Value-based methodology to analyze communication services

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***Abstract*—The objective of this paper is, first, to present a general view on the provision of communications services, and secondly to introduce a formal methodology to analyze the services. We start by identifying the key actors in the whole ecosystem: customers and owners. Service provider's task is to satisfy their needs in the best way. The model required to analyze the service consists of three main tasks: 1) how services are able to create value to users, 2) how users behave in real situations, and 3) how the results of the two tasks can be combined into one holistic model. As a result, we are able to formally analyze how different changes, like improved user interface, effects on the usage of the service, on the value it creates for the user, and finally on the business of service providers. The analysis offers a rational basis for designing and optimizing network terminals and services.**

***Index Terms*—Network service, perceived value, pricing, user experience, user behavior**

I. Introduction

THE provision of communication services is a complicated task that involves several players. Despite the importance of the issue there is hardly any analytical model available to make systematic decisions about the overall service design, or to analyze the effects of various parameters to all players. This paper presents a methodology to satisfy this need. We start with a framework that describes the main interactions between customers, business, and technology as illustrated in Figure 1.

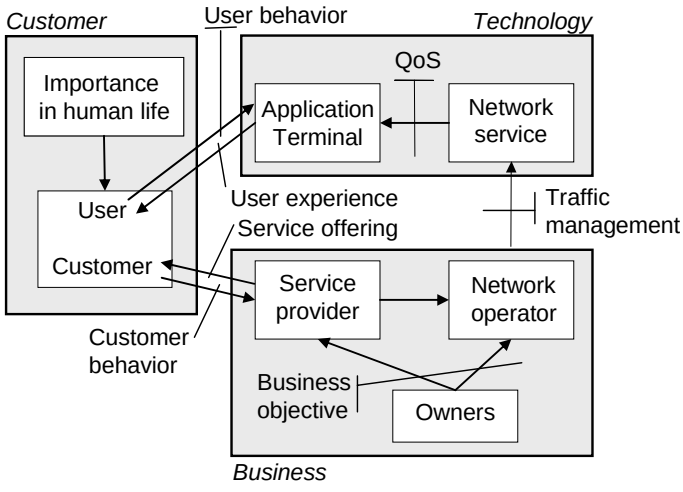

Fig. 1. Interactions between different players in the service provisioning.

The framework includes two actors that have independent aims: customers who want to maximize their happiness, and owners who want to maximize their income. We may even claim that everything else is a consequence of these, somewhat conflicting, aims. Services are offered and networks are built only if service providers have opportunity for profitable business and customers have possibility to obtain real benefits. Particularly, because service providers locate quite literally between owners and customers they have to understand the needs of both of these parties and design their service offerings to satisfy both of them.

In this framework, user and customer mean different roles of a same person: 1) Person as a customer selects the service provider and which one of the offered services to buy. 2) Person as a user selects and uses applications and decides how long and how much they are used. Customer and user may also be separate persons or entities (e.g. employer and employee). In this paper we concentrate on the user behavior part of the process. That means that we primarily assume that there are customers that are able to use certain applications. The result of the analysis can then be used to assess whether customers are, in the first place, ready to buy the service, and whether they are satisfied enough after using the service.

Any commercial company shall make their operational decisions based on well-defined business objectives. A typical objective is to maximize Return of Investment (ROI). In this paper we concentrate on the revenue side of the business objective. Costs can be calculated using various existing methods.

The main tasks in the communication business are:

1) Service provider: Deals with the customer relationship and designs service portfolio, pricing and marketing.

2) Network operator: Builds and manages the network and divides the resources between customers and applications.

These tasks can be performed in the separate parts of the same general communications company or in the independent companies. Although these tasks, as well as the whole framework, may appear trivial, the relationships are complex and extremely hard to analyze.

We use the framework to analyse changes in the customer-technology-communications company ecosystem. First we setup the current state including the technology, service offerings, and user behavior (like service usage, Average Revenue Per User (ARPU)). Then we change something in the system and analyze what are the effects on the users, on the technology, and on the business of service provider and

network operator. This analysis requires a holistic view and holistic model that we describe in the rest of the paper. The paper is organized as follows. Chapter 2 provides inside to the most important decision of a communication company, namely, pricing. Chapters 3 and 4 addresses the issue how to create value to users and how user experience impacts the perceived value. In chapter 5 we present a method to calculate the perceived value. Chapter 6 presents a model that depicts how users behave based on the created value. Finally, in Chapter 7 we outline an example case related to the use of a mobile terminal. This paper does not cover any provisioning cost or amortization issues as they are only internal issues of the communication company and do not interact with other players of the ecosystem. Their impact to the business of a communication company is analyzed using existing tools and methods.

