; Freifunk, Germany; and Djursland, Denmark and many others. The managers of these projects usually use open source software and collaborate with volunteers to obtain technical expertise and manpower. For instance, wireless Leiden (<http://www.wirelessleiden.nl>), one of the largest free WiFi networks in the world, has decreased the implementation and operation costs via employing volunteers and using open source software and donated equipment. The main business partners of this model include local community members, businesses, municipalities, schools, libraries, and nonprofit entities.

CWN advocates such as the European Alliance for Community Networking (EACN), CUWIN, FunkFeuer group, Sputnik Inc, and FreeNetworks develop open-source software and share it with CWNs to promote this innovation worldwide. This model creates a collaborative community-based system in which each member contributes his/her resources, money, or programming expertise for the betterment of the community (Rao and Parikh 2003).

The main advantages of this model are:

- (i) Providing the service for free in most cases
- (ii) Using the social capital of volunteers and donors
- (iii) Engaging the community in public affairs, educating them about new technologies, and providing them with experience
- (iv) Providing the service free of charge or at low cost
- (v) Keeping generated revenue in the community.

The main disadvantages of this model are:

- (i) Instable management structure and uncertain funds and revenues
- (ii) May face legal problems with telecommunication companies
- (iii) May not be used for municipal services
- (iv) May not cover the entire city.

This model could be improved through a partnership with content and service providers in order to increase its revenues via providing commercial services (e.g., advertisements and location-based services) or leasing bandwidth to other service providers. According to Wilco, this model succeeds when it enables as many small businesses and partners as possible to benefit.

Business model	Value offering	Financing	Business partners	Infrastructure management	Target customer
Public Utility	Serves public services, bridges the digital divide, employs public resources	Public funds	Municipalities	A municipality or a contracted company	Any community
Community	Employs social capital, achieves civic engagement	Donations, volunteerism	Municipalities, local businesses, volunteers	Nonprofit entity	Any community
Public-private	Uses public venues to host the facilities, improves management efficiency	Private funds	Service providers	A private company	Any community
Ad-supported	Content providers bridge the digital divide	From ad revenue	Content providers, technology vendors	Content operators (Google, Yahoo), or ISP	Business districts and large cities
Education	Provides students with expertise, guarantees long-term management structure	Public fund, donations, student expertise	Academic institutions, local businesses and governments, nonprofit organizations	Students of the academic institutions	Any community but more suitable for rural and underserved ones
Location-hosting	Location is an important asset, uses public places and venues	An ISP, donations, sponsorship	Community members, local businesses, public entities, nonprofit organizations	An ISP, or a nonprofit organization	Rural and underserved communities, business districts

Table 1: The main components of CWN business models

Location-hosting

This business model has evolved on the notion of *location theory*, where firms choose locations that maximize their profits and individuals choose locations that maximize their utility (Weber 1929). A commercial location-hosting business model is common in public places such as cafes, restaurants, and hotels that provide WiFi access for commercial purposes (Camponovo *et al.* 2003). In the context of CWNs, an entity hosts the facilities in return for some incentives such as customer attraction, revenue sharing, free service, brand exposure, or simply for the purpose of improving community well-being. For instance, the OzoneParis (Paris, France) project offers free Internet access to individuals who host the network facilities at their rooftop. In addition, the SkyFrames Inc. negotiates with rural schools to host wireless systems in return for some incentives. These incentives include free Internet access, subsidized or free equipment and software, and 10% of the revenue generated from community members and local businesses. The SkyFrames model is similar to the “peak and off-peak model” where the service is provided free of charge during the off-peak hours and for fee during peak hours (Meinrath 2007). One of the advantages of this model is reduced deployment and management costs through choosing locations with good visibility (e.g., business districts, high buildings) in order to provide better coverage or signal quality. In addition, specific locations have become valuable assets. The main drawbacks of this model, however, are that it may not cover the entire city and it may lack the necessary management support.

Public-private

This model illustrates a partnership with local municipalities and a private company such as a service or content provider (Ohlhausen *et al.* 2006; Abdelaal and Ali 2006; Chuang 2006). The city provides the right-of-way, may share the installation costs, serves as an anchor user, and provides legal and political support for the project. The private company funds, builds, operates and maintains the infrastructure. In return, public entities and underserved communities obtain the service for low cost (or free). In addition, the city may share the revenues. For instance, Philadelphia (Pennsylvania, U.S.) has contracted EarthLink Inc. to deploy a citywide wireless network. EarthLink funds, builds, and manages the network and shares the revenue with the city. In return, the city allows Earthlink to access public venues such as light poles, tall public buildings, and

towers to install the facilities. The service will be provided free of charge for needy individuals and public entities. The main advantage of this business model is the possibility of subsidizing the service and leasing the extra bandwidth to other local operators. This model could fit both business districts and underserved areas. This model sometimes is called *cooperative wholesale* (Chuang 2006). The main advantages of this model are:

- (i) Cities have some control over deployment and service pricing, and
- (ii) This model is capable of bridging the digital divide.

Its main disadvantages are that the business partner generates revenue from the community and may not collaborate with the community.

