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Abstract

Locations-based services are a promising revenue source for the market players in mobile business. A critical parameter for accruing revenue is the applied pricing strategy. This paper proposes the introduction of bundle pricing in the market of location-based services and describes a research model that will be used to test its applicability and indicate its robustness. To motivate the proposed research, the key players of location-based services' market are identified and the main theoretical results on bundle pricing are briefly presented. Then, the proposed research model is discussed to indicate how economic theory's results may be applied in a real market case.

Keywords: Mobile services, location based services, pricing strategy, bundle pricing, experiment, focus groups.

1   INTRODUCTION

Despite that global economy has reached an unstable situation and investments have being slowed down, mobile business evolves dynamically (Kalakota & Robinson 2002). The mobile communications market enables this evolution as the key commercial and technological drivers are aligned for growth (EITO, 2001). Researchers agreed that one of the lessons learned from e-commerce was that strong business models must support innovative customer solutions (Kalakota & Robinson 2002). A critical factor for business models' success is the applied pricing strategy that enables the key players to accrue revenue.

In the realm of technological and business developments, high speed Internet access facilitated by the rapid deployment of so called 2,5G are expected to foster the rapid adoption and diffusion of content and context specific services. These processes are anticipated to gain even more momentum with the roll out of 3G services that is already taking place throughout Europe. Location based services are expected to become a promising value adding business area. Location based services may exploit Internet content and mobility attributes. Mobility allows for services customisation or even personalisation, in terms of position and time (Ahonen & Barrett, 2002).

Mobile communications market sets a new dynamic environment with many business opportunities for both incumbent and new players (Constantiou & Polyzos, 2002). In case of location based services the key players in the value chain of service provision are:

- **Mobile Operators** provide the network infrastructure and traditionally control the customer base of mobile users. Recently, operators have started offering location-based services to mobile users as a value adding activity to their voice services. They aim at diversifying their service portfolio in order to increase their ARPU (Average Revenue Per User) as well as attract new mobile users, and achieve lock-in of existing ones. They control mobile value chain and transact with every involved party, at least in terms of communication or network service provision.
- **Content Providers** offer information services, or digital goods (e.g. news, video clips, music). Their main business activities are development, or management of content that is usually delivered to Internet users. Moreover, they personalise services in order to address specific users' requirements. They are not intensively active in mobile communication market and in most of the cases they do not directly transact with mobile users. They sell their services in aggregate level to various market players (e.g. mobile operator, content aggregator, wireless application service provider) that in turn resell it in different versions to mobile users.
- **Content Aggregators** have recently emerged in the mobile communication market. They aggregate or integrate existing content for the provision of customized or personalized services to mobile users. Thus, location based services that mainly involve content aggregation is a promising business opportunity. Content aggregators may directly transact with mobile users in service provision. They also transact with content providers to access their information databases and buy content.
- **Wireless Application Service Providers** offer technological solution in terms of software or hardware necessary (e.g. portal) that is also a prerequisite for the provision of location based services. In particular, they enable mobile users' access to location-based services. They may become competitors of content aggregators in case they decide to adopt their business activities. They directly transact with mobile users in order to provide their services. They also transact with content providers and aggregators as well as mobile operators.
- **Mobile Users** generate the demand for location based services and constitute the revenue source for commercial exploitation of location-based services. They may by further classified into individual users and business-institutional users. The main difference between these groups is the propensity to consume mobile or location-based services and consequently their willingness to pay.
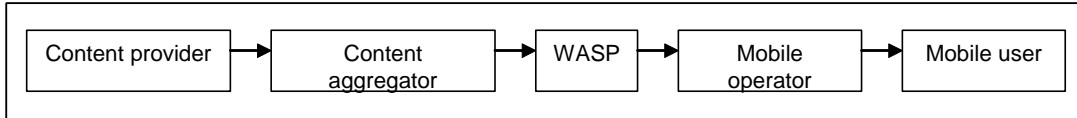
Figure 1: *The value network for the provision of location-based services including the necessary business activities. A company may span on one, or several activities.*

Moreover, **device vendors and manufacturers** are not directly part of the value chain of location-based service provision but play a critical role because the technical characteristic of mobile devices may enable, or impede the deployment of certain location-based services (e.g. Bluetooth). At the current stage that mobile operators dominate the mobile communications market they provide devices compatible to the technological evolution of mobile networks. In a different market setting, where there might be competition from other market players (e.g. content aggregators) different devices might be provided (i.e. compatible with different types of access technologies).