II. VALUE-BASED PRICING

When pricing is looked from a technical perspective, the outcome is often in an obvious conflict with the predominant opinions and models in contemporary economic sciences. Let us briefly consider the nature of this conflict.

The so-called cost-plus pricing is, historically, the most common pricing procedure because it is easy to justify and understand. It also used to be the dominant model in papers dealing with the pricing of communication services (see, e.g. [1]). In the cost-plus pricing, every product or service should yield a fair return over all costs, fully and fairly allocated. In theory, it is a simple guide to profitability. However, cost-plus pricing is particularly difficult in a service business where almost all of the cost are fixed and must somehow be allocated to determine the full unit cost. Because these allocations depend on volumes and volumes depend on price, the cost-plus pricing leads to the flawed circularity and mediocre financial performance.

According to Nagle and Holden, the main options for pricing strategies to achieve the service provider's business objectives are (Chapter 1 in [2]):

1) *Cost-based pricing*, in which the process of defining prices goes in the following order: Service → Cost → Price → Value → Customers. This means that pricing depends somehow on the used resources to reflect the cost caused by the provision of each specific service. Cost-plus pricing is one sub-option in this category.

2) *Value-based pricing*, in which the process goes in the following order: Customers → Value → Price → Cost → Service. This means that pricing tries to primarily reflect the additional value obtained by customers in the current competitive situation. The price is thereby not set to cover the costs but the costs are incurred to provide only services that can be priced profitably.

Solving the problems of cost-based pricing requires completely reversing the price setting process—starting with the customers. For customers the essential motive to purchase is their perceived value from the purchase, not the cost to produce the product or service. Thus the target price should be based on estimates of value for the customer and the portion that the service provider can expect to capture in the current competitive situation.

Another common confusion of pricing is the relationship between pricing strategies and pricing mechanisms. A service provider can execute both strategies using various pricing mechanisms, like unit-based pricing where the price directly depends on the used resources (volume, time, or number of pieces), flat rate pricing where pricing is independent of used resources, or any variations of these options. Thus the four main options can be identified: cost-based unit-pricing, cost-based flat pricing [3], value-based unit pricing, and value-based flat pricing.

In the value-based pricing the service provider's goal is to maximize the value it creates to its customers and then to use appropriate pricing mechanisms to capture as much as possible profit from the created value [4]. This value-creation issue is the least studied part of the whole framework depicted in Figure 1. Still, the failures of communication services are often related to this part of the model.

III. CREATING VALUE TO USERS

Our methodology follows the general principle that the users will use a service or an application if it creates (positive) value for them [5]. A major issue thus is how an offered service can create value to users. Clearly this depends on many things. The activity that the service is enabling should be somehow important in the person's life, the user experience should be good enough, the pricing must be reasonable, the offered service should outperform the other related services, and the benefit has to be larger than what other options for spending time and money are able to offer. We consider next more detailed the elements of value and present a model for the perceived value of a service session.

The basic criterion for any value creation is that the activity that is enabled by the offered service must be important to the user. According to Maslow [6], as humans meet 'basic needs', they seek to satisfy successively 'higher needs' in the hierarchy of needs. The importance of activities in person's life thus range from basic needs of physical health (earning money for food or helter, creating security, etc.) and emotional health (social interaction, love) to more intellectual needs of desire for information and entertainment.

In order to be important the activity must be relevant in the person's everyday life. A good measure for the importance is the total consumption of time with the activity. Clearly, if a user is willing to spend his limited time to something it must be of some importance to him. But the time consumption is not the whole picture. One minute with some activity can be more important than another minute with some other activity, for instance, a video call may be more important or beneficial per minute than a voice call. The question is then how much happiness the activity generates to the person's life, not just during the service session but also afterwards. E.g., a great

rock concert may excite happy memories long after the concert. In our methodology the time consumption together with the level of happiness forms the basis for the perceived value.

The recent studies in the brain science have shown that happiness can be objectively measured and that what people say about their feelings also correspond their actual brain activities [7]. The surveys have shown that social interactions are the most important sources of happiness whereas commuting, working, and house works brings least happiness [8]. An important service is thus able to decrease, or to help in, low happiness activities and to increase high happiness activities.

