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# Multidimensional Participation in Hybrid Wireless Communities

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# MULTIDIMENSIONAL PARTICIPATION IN HYBRID WIRELESS COMMUNITIES

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## Abstract

*Wireless communities have been long considered an interesting approach to provide mobile Internet, but the key issue is whether they are able to attract and retain a critical mass of active members. It is therefore crucial to understand what motivates and dissuades people from joining and participating in them, especially with the development of mainstream 3G technologies, in order to evaluate their potential development. This paper analyzes motivations and barriers influencing participation in a large wireless community – Fon – based on a survey of 268 members. Two distinct forms of participation driven by different motivations emerge: a ‘participation by sharing’ driven by idealistic motivation and a ‘social participation’ driven by social motives and technical interest. Utilitarian motivations do not play a major role for active participation despite being crucial in attracting members to the community. Accordingly, the way hybrid wireless communities are currently designed (hardly offering occasions for a social usage experience, experimentation and with decreasing utilitarian benefits due the development of 3G technologies) is casting serious doubts about a possible potential development above the status of a niche complement to the dominant cellular technologies.*

*Keywords: wireless communities, adoption, motivation, participation.*

# 1 Introduction

We live in an increasingly mobile and connected society. Two IT trends contribute to shape our lives in this way. The diffusion of mobile computing devices has sharply accelerated in the last ten years, fostering a need for Internet access anytime anywhere (Ladd et al. 2010). In parallel, the evolution of social computing platform is placing communities at the center of “a dramatic evolution of the Web, matching the dot-com era in growth, excitement, and investment” (Parameswaran 2007).

It is thus natural to wonder about the potential of combining these trends into wireless communities, allowing members to share wireless Internet access through their Wi-Fi connections. Some observers envisioned them enabling a “napsterization” of wireless communications, shaking the foundations of the telecom industry and realizing the vision of a free wireless Internet for anyone anywhere (Clark 2002). This vision has been on the table for a decade and is somehow still associated with Wi-Fi despite it only allows sharing in close proximity (Cho 2008) and 3G/4G networks have insofar arguably better fulfilled the anytime and anywhere (but not free) vision. Still, Wi-Fi remains an intriguing option because it operates on unlicensed spectrum and thus allows alternative community-based models that were successful in other fields like P2P and user generated content communities.

For wireless communities to be viable it is however fundamental to attract a critical mass of members willing to share their Wi-Fi. This requires understanding why people may decide to join, actively contribute, and designing suitable incentives to attract and maintain their participation over time.

Existing research studied this issue in ‘pure’ communities, built and operated by members in a self-organized way. In reality, there are also ‘hybrid’ communities, where a company supports individuals who share their own access points by operating central network elements and offering incentives in exchange for the right to exploit the community network. This distinction is crucial because the presence of a supporting firm may influence members’ motivations and participation. In fact, hybrid communities appear to be more successful in attracting members: while the largest pure community (NYC Wireless) has 40’000 members, the largest hybrid community (Fon) has more than 8 million.

The research question that this paper wants to address is: what drives or hinders people to actively participate in a hybrid wireless community? This implies identifying the various types of participation in a wireless community, understanding motivations for active involvement and empirically validating them with a sample of community members.

A mixed method approach is used. In a first stage, a theoretical model was developed on the basis of a literature review on motivations in various communities as well as exploratory content analysis of forum posts and interviews of members of a wireless community. This paper presents the second step, a quantitative confirmatory analysis based on a survey with 268 members of the Fon community. More details on this community and the methodology are provided in section 2 and 5.

## 2 Study context: the Fon community

Wireless communities emerged around the year 2000. With mobile operators struggling to deploy 3G networks, a grassroots movement quietly set up open Wi-Fi hotspots and organized itself in wireless communities allowing members to provide free Internet to each other and the population (Schmidt and Townsend 2003). Fueled by cheap equipment and flat-fee Internet connections, they started to grow and become an exciting option for offering wireless broadband, especially in densely populated areas.