The pricing strategies adopted in bilateral business relationships affect the revenue flows in a business model (Constantiou & Polyzos, 2002). In this paper, we focus on pricing schemes for location-based services. We investigate individual mobile users' willingness to pay and derive an optimal pricing strategy that can be adopted from any player involved in provision of location based services. We propose a research model, which combines qualitative and quantitative methods.

Serving this objective the paper is structured as follows. Section 2 describes the theoretical background on pricing and emphasises on bundle pricing. Section 3 presents the proposed research model, the research methodology and the research objectives. Finally, section 4 discusses the current stage of research.

2   THEORETICAL BACKGROUND

2.1   Pricing strategies in mobile communication networks

From an economic perspective optimal pricing schemes for location-based services should be based on the specific preferences of each mobile user. However, the utility function of each mobile user is different and since there is no standardised service to value, it is difficult to use classical economic theory to propose a pricing strategy. The personalisation aspect of location-based services leads to different utility functions based on each mobile user's preferences. In this context location based services cannot be considered homogenous and therefore an aggregated demand curve cannot be used (Varian, 1992). Economic theory proposes first-degree price discrimination in order to address each mobile user's utility and consequently its willingness to pay as well as extract the consumer's surplus. This involves a complicated pricing strategy where a different price is set for the location based services each user buys (Varian, 1992). However, the high complexity and implementation costs of such strategy render it obsolete (Milgrom & Roberts, 1992).

From a network perspective, pricing strategies in mobile communications market are based on the implicit assumption of limited network resources (Gupta et. al. 1999). In particular, the applied pricing schemes interpret information services as network traffic sources (Shenker et al. 1996). Pricing schemes are mainly based on time units that the mobile network was occupied by the service's traffic, or the volume of traffic generated (e.g. megabyte) (Laffont & Tirole, 2000). Moreover, a commonly used pricing scheme for SMS and MMS is unit based.

Mobile operators have recently started to investigate mobile users' preferences and mainly adopted flat pricing (e.g. subscription to the service). Moreover, in order to launch new services, for a short period, they may offer them free of charge. Flat pricing has been used by ISPs when introducing new services along with versioning of network services. In particular, they offer different classes of

services (e.g. premium, "best effort") (Cremer, 2000) and segment the market to users that have network service quality requirements and simple "web-surfers" (Clark, 1996 & Greenstein, 2000). However, these strategies do not seem to accrue revenue for the key player in the long run. In particular, flat pricing schemes combined with fixed service offers and high churn rates may lead to price wars in a competitive environment (McKie Mason & Varian, 1996). In the Internet service market many ISPs have recently engaged in a price war for Internet access services and complained for working below profit margins or even below operating costs.

Furthermore, a single location based service (e.g. information service), has low value compare to the high implementation cost of per unit pricing (e.g. various measurements and monitoring of each user's request). Micro payment is a possible solution but in order to be adopted and fully exploited by mobile operators or other key players, further infrastructure investment might be needed (Costello, 2002 & Krueger, 2001). For example, the deployment of mobile agents either in the operators network, or in the mobile device of each user might be necessary to deal with the dynamic nature of micro payments' schemes and do "not disturb" the mobile user (Edell &Varaiya, 1999). Moreover, a third trusted party, or a clearinghouse may be needed to monitor the micro payments and provide billing services.