Another way to look at the importance is to consider the willingness to pay for an activity. The rationale is that if a customer is willing to spend his limited money to some activity it must be important. The more he is willing to pay per minute the more important it obviously is. We need, however, be careful when interpreting the available price information, because the market situation can have a considerable effect on the prices: with a monopoly, a service provider might seize an inordinate share of the perceived value.

In order to evaluate the importance of the service, it is necessary to take into account what share of the activity the offered service is able to satisfy and how it relates other options the user has for a specific activity, like reading news via a mobile terminal. For instance, the same news might be received through newspapers, radio or TV, often with zero marginal cost. Besides, if the activity is not mandatory, the same time can be consumed for many other purposes, like listening music or reading a book. The user experience with the offered service is the key in these aspects.

IV. User Experience of Service

The user experience relates to everything that user experiences while using the service [9]. A fluent and carefree experience is what users seek, whereas a confusing and tangled experience is what users often get. Even if only one phase of the service causes major irritation, all the positive experiences can be destroyed, and the user will cease to use the service.

The question here is how changes in the user experience of the offered service or application impact the value that the user perceives from the service. By offered service we mean here the part of service provider's offering that is able to satisfy one type of need; e.g. to make voice calls or to read news. A service session is one instance with the service, i.e., a phone call or reading a news item. Next we consider user experiences of one service session in three parts: benefits, costs, and successes. The primary principle is that a user gets value from a successful session and the value of the session is equal to the difference between benefits and the opportunity cost of the session.

A. Benefits

Benefits relate to pure positive aspects of the service. We are interested here in the relative benefits of service sessions that originate from differences in user experiences. For example, how much more beneficial is a news item from otherwise similar but 50% larger phone screen? What is the average benefit of a piece of music in a selection of 1000 pieces versus 2000 pieces? 1-megapixel photo compared to a 2-megapixel photo? An excellent video stream (Mean Opinion Score (MOS) = 5) compared to a satisfactory video stream (MOS = 3)? The answers to these questions may vary from 5% to 30%, and depend on the expectation.

According to the Kahneman et al. [10] the users evaluate their benefits relative to a reference level (usually their status quo or expectation due to marketing) so that the gains are by factor of about 2-2.5 lower than losses [11]. This implies that below the reference the perceived value decreases rapidly and above the reference level the user experience is "good enough" (e.g. MOS = 4) and further improvements do not significantly increase the benefits; customer's rationality is bounded [12]. The reference level is, however, not stable. "Good enough" is only good enough for the present and the criteria for it may change. New innovations emerge, marketing creates new expectations, and the charm of novelty degenerates. Psychological research has found that despite the objective gains during years the subjective benefits are relatively stable over time [13]. This means that the perceived value from a gain will vanish along a time and maintaining of the perceived value requires continual new gains.

Another issue that effects on the total benefit of a service is the penetration of the service. There are many fundamental services (e.g., voice, e-mail, and text messaging) that become really useful only when they are used by a great majority of the whole population. For instance, even if one person in a group is not using e-mail, e-mail cannot be applied efficiently for internal communication. This issue can be modeled by KK-law that describes the value of the group forming services as a function of service penetration in the society [14].

B. Costs

In order to obtain benefits from a service session the user has to invest some time and money for the service. The monetary cost is the perceived cost due to the pricing scheme. E.g. in the business segment if the company pays the bill, the perceived value is only a fraction of the actual price as the pricing affects only slightly to the user behavior. Similarly, if the user does not know the price, the perceived cost might be higher or lower than the actual monetary cost. Note particularly that with a monthly fee the marginal monetary cost of a session is zero.

The time consumption for the service often is more significant cost factor than the paid price. The cost originates from the principle that if a user spends his time to the service he cannot use the same time to some other activity which would bring net benefits for him. Thus he loses the potential net benefits of this best alternative. This is called the

opportunity cost for the service, or simply the value of time, for instance, 0.15 €/minute.

The opportunity cost has also other dimension than time: the effort needed to accomplish the task. The effort level describes, on the one hand, the irritation or trouble with the service and, on the other hand, the attention level needed during consumption of the service. If everything is working in expected manner, the effort level is by definition one. If the usage is irritating, the required effort level is above one, whereas if the user does not need to pay full attention to the service, the effort level is below one. Because the opportunity cost is the product of time and attention level, a 10 second task with effort level three is equal with a 30 second task with effort level one. User studies can be used to find the models for the effort level [15].