Quickly other players began to offer Wi-Fi Internet access with various business models ranging from pure communities (built and operated by members in a self-organized way) to commercial providers (which deploy hotspots, manage them and charge users for access), passing from hybrid communities (a business supports members sharing their hotspots by providing preconfigured hardware, incentives,

operating central network elements in exchange for exploiting the community network) and various forms of government-based municipal networks (Rao and Parikh 2003b, Lehr and McKnight 2003).

Fon stands out as the most successful in attracting people, with millions of members worldwide. It is a for-profit company founded in 2005. Its mission is to create “a Wi-Fi network built by the people” where “you share a little bandwidth with others and millions more share with you”. Initially it offered a firmware for turning standard routers into Fon hotspots, but the firm quickly began to sell its own preconfigured routers as a way to get revenue besides access fees from non-sharing members and advertising. Fon received funding from large firms and used it to promote low cost routers, seeding the community network and enabling its growth. With this model “Fon has been losing large amounts of money” (Middleton et al., 2008). Over time, Fon adjusted its business model and started to focus more on selling routers at higher prices and relying more on building partnerships with telecom operators (like BT Group, SFR, ZON, Comstar, Belgacom etc.) to expand its network.

Fon offers three memberships types targeting different users: “Linus” members share their connection for free and freely access other Fon spots, “Bill” members also get 50% of the net revenue generated by their spots, and “Alien” members do not share connectivity and must purchase access to Fon spots.

Fon’s value proposition emphasizes its utilitarian aspects by promising “free access to millions Fon spots worldwide”, “speedy connection to all your devices” and the possibility to “make some money”. At the same time, Fon tries to address potential concerns by claiming it is “easy”, “secure” and allowing bandwidth limits. Whether these claims are maintained is not an issue covered by this article (cf. Middleton et al. 2008).

Fon also promotes itself as “a community network built by the people”, although it provides members limited control. They can only limit the shared bandwidth, visualize who connects to their spots and exchange messages with other members. Except that network infrastructure is provided by individual members, Fon basically operates like an ISP as it controls the technical solution and operates central network elements. Fon also maintains a database of hotspots and provides an interactive map.

### 3 Literature review

#### 3.1 Motivation theories

Understanding human behavior like adopting technologies is a popular research issue and many theories have been developed. Hereafter the three most relevant research streams are briefly illustrated.

The first emphasizes intentional decision making, especially in technology adoption. It starts with the expectancy-valence theory (Vroom 1964) suggesting that people are motivated to perform an activity if they expect that their efforts will lead to some valuable outcomes. The Theory of Reasoned Action (Fishbein et al. 1975) suggests that a person’s behavior depends not only on “beliefs about the behavior’s consequences and [their] evaluations” but also on “beliefs that relevant referents think he should or should not perform the behavior”. The Theory of Planned Behavior (Ajzen 1991) further accounts for “the perceived ease or difficulty of performing the behavior”. These theories were adapted to explain technology adoption and usage: the Technology Acceptance Model (Davis 1989) proposes that technology adoption is driven by its perceived usefulness and perceived ease of use. The Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2003) integrates those theories proposing four determinants of behavioral intention (performance expectancy, effort expectancy, social influence, facilitating conditions). Although developed for working contexts, these models were also successfully applied to non-working contexts (see King and He 2007).

The second stream is represented by the Self Determination Theory (Deci et al. 1985). It distinguishes various types of motivation ranging from intrinsic motivation (doing something for its inherent satisfaction) to extrinsic motivation (to get some separable outcome). The latter is further

differentiated between external (to get some reward), introjected (it enhances self-esteem), identified (it is considered personally important) or integrated (assimilated with one's values) motivation.

The third stream focuses on prosocial behavior like helping, comforting, sharing and volunteering (Batson 1998). The Functional Approach to Volunteers Motivations (Clary et al. 1998; Snyder 1993) explains that people enact such behaviors because it serves functions like gaining knowledge, express one's values, comply with social expectations, get utilitarian rewards, enhance one's ego or protect against negative feelings about oneself.