The specific attributes of mobility underlined in location-based services, along with the need to derive a more profitable pricing strategy are the main motivations for the research work proposed in this paper. Location based services take into account the "whereabouts" of the individual using them. The utility derived from the services depends on the location of the user. For example when travelling to the airport information on possible delay in the departure time, or high traffic on the road, may be valuable, whereas this information is worthless otherwise. Similarly, advertisers may choose only to target people within a certain distance by the offering of a specific outlet. In this research we seek to integrate the concept of pricing with location in order to identify optimal bundles of services. A bundle may be a mix of both location sensitive and non-sensitive services. In particular, by commercially exploiting the attributes of mobility in location based services as well as the existing economic and marketing strategies for services pricing in mobile market, a new pricing scheme that involves bundling of services and market segmentation is proposed. We believe that bundle pricing is the optimal scheme for location based services since it allows commercial exploitation of specific mobility attributes (i.e. location awareness). Moreover, by exploiting the personalised value and the positive externalities of location based services through bundling with other mobile services, a wider adoption of the latter services may be stimulated.

2.2   Bundle pricing and market segmentation

Bundle pricing is different approach that by-pass both theoretical and practical complexities of pricing for a single mobile user, or a single service. Bundle pricing has many potential benefits, including cost savings in production and transaction costs and sorting consumers according to their valuation (Salinger, 1995). When consumers' valuations for two goods are negatively correlated, bundling can increase seller's profits (Hanson & Martin, 1990). In addition if products are positively correlated but not perfectly, bundling may still increase the seller's profits. Moreover, bundling can be used as a device of price discrimination when products are offered in mixed bundles (e.g. offering both the complete set of bundles and subsets). Bundle pricing schemes mainly involve flat prices (Shapiro & Varian, 1998).

There is a lot of research on bundle pricing in the Internet. Many researchers analysed intangible goods (e.g. software) and information services (e.g. online news). They mainly focused on the role of bundling for a monopolist, or a player with high market power and indicated the conditions for efficiency increase or profit maximisation (Schamalensee, 1984, McAfee, McMillan & Whinston, 1989). Bundle pricing is recommended from both economists as a profit maximisation strategy under specific conditions that are discussed in this section and marketing researchers as a way to exploit positive externalities of some services and increase switching costs for the users. In case a service exhibits positive externalities, at an introductory stage it makes "good sense" to deploy it through

bundling. For example most phones were SMS capable before market demand made obligatory to add this functionality to the devices. Bundling enables creation of a critical mass of service users. Bundling may increase the market power of the first mover. Moreover, bundling facilitates the introduction of new services that a user may be interested to in the future (e.g. Microsoft office that includes various programmes). In such case the user may decide to use a new application that is bought bundled with others because it is perceived as free of charge (Shapiro & Varian, 1998).

The most systematic work on understanding the role of bundle pricing for information services, or intangible goods was made by Bakos and Brynjolfsson (1999). This paper offers insight on the use of bundle pricing as a tool for market segmentation. Despite the fact it is mainly focused on a monopolistic market, in a latter paper (Bakos & Brynjolfsson, 2000) indicated the use of bundle pricing in a competitive environment. They proved that bundling of information goods can significantly increase profits even when the valuations of individual goods are positively correlated but not on the same variables. The valuations for all goods may be highly correlated but not on the same underlining variables, which can be thought as characterising different market segments.

In this context the market can be segmented according to the underlining variable that may be interpreted as mobile users' types. Submarkets can be identified according to the different values of the underlined variable so that mobile users' demands are independent. In such case bundling increases profits, reduces deadweight loss and mobile users' surplus. This type of segmentation can be generalised to multiple underlining variables (e.g. sex, age, educational background).

Based on the theoretical results of bundle pricing and market segmentation, the proposed research model aims at applying them in the market of location based services and test their robustness. Mixed bundle strategies will be used and will include:
- Several bundles with subsets of the available location-based services
- Bundles that enable screening mobile users into different market segments and allow price discrimination by reducing the importance of idiosyncratic factors that add noise in the valuations for individual services
- Incentive compatibility to prevent high value mobile users of mimicking low value ones and strategically modify their behaviour to pay lower prices.