The opportunity cost is calculated from the usage sequence of the service session. The usage sequence includes all steps that relates to the service item. Each step is specified by its duration, effort level, and probability. Figure 2 shows a typical usage sequence for reading a news page. First, the user takes the terminal and opens the application, then navigation and downloading steps alternate. After downloading the actual news page, the news is read. The final step in a normal usage sequence is the backward navigation to a point where a new service session may begin. The usage sequence has an additional step due to failures which cause extra time consumption and irritation. The opportunity cost of a service session corresponds the area of the usage sequence (=time * effort).

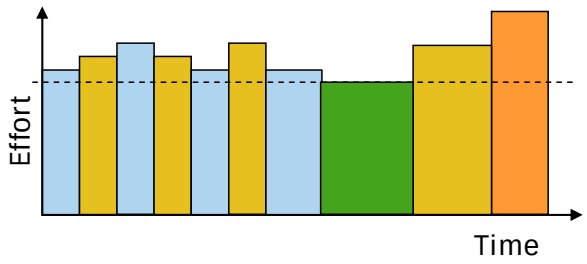

Fig. 2. Usage sequence for browsing to a news page, reading it, backward navigation, and extra time and irritation due to related failures. Dashed line represents expected effort.

C. Success

The user perceives value only from successful service sessions. For example, a successful video call requires that caller's terminal supports video calls, his network is available, network supports video calls, there is appropriate connection to the receiver's network, receiver's network supports video calls, receiver's network is available, receiver's terminal supports video calls, and that the receiver is available. In some cases the caller will reattempt after an unsuccessful attempt. Reference [16] provides a model to analyze perceived value due to success rates. The basic idea is that the more valuable the session, the more reattempts the user will make. A rational customer will make a new attempt if and only if the expected value of the reattempt exceeds the total cost related to the attempt. Higher expected value or lower reattempt cost thus means that the user will try more often and also will get the attempts through more often.

V. Calculating Perceived value of service

The term "perceived value" refers here to the total savings or happiness that the customer receives from the service. Its building blocks are the importance of activity, user experience of the service, and user's other opportunities. The perceived value does not directly depend on the price of the service or any costs to provide the service. In order to concretize the term, we have to start with something concrete. One possibility is to utilize Gross National Product (GNP) divided equally among all the minutes inhabitants are awake. For instance, if we take Finland with GNP of 150 billion €/year and population of 5.24 million [17], the result is 0.077 €/min. Then if we deduct the share of taxes (45% in Finland), we end up with a value of 0.042 €/min or 2.5 €/h. This could be said to be the average monetary value of time. Furthermore we may look what consumers are willing to pay for spending their time: coffee in café 2.5€/30min = 0.083 €/min, movie 7€/120min = 0.058 €/min, mobile calls 0.069 €/min, holiday week 500€/6720min = 0.074 €/min. All very close.

We may also ask: what is the price for which you are willing to spend one week with doing absolutely nothing (no entertainment, no contacts)? The answer could be 0.30 €/min = 2142 €/week (excluding sleeping); in any case, it likely is much higher than the simple monetary value of time. These numbers, 0.04, 0.07 and 0.30 €/min, defines roughly a scale to which we can position the perceived value of different activities and service sessions.

So what does happen when a new service session is offered to a user in this framework? This process is illustrated in Figure 3. Let us denote the average value of life by V_0 (in €/min scale, compared to pure nothingness). First he needs to make a decision either to accept or reject the service session. If the session is accepted he has to sacrifice (due to limited time or money) some other activity and all its benefits, and the value of life drops to V_1. On the other hand, he does not have to pay for the sacrificed activity any longer. As a result, the value of life would be V_2. But he also releases the time spent to the sacrificed activity and has now the option to use that time to something beneficial. The free time has an option value to the user. (Situation is similar to a person who keeps money in cash even if there is an option to get better value from an investment.) The value of life in this imaginary state is V_3. When the user starts the service session, he first loses the option value of time and drops back to level V_2. But then he obtains all the benefits of the offered service and reaches value V_4 (which also includes issues related to imperfect user experience discussed in the previous chapter). Further, if he needs to pay for the service, he has to deduct the price from the obtained value. The final result is an average value of life during the service session, V_5.