### **3.2 Motivations in wireless communities**

A literature review on wireless communities confirms that the importance of the role of individuals in the formation, growth and survivability of wireless communities (Bina and Giaglis 2005). The earliest papers (McDonald 2002; Camponovo et al. 2003; Rao and Parikh 2003a; Readhead and Trill 2003) only highlight the need to understand member motivations in general. Two articles (Auray et al. 2003; Schmidt and Townsend 2003) offer a first list of motivations: create cooperative spirit, gain prestige in the community, promote free communication and challenge telecom firms. Two potential conflicts of interests between members and the community are also analyzed: inducing members to contribute to the community instead of free riding (Sandvig 2004) and limiting them to a fair usage (Damsgaard et al. 2006). However, these papers stay only at a conceptual level, with little empirical evidence.

The first empirical studies (Bina and Giaglis 2006; Lawrence et al. 2007) suggest that participation is driven by a mix of intrinsic (enjoyment, competence, autonomy, relatedness), obligation-based (reciprocity, community values) and extrinsic motivations (rewards, external pressure, self-esteem, connectivity needs, human capital, altruism), but hindered by perceived effort to join and participate.

Focusing on Wireless Toronto, Wong and Clement (2007) suggest that people have “positive feelings about the benefits of sharing [...] but reservations about making their own signals open” because they believe it is difficult, distrust strangers, worry for security or bandwidth. Yet, sharing is more likely if these concerns are addressed and members perceive benefits like cost reductions or higher reliability. Cho (2008) reports a mix of motivations based on personal interest (fun, technical, social networking, Wi-Fi access) and public interest (Information Society inclusion, media democracy, civic activism).

Abdelaal et al. (2009) concentrates on member participation, highlighting that members contribute in other ways besides sharing (i.e. time, money, expertise, hardware, software) and suggests the importance of social capital in addition to technical and economic benefits.

Only recently researchers started to focus on hybrid communities. Biczók et al. (2009) build a game-theory model of the motivations of members, community operators and ISPs. Shaffer (2010) conducts a survey of members of pure and hybrid communities, finding common motivations (offer broadband access, use technical skills, get connectivity) but with different intensities. Finally, Camponovo and Picco-Schwendener (2010, 2011) interviewed Swiss Fon members: they appear to be motivated by tangible rewards (especially free connectivity), idealism (altruism, reciprocity) and technical interest, while social and intrinsic motivations are weaker. Members are aware of potential risks (security, abuse and legality) but are mildly concerned as they feel reassured by the supporting firm.

## **4 Research model and hypotheses**

To guide this research, a theoretical model explaining why individuals may participate in a hybrid wireless community is developed. It is based on literature on motivations in virtual communities (cf. Camponovo 2011), literature on motivation theories and wireless communities (cf. section 3), analysis of forum posts and interviews with Fon members (cf. Camponovo and Picco-Schwendener 2010, 2011). The resulting model proposes that participation in hybrid wireless communities is driven by utilitarian, idealistic, social and intrinsic motivations and hindered by concerns and perceived effort.

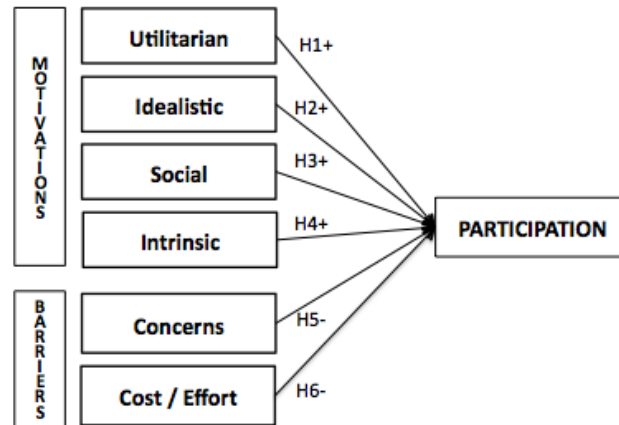


Figure 1. Theoretical model of participation motivations in wireless communities

As a result, the following six hypotheses are proposed:

**H1) utilitarian motivation positively affects participation.** This hypothesis is supported by the three theory streams: technology adoption is driven by its perceived usefulness, people can be extrinsically motivated to attain some separate outcome, and even volunteerism activities may have an instrumental function. Research on pure wireless communities offers mixed support: some studies find utilitarian motivations to be lower than intrinsic and idealistic motivations, while others find getting connectivity a major motivation. In hybrid communities, utilitarian motivations like free connectivity are expected to be a key motivation to join the community as the network is larger and thus more valuable.

**H2: idealistic motivation positively affects participation.** Self Determination Theory suggests that people may be motivated by psychological reasons such as enhancing self-esteem through idealistic actions expressing personal values. Research on prosocial activities supports their enhancement function to help develop psychologically, feel better about oneself and express one's values. In pure wireless communities, idealistic motivations are consistently found to be crucial. In hybrid contexts, idealistic motivations are also expected to be important, although they may be perceived as worse suited to achieve idealistic goal due to the presence of a supporting company.

**H3: social motivation positively affects participation.** "People are sometimes motivated by a desire to win prestige, respect, friendship and other social or psychological objectives" (Olson 1971). Social motivations play a role in the diffusion and adoption of an innovation. People may act to satisfy a relatedness need, establishing a sense of mutual respect and reliance with others. Prosocial activities often satisfy a social function. In pure wireless communities, social motivation is a third factor behind intrinsic and idealistic reasons. In hybrid communities, it is assumed to play a similar or weaker role because of the firm-supported, resource-oriented nature and larger size of the community.

**H4: intrinsic motivation positively affects participation.** People can be intrinsically motivated by performing an interesting or enjoyable task for the sake of doing activity itself or to satisfy need of feeling competent by succeeding at challenging tasks. In pure wireless communities, technical interest is found to be a motivating factor. In hybrid communities, this factor is expected to play a somewhat reduced role due to the fact that the technology is more mature and controlled by the supporting firm.

**H5: concerns about sharing negatively affect participation.** Research on pure wireless communities found that people may be reluctant to share due to concerns like security, privacy, reduced bandwidth and distrust for strangers. In hybrid communities, these concerns are expected to be reduced by the presence of a supporting company proposing solutions to tackle these issues and reassuring members.

**H6: effort expectancy negatively affects participation.** Technology acceptance research considers effort as a key adoption determinant. In pure communities, the perceived difficulty and effort required to join and participate appears to be a significant barrier. In hybrid contexts, the underlying firm should make it easy to join and participate through a standardized and mature technical solution.

## 5 Methodology

### 5.1 Instrument development and data collection

Survey questions were developed based on already validated measurement scales, adjusted to the hybrid community context and refined through a pre-test with a small number of respondents to strengthen their validity and reliability (Straub et al. 2004). The constructs and items are shown in the following table. The items are measured using five-point Likert scales measuring the level of agreement and followed a random order in the survey to avoid any response bias.