Business model	Advantage	Disadvantage	Example
Public utility	Generates revenue for the community, subsidizes the service, uses public buildings, may use the system for public services, stability of funding , better service	May have legal and management issues, does not engage the civic society	Lebanon, OR; Dayton, OH Chaska, MN
Community	Engages the community, uses the social capital and community resources, empower the civic society	May not cover the entire city, may not be used municipal services, may face some legal issues	Manchester Wireless, UK; Champaign-Urbana (IL) Wireless; Austin (TX); Wireless Ghana
Public-private	Integrates public and private resources, subsidizes the service, could be used for municipal services	May not empower volunteerism, the private partner shares the revenue	Philadelphia, PA
Ad-supported	Content providers subsidize the service or provide it for free	Not viable for small and remote communities, may provide low service quality	Hamburg, Germany; San Francisco, CA; Mountain View, CA
Education	Decreases deployment and management costs, enhances education, builds expertise	May not scale up to cover the whole city	SparkNet, Smart School
Location-hosting	Concatenates different WiFi clouds, increases the value of specific locations, reduces costs, provides better coverage	May lack the necessary management support, may not cover the entire city	OzoneParis, SkyFrames

Table 2: Advantages and disadvantages of different CWN business models

Other business models

The *Distributed Ownership and Central Management* model provides specific incentives to end users to share their facilities such as routers or access points with others in a win-win partnership. In this case, users own and manage part of the infrastructure, thus reducing implementation and operation costs. The main examples of this model are the NYC Wireless (New York City, U.S.) and the B.C. Wireless projects (British Columbia, Canada), which are built on the notion of aggregating ad-hoc networks owned by community members. However, this model may not cover the entire city and may have some management and reliability issues. Similar to the community model, the success factors of this model are the social capital embedded in the community. The value of this system depends on the number of individuals who own the infrastructure, due to network externalities.

IMPLICATIONS FOR PRACTICE AND FUTURE WORK

We have discussed different CWN business models and identified their main components, advantages, and disadvantages as shown in Table 1 and 2. Specifically, we have classified them into six categories: public utility, community, public-private, ad-supported, education-centric, and location-hosting. In addition, we have demonstrated their suitability for different communities. We believe that our proposed typology provides more careful treatment and classification of these models compared to previous attempts.

This study would help practitioners to choose the best model that is most suitable for their community as shown in Figure 1. For example, the ad-supported and public-private models may not be the best solution for rural and underserved communities due to the lack of commercial incentives and insufficient capacity. The essence of the ad-supported model is the economies of scale required to generate enough revenue from advertisements in order to support a free WiFi service. However, we suggest such models for metropolitan areas where there are economies of scale and a high demand enough for generating sufficient revenue to fund the infrastructure, e.g., large cities and commercial districts. The community, education-centric,

and location-hosting models could suit any community, especially those that are underserved and rural. Nevertheless, CWN business models are not mutually exclusive; practitioners may choose any appropriate mix of them that suites best their community and answers key questions outlined earlier. In fact, the key to success for this emerging innovation is adopting the proper business model that fits the economic and social settings of the designated community. Practitioners should consider generating revenue from supporting community content and advertisements such as community bulletin boards, classified advertisements, announcements, and location-based services. Regardless of the adopted business model, practitioners should collaborate with local communities, businesses, municipalities, non profit entities, and academic institutions in a win-win partnership to fund build and maintain the system. This is to obtain and employ the resources of these different entities and generate a broad range of value offerings in different venues. For more suggested success steps, we refer readers to Abdelaal and Ali (2006).

This study is important for several IS research areas. This is because the realm of CWNs is at the confluence of communities, nonprofit organizations, and technology. Therefore, addressing the value offerings, business partners, target customers, and financial aspects of these nonprofit organizations would have significant impact on several research areas. These areas include the productivity paradox of IT, IT for development (ITD), social transformation of IT, economy of knowledge, social capital and IT, and civic engagement. In addition, classifying CWN business models and understanding their components is an important step towards explaining the CWN phenomenon. Lambert (2006) believes that an early conceptualization and classification of business models is an important step towards building theories for these models and explaining the phenomenon. CWNs have the potential to create many value creation opportunities such as increasing the value of specific locations that host the facilities, boosting volunteerism and social ties, improving civic engagement, boosting the business environment and empowering economic development. However, these areas require further investigations supported by empirical evidences. Moreover, this study shows the growing importance of the community, social networks, and nonprofit entities as units of analysis in the realm of IS research. In particular, it shows that the civic society and nonprofit entities can have their own stake and contributions in the digital domain as well and this area needs to be addressed in the future. The impact of CWNs (and open-access wireless infrastructures in general) on the telecommunication industry is a topic that needs more investigation. There is also a need for special instruments to validate and evaluate these emerging business models which are still in nascent stages. We believe that this groundwork is an important step towards a unified theory that explains and predicts the CWN phenomenon and its social and economic implications.

CONCLUSION

This paper is an attempt to conceptualize and map CWN business models to their target communities. We proposed a typology of CWNs business models that considers the social settings and the main issues of these emergent systems. This typology classifies them into six main models: public utility, ad-supported, education-centric, community, location-hosting, and public-private partnership. We identified the distinct components of these models, which are value offerings, target customers, main business partners, infrastructure management, and financial aspects. In addition, we enumerated their advantages and disadvantages and provided examples in this regard. This typology links the business model concept to its impact on the society. The findings of this work are important for future research on the social and economic implications of CWNs in different social settings. Our future work will focus on validating these business models with empirical evidences and building a unified theory of CWN business models.

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