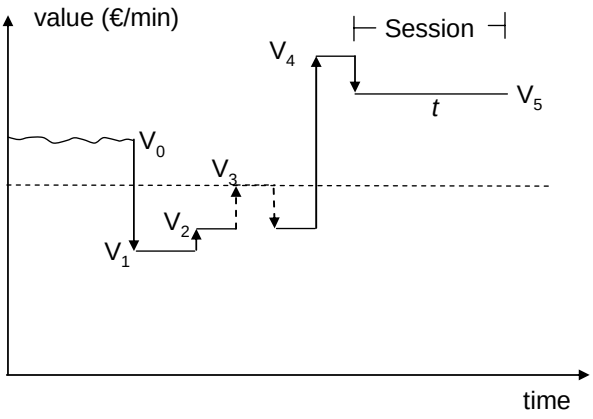

Fig. 3. Different value levels related to a service session.

Now we can define some the key terms as follows:

- Benefit of the offered service = V_4-V_2 [€/min]
- Maximum readiness to pay = V_4-V_3 [€/min]
- Opportunity cost for the service = V_0-V_3 [€/min]
- Net benefit of the service session = (V_5-V_3) * t [€], where t = the duration of service session.

In this framework, the perceived value corresponds to the readiness to pay in a totally monopolistic situation (= V_4-V_3), in which the only choices are to pay the requested price or to be without any service that satisfies the same need. In practice, however, customers are willing to pay only a part of the perceived value to the service provider. The remaining benefit is their net benefits.

We may notice from Figure 4 that the user has to sacrifice the net benefit of some other activity (= V_0-V_3) in order to use the service. That net benefit is the opportunity cost for the offered service. In practice we may use the average net benefit of activities E[V_0-V_3] as the opportunity cost as the options vary. The opportunity cost corresponds then the average (option) value of time (= V_3-V_2).

Importance of a service could be defined as the relative significance of an activity to the average value of life, i.e., how much the value of life will increase compared to an average activity. Thus we can make the following definition:

Importance of a service per minute = $E(V_5\text{-}V_3) / E[V_0\text{-}V_3]$.

We can assume that the importance defined in this way is a relatively stable parameter within a customer segment. This importance can also be used to make realistic assessments about the relative values of different activities (this is, anyway, what we do all the time in our normal life).

We may now utilize the average monetary value of time by noting that the user is typically willing to pay part of his average perceived value to the service provider. As a result, the perceived value from a service session is:

*Perceived value = t * Importance of service * 1/K * Monetary value of time [€/min]*,

where K = part of the perceived value that the user is willing to pay to the service provider and Monetary value of time [€/min] = K/(1-K) * Opportunity cost [€/min]. The perceived value is then used as a basis for analyzing the actual behavior of users.

VI. Modeling User Behavior

In the previous chapter we considered the value of a service session. Now we look at the user's experiences and behavior during a longer period, a month. The considered user is an average representative of a customer segment and an active user of the offered service. The purpose of the method is to analyse how changes in the user experiences impact to users' monthly behavior (see Figure 4). The starting point for the analysis is the current situation: how much the user is using the offered service, what the perceived value is (calculated using the method of previous chapter), and what the user is paying for the service. The method first transforms the changes in the various service performance factors into the user experience changes (see Figure 5) and then uses the net benefit model to transform the user experience changes into the changes in the user's monthly behavior which is the output of the method. To get the whole picture the similar analysis should be made in all customer segments and for different services.

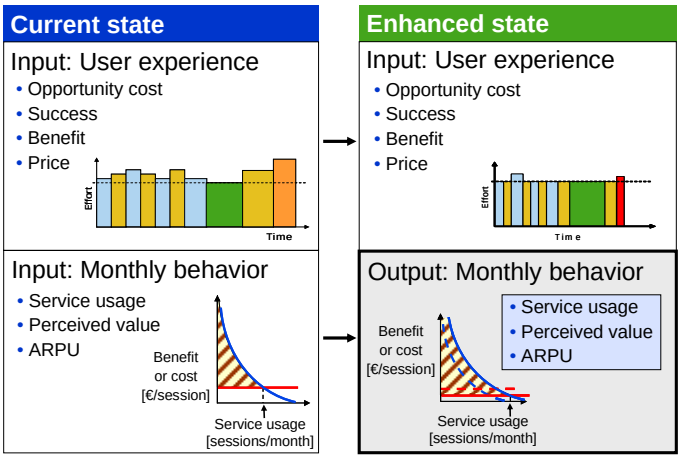

Fig. 4. Description of the method to analyse impact of changes in user experiences into user's monthly behavior.

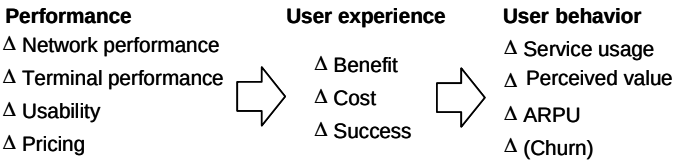

Fig. 5. Phases in the modeling.