Construct	Item	Wording	References
Participation by sharing	PS1	My Fonera is always on and connected to the Internet	Social capital contributions (Abdelaal et al. 2009)
	PS2	My Fonera is installed in a way that it is easily accessible by other members	
Social participation	SP1	I interact with other community members (Fon messages, forums, meetings)	
	SP2	I volunteer my skills to help members or improve the Fon offering	
Utilitarian Motivation	UT1	Participating in Fon is useful to get free Internet access when not at home	Intrinsic Motivation Inventory: usefulness (Ryan 1982)
	UT2	Participating in Fon enables me to get free Wi-Fi access worldwide	
Idealistic Motivation	ID1	I can use other people's access points, so I desire to give back	Reciprocity (Bina 2007)
	ID2	I know other Foneros share their access with me, so it's fair to share my connection too	
	ID3	When I contribute to the Fon community, I expect others to do the same	
Social Motivation	SO1	I would like a chance to interact with other Foneros more often	Intrinsic Motivations Inventory: relatedness (Ryan 1982)
	SO2	I feel close to the other members involved in the Fon community	
	SO3	I feel like I can trust other people in the Fon community	
Intrinsic Motivation	IM1	Participating in Fon allows me to learn or apply technical skills	Basic Psychological Needs: competence (Bina 2007)
	IM2	I am interested in Fon from a technical viewpoint (to see how it works)	
Concerns	CO1	Security or privacy (viruses, hackers, access to personal data etc.)	Concerns (Wong 2007)
	CO2	Abuse (illegal or immoral activities)	
	CO3	Legality (of sharing my Internet connection)	
Effort expectancy	EF1	The Fonera is easy to setup	Effort expectancy (Venkatesh et al. 2003)
	EF2	Fon spots are easy to use	

Table 2. Model constructs and measurement scales

To contact Fon members, Fon agreed to promote the survey in its April 2011 newsletter to all Swiss Foneros. In addition, the survey was advertised through the Fon Twitter channel and official Fon forum. In that way, it was possible to collect data from members of other European countries, allowing to check for particularities in the sample and to extend generalizability.

The survey was published on the project website ([www.wi-com.org](http://www.wi-com.org)) from April to October 2011. It was available in English, German, French and Italian. 388 responses were obtained, among which 91 were incomplete and 29 were not from Fon members, resulting in 268 usable responses. The sample demographical composition appropriately reflected the Fon population. In particular, in terms of member types the sample consists of 135 “Linus” (45%), 105 “Bill” (34%), 17 “ex” (7%) and only 9 “Alien” (3%) members. Because Alien members are too few and because the distinction between Linuses and Bills has become less relevant since a few years (in the beginning Bill members could gain revenue but did not get access to the network, now they get the same benefits as Linus members plus revenue sharing) we do not make separate analyses by membership type.

A Structural Equations Modeling technique was employed for data analysis. The software employed was LISREL 8.8 for Windows. The data analysis process followed a two-stage approach as recommended by Gefen et al. (2000). Firstly, the measurement model is tested using confirmatory factor analysis to evaluate the validity of constructs and indicators. Then, the structural equation model is tested to assess the relationship between constructs and the overall fit of the model.

## 5.2 Instrument validation

To validate the measurement model, content, discriminant and convergent validity were assessed. To assess content validity, item wordings were examined for consistency with the literature and through a pre-test. Discriminant validity was assessed by checking that correlations of factors supposed to measure distinct constructs are not above the 0.85 level (Kline 1998). Convergent validity was assessed with a confirmative factor analysis: reliability statistics and standardized loadings (table 3) are above the respective 0.7 and 0.5 recommended thresholds (Kline 1998) except effort expectancy which is close. Congruent with Abdelaal et al. (2009), the participation construct was split in two: “social participation”, where members are socially involved in the community by interacting and helping each other to improve the community and its services, and “participation by sharing”, where members actively share their Internet connection with the community, making an effort to keep their routers always on and placing them to reach the public space.

Construct	Items	Reliability	Loadings	Mean	St.Dev.
Participation by sharing	PS1	$\alpha = 0.81$	0.78	4.10	1.22
	PS2		0.88	4.10	1.12
Social participation	SP1	$\alpha = 0.74$	0.73	2.30	1.25
	SP2		0.80	2.92	1.24
Utilitarian motivation	UT1	$\alpha = 0.78$	0.83	4.12	0.95
	UT2		0.72	4.10	0.91
Idealistic motivation	ID1	$\alpha = 0.78$	0.77	4.09	0.87
	ID2		0.82	4.18	0.91
	ID3		0.62	4.16	0.88
Social motivation	SO1	$\alpha = 0.78$	0.79	3.16	1.33
	SO2		0.78	2.87	1.08
	SO3		0.64	3.35	0.88
Intrinsic motivation	IM1	$\alpha = 0.73$	0.83	3.32	1.14
	IM2		0.72	3.62	1.10
Effort expectancy	EF1	$\alpha = 0.65$	0.84	4.15	0.83
	EF2		0.58	3.86	0.90
Concerns	CO1	$\alpha = 0.84$	0.81	3.22	1.31
	CO2		0.89	3.37	1.30
	CO3		0.71	2.99	1.30