There is an asymmetric information problem for the key player offering location-based services because of mobile user's unknown type and his/her ability to modify his/her behaviour in order to pay a lower price that leads to efficiency loss. In particular, in order to implement incentive compatibility the key player should distort optimal bundles by deteriorating some of them (e.g. exclude a service category that is popular for high value users). In such case there is an efficiency loss for the segment that is excluded from some services and surplus is not completely extracted from some mobile users with high valuations (Laffont & Martimort, 2002).

Finally, in terms of competition bundling increases incumbent player's perceived market power in terms of single-service competitors selling similar services (Bakos & Brynjolfsson, 2000). The resulting equilibrium can be less profitable for potential entrants and can discourage entry in the markets where the incumbent player is active, even when the entrants have a superior cost structure or quality. This is an encouraging result for any market player that will take the role of first mover in location-based service market and managed to create lock-in.

3   RESEARCH METHOD AND METHODOLOGY

The purpose of this research is to introduce bundle pricing in location-based services' market. Starting with an exploratory approach, mobile users' most popular services will be identified and broad market segments will be defined. Services will be then bundled according to users' preferences and offered using flat pricing to the different market segments. Subsequently, the bundle pricing will be assessed in terms of profit maximisation for a key player in a competitive environment. By applying existing theoretical results on bundle pricing we expect to obtain empirical evidence on its applicability and

robustness in the specific market context that is a promising empirical field for research. In addition, we expect to offer insight and practical recommendations for any market player that offers location-based services.

The empirical testing of bundle pricing and market segmentation for location based services will be based on the research model proposed in this paper that includes three phases. The services to be investigated are mainly information ones. In particular, they relate to the physical location of an individual and offer either information regarding its personal preferences (e.g. information on available recreation services in a specific location), or regarding the physical surrounding (e.g. maps, directions). Moreover, interactivity of users in the same physical location will be assessed by services that relate to establishing contact and allowing revelation of user' location and preferences to other users. In the first phase, research will focus on defining the various mobile users' groups, their willingness to pay and the most popular services. In the second phase, different bundles of mobile and location based services offered in flat pricing schemes will be assessed through an experiment and market segments will be redefined. In the third phase, service bundles and pricing schemes will be tested in a trial in terms of robustness and profit maximisation of the market player involved. Figure 2 offers a schematic representation of the proposed research model.
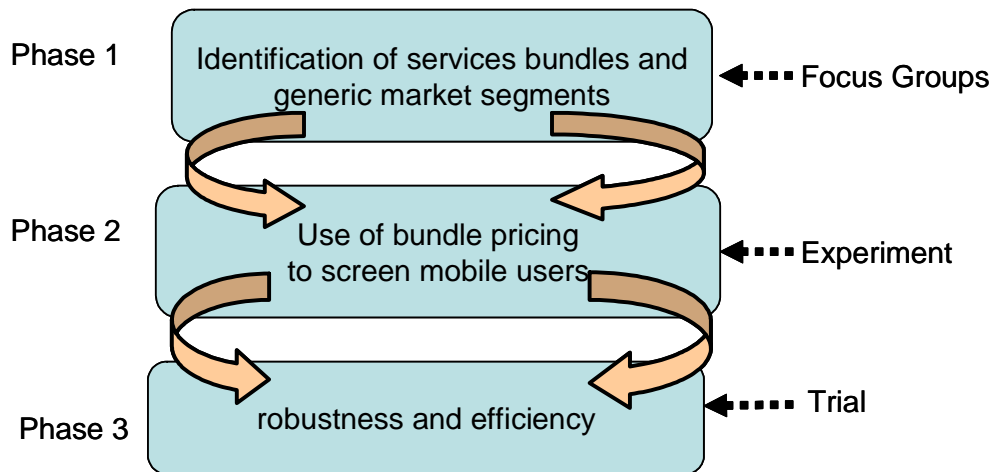

Figure 2.   The proposed research model.