A. Net benefit model

The net benefit model is based on the basic microeconomic demand theory (see, e.g., [18] Figure 6). It consists of a benefit curve and cost curves. The benefit curve represents benefits from the offered service during one month for an average representative of a customer segment. The assumption

is that some service sessions are more important than others, and thus more beneficial. The benefit curve ((1) in Fig. 6) is formed by arranging the successful sessions during a month into the order of their benefit. (In some service it is better to use time as a unit of demand.) As common in microeconomics, we use logarithmic or exponential shapes in the demand curve, although other shapes also are possible.

The net benefit model has two cost curves: opportunity (2) and monetary (3) cost. Both are assumed to be independent of the benefit of the session, thus the average costs of the session is used. The opportunity cost is calculated as described in Chapter 4. It includes the time and effort aspects of the consumption. The monetary cost is the price paid by the user. Note that in some cases the user does not pay the bill, and sometimes the user is not able to assess realistically the price to be paid. These cases have to be assessed appropriately: the perceived price determines the behavior while the real price defines the ARPU.

The net benefit model assumes a rational user which will use the service if the benefits from a session exceed the costs of session (meanwhile costs and benefits may build up irrationally). The point where the benefit and cost curves cross defines thus the number of sessions during a month (4). The area that remains between the benefit and opportunity cost curve (hatched area (5) in Fig. 6) represents the user's perceived value from the service.

The net benefit model is input for the current state and output for the enhanced state in the analysis. For the current state the net benefit model is formed from the service usage, ARPU, and perceived value calculated as described in the Chapter 5. For the enhanced state, the service usage, ARPU, and perceived can be obtained from the model.

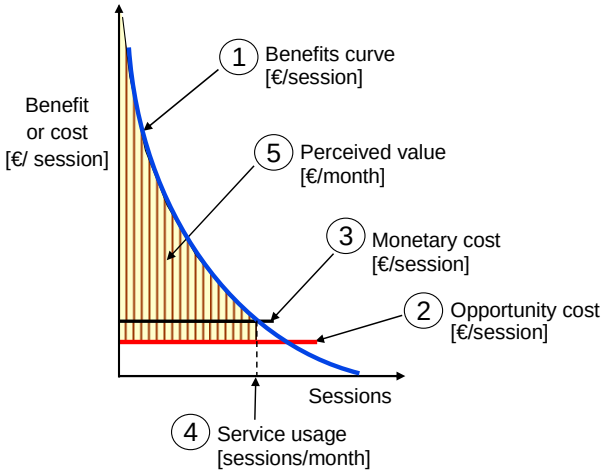

Fig. 6. Net benefit model for a service.

B. *User experience changes*

The net benefit model is used to calculate how changes in the user experiences affect the service usage, user's perceived value, and operator's revenue during a period of one month. The user experiences are divided into three parts: costs, benefits, and successes, as described in the previous chapter. Each part has its own model that captures the characteristics of the specific user experience change.

The cost change is simply the change in the average cost of the sessions due to changes in the opportunity cost or perceived cost of pricing. The opportunity cost is calculated using usage sequences. The changes in network or terminal delays, bit rates, terminal or service usability, etc. will change the user sequence and thus the opportunity cost of the session. The impact of the cost change is modeled as shown in the Figure 7a. For instance, if a cost factor declines, the average cost of the service session will descend and in a greater amount of sessions the benefits exceed costs. Thus, the usage of the service during a month will increase. Similarly, the perceived value during a month will increase due to increased value of existing sessions (perceived value = benefits – costs) and value from new sessions.

Benefit changes are probably the most difficult to estimate. Even for one session it is relative difficult say how a user experience change will impact the benefits. The question is even more difficult when we consider a distribution of sessions during a month. However, our assumption is that better quality increases benefits more in the important sessions. Thus the benefit changes are relative to the benefit curve (see Figure 7b). Similarly as with cost changes, the benefit improvement will increase both the usage and the perceived value.

The third change is the success change. It is divided into usage change and value change. Various success rates and re-attempt probabilities will directly impact the number of successful sessions and thus the usage. The change in the perceived value is calculated from the success rates and reattempt probabilities as described in Chapter 4.