Table 3. Convergent validity measures

## 5.3 Results

After establishing the validity of the measurement model, the structural model was examined. From the results emerged that two different types of participation are associated with different motivations.

Social participation is driven by social motivation, intrinsic motivation and effort expectancy. On the other hand utilitarian motivation, idealistic motivation and concerns do not impact it significantly. Model fit indexes (Chi-Square=118.82 with 98 df, 0.07 p-value, NFI=0.95; IFI=0.99; CFI=0.99; GFI=0.95; AGFI=0.92; RMR=0.045, RMSEA=0.028) meet recommended levels showing a good model fit (Gefen et al. 2000). The model explains 58% of the variance of social participation.



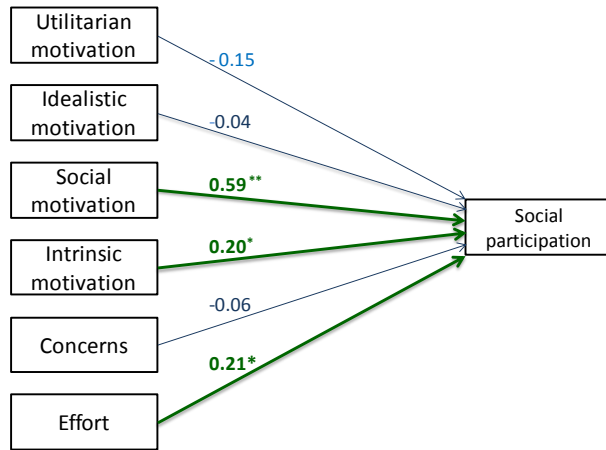


Figure 4. Structural model, social participation (significance: \*  $p < 0.05$ ; \*\*  $p < 0.01$ )

Participation by sharing is driven by idealistic motivation and effort expectancy, while intrinsic motivation impacts it negatively. Utilitarian motivation, social motivation and concerns do not have a significant impact. Model fit indexes (Chi-Square=111.73 with 98df, 0.16 p-value, NFI=0.95; IFI=0.99; CFI=0.99; GFI=0.95; AGFI=0.93; RMR=0.041, RMSEA=0.023) show a good model fit (Gefen et al. 2000). The model explains 26% of the variance of participation by sharing.

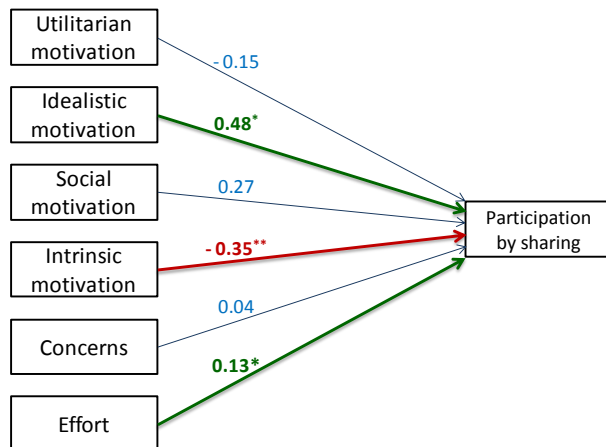


Figure 5. Structural model, participation by sharing (significance: \*  $p < 0.05$ ; \*\*  $p < 0.01$ )

## 6 Discussion

Two different types of participation in hybrid wireless communities emerge, influenced by different motivations: participation through social involvement in the community and participation by sharing Internet connectivity. This is congruent with the intuition of Abdelaal et al. (2009) that members can contribute not only by sharing, but also by taking time and expertise to help other members.