The proposed research model combines qualitative and quantitative research. Qualitative methods will be used to offer information on the different characteristics of mobile users and initial indications of the most popular services. Then, through quantitative methods bundle pricing will be used for market segmentation and assessed in terms of robustness and profit maximisation.

In the first phase, focus groups will be used (Morgan, 1988). Four groups of 8 participants will be formed according to criteria of age, sex and experience in use of mobile services. Focus groups will offer initial indications on a broad categorisation of segments and on the most preferred services. In particular, the services' portfolio of a national mobile operator will be used in the focus groups where users will be able to access services through 3G mobile devices. Moreover, the participants will be interviewed to investigate their willingness to pay.

In the second phase, an experiment with 50 participants will be conducted. The experiment's duration is set to four months. GPRS compatible mobile devices will be granted to the participants in order to be able to access the services offered by a national mobile operator. Each device will contain a fixed amount of money to be spent in communication, data, mobile and location-based services. Thus, although the participants are not using their own money there is a real element of budget allocation and financial loss (Smith, 1994). This experiment will be conducted in close collaboration with the mobile operator.

The first month mobile and location based services will be provided separately and free of charge, in order to observe participants' preferences for specific services and identify market segments. Based on these indications, in the next three months, services will be offered in bundles of various combinations. Services bundles will be charged using flat pricing on a monthly base. Prices will reflect possible costs incurred (e.g. for acquiring and aggregating content). Moreover, bundle pricing will be used as a screening mechanism that enables users' self-selection. Thus, it is expected to induce mobile users to reveal their preferences towards specific bundles as well as their willingness to pay.

The experiment is expected to elaborate and specify the broad market segmentation made according to the initial phase's results. In addition, the participants will be part of two different social groups chosen according to working place criteria (e.g. employees or students), and will be able to interact with each other when using the mobile services, since we expect users to learn from each other. In addition, we anticipate that some mobile services exhibit positive externalities. Thus, a pocket of users with a high likelihood of engaging in interactions (i.e. it is difficult to test the usefulness of for example SMS services without at least two test persons) is warranted. After the experiment the participants will be interviewed in order to reveal further information on the attitudes and behaviours towards mobile and location based services.

In the third phase a trial including 200 participants will be conducted. During the trial participants will be able to access mobile and location based services only through specific bundles. The trial will last 3 months and participants will have to pay on their own when buying services' bundles. This trial is expected to indicate robustness and efficiency of bundle pricing for mobile and location-based services. Moreover, the screening properties of bundle pricing in terms of revealing mobile users' preferences and market segmentation will be reassessed.

The research framework includes three phases in order to offer flexibility and allow adaptation to the technological and market evolution on location- based services. We aim to explore and measure usage of services bundles as well as willingness to pay, as users become more experienced with the services and externalities effects emerge. In this context, theories of innovation diffusion and bundle pricing will be tested through regression analysis to empirically corroborate theoretical expectations.

4   CURRENT STATUS AND PLAN

Despite their high significance location based services have not been commercial exploited and widely diffused yet. We believe that the better understanding of mobile users' needs and attitudes, as well as their willingness to pay for such services will offer useful insight on both the practitioners and the academics. Location based services may become one of main enablers for mobile services' market evolution.

To date, the research is at the second phase. Focus groups offered initial indications on adoption and diffusion of mobile and location based services by mobile users, as well as identified some broad market segments. Moreover, the key attributes that enable or impede location based services wider adoption have been identified. Using the feedback from focus groups, the experiment has been launched. The experiment is part of the Mobiconomy project[1], which main goal is to describe, analyze and offer practical guidelines of the design and implementation on location-, situation- and time-sensitive services. The execution of the project results in the development of strategy for a scalable implementation of desirable, viable and sustainable location based services. The partners in Mobiconomy are all key players in the provision of mobile services and have strong but complementary interests in the study of this emerging market.

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