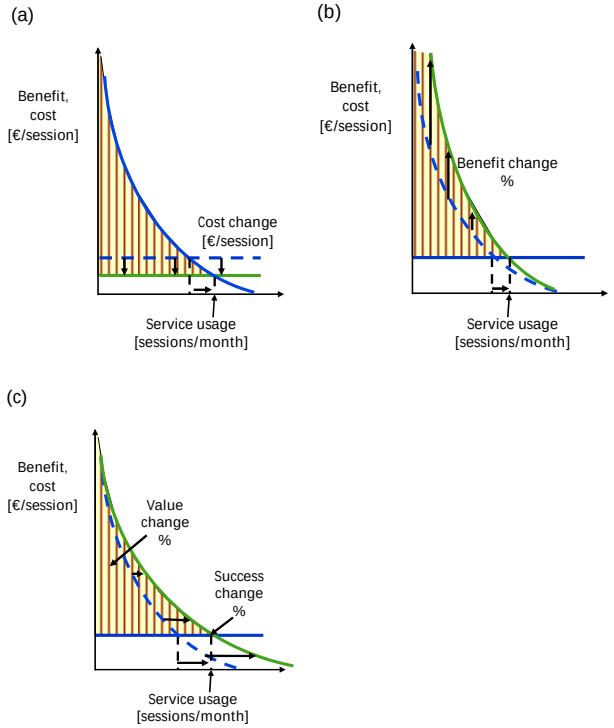

Fig. 7. User experience changes in the net benefit model. a) Cost, b) benefit, c) success change.

The analysis is finalized by combining all cost, benefit, and success changes in the net benefit model. The model is able to analyse not just the impact of different user experience changes but also their interdependences. The output of the model is the change in the user's monthly behavior, i.e., service usage and perceived value. The impact to the ARPU can be calculated by knowing the pricing scheme and tariff level.

If the improvements are large enough, we shall consider the substitution effect where improvement will considerably shift usage from the other service to the analyzed service. The substitution is not included in this current model, but the model can be used to calculate where these disruptions could happen.

C. Dimensions

The net benefit model is created at a time for one service, one average active user in a customer segment during one month. Further, the user experiences may alter so much between terminals and technologies that they require own dimensions. Similarly, different performance improvement options are a new dimension. However, in the most dimensions the variation can be parameterized and different net benefit and usage sequence models are needed only for different service types, like messaging, browsing, and streaming.

Customer segments are characterized by their service usage, importance of service, capability to use the service, monetary value of time, and price perception. The capability to use the service will directly change the duration of some steps in the usage sequence. Price perception describes how much the pricing affect the usage. Other characteristics are defined in previous chapters.

The final result of the analysis is obtained by combining the results from various dimensions. The end result is the total change in the service usage, users' perceived value, and ARPU due to changes in the analyzed service portfolio, terminals, network, and/or customer base.

VII. Case Study: Reading News

The usefulness of the whole framework can be proved only through case studies. Previously, we studied the problems related to Multimedia Messaging [19]. Other cases and more information about the model can be found from our web-site [20].

In this chapter we briefly analyze a case where a user reads business news from a mobile web site (http://www.yle.fi/mobiiliuutiset), to which he has bookmark in the web browser. We use the following assumptions for the browsing session: monetary cost is 1.5 €/MB, opportunity cost is 0.5 €/min, importance is 3 (compared to opportunity cost, or 1.5 €/min) and the user reads 20 news in a month.

The measurement was done for four terminals, 1) N6230 (Series 40, EGPRS), 2) N70 (Series 60, 3G), 3) N9500 (Series 80, EGPRS and WLAN 802.11g), 4) IBM laptop (Firefox, WLAN 802.11g). The measured and modeled usage sequences are shown in Figure 8. Steps in the usage sequence were: open terminal (power is already on), open browser, navigate bookmarks, open portal page, navigate to news, open news, read news, and browse back to portal page. The probability of each step was 100%. The effort level was modeled using following formula: up to 4s effort level is one, after that effort level will increase exponentially so that at 30s the effort level is two. The effort level during reading the news is one. The monetary cost of a session was €0.04 whereas the opportunity cost was €0.3 - €1.4. We assumed the same benefit from the news and the same success rates in each terminal.