### 6.1 Social participation

Social motivation is expectedly the most important factor explaining social participation. Socially motivated members are highly involved in community aspects like interacting with other members or contributing to forums and blogs. However, social motivation and social participation in Fon are quite low (averages of 3.13 and 2.61) and lower than in pure communities. Possible explanations are that the

resource-oriented nature of the community promotes sharing above social aspects (Camponovo 2011) and that its larger size makes social ties between members less relevant (Olson 1971).

Intrinsic motivation and effort expectancy favor social participation. Members interested from a technical viewpoint get involved in exchanging know-how with peers, discussing technical aspects on forums and volunteering skills to help other members solve problems. The easier it is to participate and exchange knowledge through well-established channels, the more prone people are to do it.

More interestingly, utilitarian and idealistic motivations do not affect social participation. This is probably due to the fact that the goals of respectively getting or promoting free connectivity do not require interacting with the community and help each other.

## **6.2 Participation by sharing**

Idealistic motivation is the most important aspect explaining participation by sharing. It also is the strongest motivation overall (average 4.14). This is expected, as communities are built on the concept of reciprocal sharing: members who care about sharing and reciprocity logically put effort in sharing their connectivity to the community. Sharing is also positively influenced by effort expectancy, which is expected because the easier it is to participate, the more participation will occur.

Surprisingly, intrinsic motivation has a negative effect on sharing. Those motivations are lower than in pure communities. A possible reason is that pure communities are composed of more technically oriented early adopters (Rogers 2003), while hybrid communities have more pragmatic late adopters. In addition, Fon controls the technical solution, limiting experimentation and technical challenges.

Against our expectations, utilitarian motivation does not affect sharing, even though it is the second highest motivation (average 4.11). An explanation is that active participation is not needed to get free network access: Fon only checks that a member's router is on when he wants to connect, but not at other times or if the signal is truly accessible. Sharing does not provide additional benefits. Moreover, members do not use the community network frequently (with an average of 2 accesses in the last 12 months) due to the difficulty of finding accessible spots (e.g. limited range, offline routers) and the fast proliferation of 3G/4G networks with flat rate subscriptions. The motivation of free Internet access seems to be relevant mainly abroad, where other wireless technologies still cost too much.

Finally, sharing is neither affected by social motivation (it does not require social involvement), nor by security and legal concerns (the presence of a firm reassures members that such issues are addressed).

## **6.3 Theoretical implications**

So far, research has mostly analyzed motivations or participation in isolation (without studying their relationship) and in pure wireless communities. This study contributes to theory by extending research to hybrid wireless communities and by studying the relationship between motivation and participation.

In contrast with pure wireless communities, this study found a different mix of motivations where idealistic (average of 4.14) and utilitarian (4.11) are higher than intrinsic (3.47) and social (3.12) motivations. Pure community members are motivated more by intrinsic, idealistic and social than by utilitarian motivations. However, since these studies were conducted in different years and cultural contexts, it is not clear whether the difference stems from different community types, cultural differences or different maturity stages (pure communities came earlier and attracted technically-interested early adopters, while hybrid communities attracted practically-oriented late adopters).

With regards to the relationship between motivation and participation, two types of participations with different motivations have been found. Participation by sharing is more ideologically driven, whereas social participation is driven by social and intrinsic motivations. Effort expectancy facilitates both participation types. This may open new views on participation in virtual communities, where until now it was mostly regarded as one single indivisible concept.

## 6.4 Practical implications

One interesting finding is that although utilitarian motivation is high and crucial in attracting members, it does not result in higher levels of active participation, maybe because it is not required to get community benefits. This may be addressed by making benefits depend on participation. Then again, incentives like free connectivity and revenue sharing may simply not be attractive enough anymore. Members rarely use the community network as finding accessible Fon spots is not easy and 3G networks are now diffuse. In many areas, Fon has not a critical mass to offer ubiquitous coverage and members must often go to residential areas instead of being able to connect where they are. There are also range limitations: many routers do not reach the public space and members often have to stand on the street instead of comfortable places like parks or bars. Moreover, the diffusion of smartphones and the improved quality and availability of 3G networks with affordable rates makes Wi-Fi networks less attractive. Finally, low usage also makes revenue sharing less enticing, except maybe in attractive places like city centers. It would therefore be dangerous to rely on utilitarian incentives too much.

Idealistic motivation like reciprocity plays a fundamental role in inducing members to actively share their Internet connection. It is crucial for communities like Fon to keep this in mind, especially when defining partnerships with other operators. Partnerships are mostly judged positively by Fon members as they help expand the network, but only if reciprocal access rights are ensured. Otherwise, Fon members will feel disadvantaged and may cease to contribute. A similar problem may stem from the low usage of Fon, which may also reduce idealistic motivation: if members cannot find and access other Fon spots, they may feel they give more than they get, reducing their motivation to contribute.

Social participation also plays a key role in creating community spirit among members. It is mainly driven by social aspects and intrinsic technical interest. Fon is weak in both aspects as there is limited interaction among members - Fon messages and forums are seldom used - and technical aspects are controlled by Fon, leaving little room for experimentation. Accordingly, it may be beneficial to improve communication tools and allow higher user involvement in the evolution of the community.

Finally, effort expectancy plays a positive role in both forms of participation. Fon's hardware and authentication system appear to be easy to use. However, it is not easy to find working Fon spots due to offline routers, limited signal or misplacement on the maps. Improvement of search tools, signal strength of Fonera routers and better education of members in how to install them may be useful.

Participation in hybrid wireless communities seems to be more passive than in pure communities. In fact, most members are actively involved only at the beginning when they set up their router, decide where to place it and whether to enhance the signal with an antenna. After this, the router mainly runs by itself. Social participation in general and usage of other Fon Spots is low. While members may not mind continuing sharing, as it does not require them any effort, this does not promote their involvement and makes them more passive. As a result, their participation may not be sustained over time limiting the potential expansion and long-term sustainability of the community.

## 7 Conclusions

This paper analyzed motivations and barriers influencing participation in the Fon hybrid wireless community, based on a survey of 268 members.

In contrast with pure wireless communities, where intrinsic, idealistic and social motivations play a key role, utilitarian motivations are important together with idealistic motivations. Participation in hybrid wireless communities is also different: members are less actively involved. Most users put effort in the community when they join, but just let the router run by itself afterwards. Moreover, other Fon spots are not frequently used, which may reduce both the perception of utilitarian benefits and idealistic motivation, eventually further reducing their participation as time passes.

With regards to participation, this study identified two distinct forms of contributions by members: social participation by interacting with and helping other community members and participation by sharing connectivity. Each type is driven by different motivations: social participation is driven by social motivation, technical interest and effort expectancy, whereas active sharing is driven by idealistic motivations (such as reciprocity and altruism) and effort expectancy. Surprisingly, utilitarian motivations do not have a significant impact, even though they are high and play a crucial role in attracting members when deciding to join the community. Also, security and legality concerns are insignificant as members seem to be reassured by the supporting firm.

These findings entail a number of practical implications. Firstly, it may be dangerous to only rely on utilitarian incentives: they may allow the community to attract members, but may not be enough to sustain their participation especially if other technologies develop to provide appealing alternatives to satisfy the same needs. It is also important that typical community values like reciprocity are respected, especially when designing incentives and negotiating partnerships. Furthermore, it may be beneficial to nurture social and intrinsic motivation by improving communication tools, fostering a sense of community and promoting member experimentation and involvement. Finally, it is important to continue ensuring ease of use and improving ease of finding accessible spots by enhancing search tools and improving signal strength of routers.

This paper has some limitations. It analyzed one wireless community and the sample mainly consisted of Swiss members. We cannot rule out that different contexts (communities, cultures and periods) may yield slightly different results. It would therefore be useful to extend this research to other contexts.

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