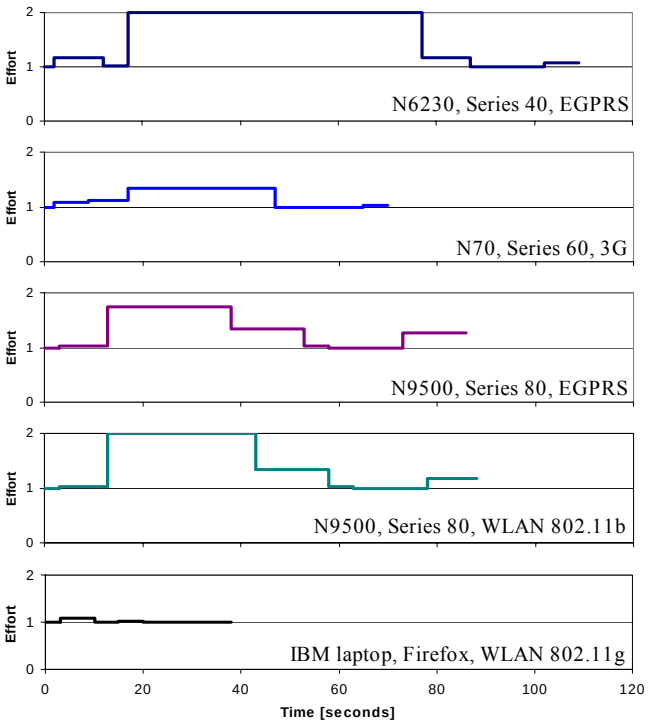

Fig. 8. Measured and modeled usage sequences.

The usage sequences were analyzed using the methodology. Figure 9 shows the difference in the perceived value between each terminal. The results show that in the similar laboratory context the user's perceived value with the mobile browser is about 20% - 60% of the perceived value with a PC browser. Thus, there is an apparent opportunity to still improve the mobile services. The biggest problem in all mobile cases was the page downloading time which causes opportunity costs to the users. N9500 with WLAN was slightly worse than with EGPRS mainly due to much longer connection setup delay although the page download time was shorter. According to the model, the revenue potential with N70 is 150% higher than with N6230, N9500 falls in the midway. As it is relative hard to increase benefits of a service (at least relative to other options), the service providers can improve their business, only if they, together with terminal vendors, can essentially decrease the opportunity cost, i.e., time and effort, perceived by users.

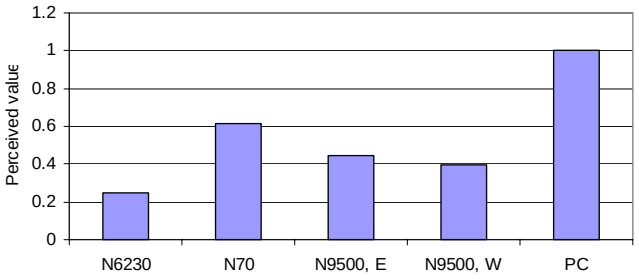

Fig. 9. Relative perceived value due to browsing user experience

VIII. Conclusions

The objective of this paper has been very ambitious: first, to make a general view on the provision of communications services, and secondly to introduce a formal methodology to analyze the services. Naturally, a brief paper cannot profoundly assess all relevant aspects. However, we stress that a systematic approach is needed to make reasonable conclusions about service design, because otherwise, all decisions will be made based on pure intuition (which, of course, may sometimes bring about better results than a formal model).

But even if the intuition of a key person is the final criterion, a formal analysis can essentially support the decision process. In this paper we start by identifying the key actors in the whole ecosystem, that is, customers and owners. Even though this claim is, in a way, self-evident, it seems that it is often omitted. For instance, a huge amount of theoretical studies have carried out to optimize the network services without any meaningful connection to the final decision makers (customers and owners), as if the sole purpose of network operator was to build an optimized network. In fact, the problem is not in the optimization as such, but in the optimization criterion. In reality the only relevant optimization criterion is something that is closely related to the business objective of the network operator.

Moreover, whoever (at least, after reading this paper) tries to solve this optimization problem shall be aware of the main challenges of the task. Particularly important and difficult is to understand how services are able to create value to users. Chapter 4 outlined some principles that can used to assess the issue. The task can be divided into three parts: the value of the service in human life, the effect of user experience, and how the perceived value of the service is formed based on these two aspects. The perceived value is then used as a basis for analyzing the actual behavior of users. Chapter 6 presents the main principles of user behavior modeling that is essentially based on microeconomic theories. As a final result, we are able to formally analyze what effects different changes, like improved user interface, have on the usage of the service, on the value it creates for the user, and finally on the business of service providers. The last chapter presents a case in which real mobile terminals are compared with each other and with a laptop, from the perspective of a real user. Similar analysis can be made for any mobile terminal and any mobile services, and be extended to different customer segments. The analysis offers a rational basis for designing and optimizing network terminals and services.

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