Internet futures:
growing market intelligence to allow telecoms operators to seize the opportunities of the information age

~~~~~~~
Frederic Lagacherie
BT Laboratories
Martlesham Heath, ADMIN2 PP7
Ipswich, IP5 3RE, UK
+44 - 1473 - 642397
frederic.lagacherie@bt.com
~~~~~~~

Abstract

With the introduction of new access technologies in carrier networks, as well as the expected expansion of the bandwidth to the end user, telecoms operators are triggering extensive business analysis to understand and hopefully anticipate the evolution in total bandwidth demand. In the face of great uncertainty in peak IP traffic forecasts and the need for significant investments in network facilities, it is vital for decision-makers to have the tools that will help to manage the risks related to these investments.

The challenge for modellers here is to conceive the Internet as a complex system of convergence where the combination of humans, technology and their interactions are responsible for the future development path. In that respect, we have taken a socio-technical perspective to break the perceived complexity down to a mode where behaviours can be simulated dynamically over time. The objective of this model is to estimate bandwidth demand by sizing the Internet market evolution in terms of the numbers and types of subscribers.

This paper[1] details the soft-variables and relationships that have been used within a System Dynamics model to create a seamless environment, in which to explore potential market scenarios and test various strategies so as to optimise customer retention and profit from the point of view of an ISP.

Introduction

The oligopolistic environment in which telecoms operators have to compete has forced them to adopt more complex processes to support their decisions. As consumer demand asks for more tailorisation and value for money, competition has lead telecoms operators to take faster strategic decisions including changing the focus of their core business. The Internet [2], in that respect, offers an unprecedented wealth of both opportunities and threats for emergent and incumbent actors. Developing from providing simple access to residential customers, ISPs have emerged as the brokers between content, online applications, telecoms operators and the end customer. Since ISPs now own the customer interface, and consequently the user's profile, and since traditional telephony applications are being adapted to the IP paradigm, (voice, fax and call centres to say the least), ISPs could relegate telecoms incumbents to the unpleasant role of being just bit carriers.

To escape the over-optimistic/pessimistic future drawn from linear forecasting, telecoms operators must look at random and decision-lead events that may act as break points in the way the Internet market will evolve. The recent drive by ISPs to provide Voice over IP (VoIP) services belongs to that range of events that *may* threaten the telecoms operators "cash cow", i.e. the conventional voice telephony business. However, as humans, we are limited in our ability to mentally shape a model that can capture the dynamic complexity of the Internet industry and the likely consequences of our interactions with it. With very few references to history possible, this paper describes a System Dynamics model that provides a template of product adoption, competition and corporate decisions for the take-up of Internet services.

The engine behind the model allows the user to assess in real-time how each decision or change in the environment will affect the way consumers connect and make use of the services over time. For instance, some Internet service providers were ready three years ago to launch a free subscription Internet access service. Although this business model seems to be effective today, it did not appear so at that time. This was mostly due to the lack of sponsors ready to believe in sufficient return on their investments through advertising and online purchasing. By simulating Internet demand from a bottom-up approach, this model will help us to understand the long-term implications of today's tactical decisions upon telcos' network provision business. It will also emphasis the type of ISP business model that can be sustained in a competitive marketplace.

Background to the model

In order to focus the scope of this paper on to a manageable number of variables, the model proposes to consider a competitive, liberalised telecoms market for residential customers in Western Europe. The end model consists of three key modules, as shown in figure 1.

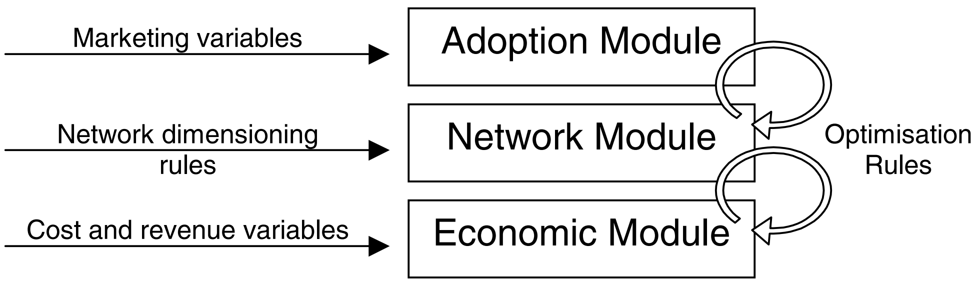

Figure 1. Theoretical structure of the Internet model

This paper will concentrate of the functionality of the Adoption Module. The goal behind the Adoption Module is not to describe why residential customers behave in a certain way, but rather to investigate how their behaviour can trigger various scenarios and also to assess the effectiveness of a policy in influencing these behaviours. Typically, the Adoption Module creates a set of data that inputs into the Network Module in order to observe the impact of each scenario on dimensioning of the network. Data requirements from the Network Module feed in turn into the Economic Module to monitor the cost effectiveness and revenue optimisation of a given policy.

The *approach* taken to develop this descriptive model involves initially identifying the level of complexity that should be put in the design of the model. A first set of variables has been identified from interviews with professionals and scans through various internal and external market researches. Some sensitivity analysis was subsequently performed to identify the influential variables and to remove other variables that only added to the complexity. In order to further create a realistic simulation environment, the model has been developed as customer-centric. That is, the model's loops and valuation variables (attractiveness, price, performance) have to be understood as a function of the customer's perception.

The *competitive environment* is composed of various actors of all sizes and geographic scopes, ranging from a local ISP targeting a niche market to the global OSP. Six of these have been retained for their divergence in setting their strategy, attracting investments and their respective maturity in this business.

The *products* described for the scope of this paper are restricted to traditional ISP services including email, web browsing, ftp, fax and Voice over IP.

The *customer segments* have been clustered according to a socio-demographic classification. It has been shown that the Internet is spreading across demographic layers as a function of revenue and education. Further studies suggest that a sub-classification should encompass a distinction between family and non-family. Residential customer segmentation must be considered particularly carefully as personalisation is becoming the marketing artefact by which companies are seeking to increase their share of customer [3]. As it will be shown later, the value of an ISP should not be regarded as the number of its subscribers, but as the frequency at which subscribers connect as well as their attitude once on-line.

Application of System Dynamics to the adoption of Internet services

The module uses the multiple combinations of product adoption, competition and corporate decisions to map the complexity of the Internet market. Some of these aspects will be discussed in this section.

a. Product adoption

The diffusion of Internet products is believed to follow a Bass diffusion model, as innovation and imitation drives the evolution of today's applications and services that use the Internet as a transport mechanism. The model will be limited in the number of connected households by the overall penetration of Internet access technology, (mainly PCs, TVs and telephones). This limit is materialised in figure 2 below, extracted from a Powersim model, by the upper blue line.

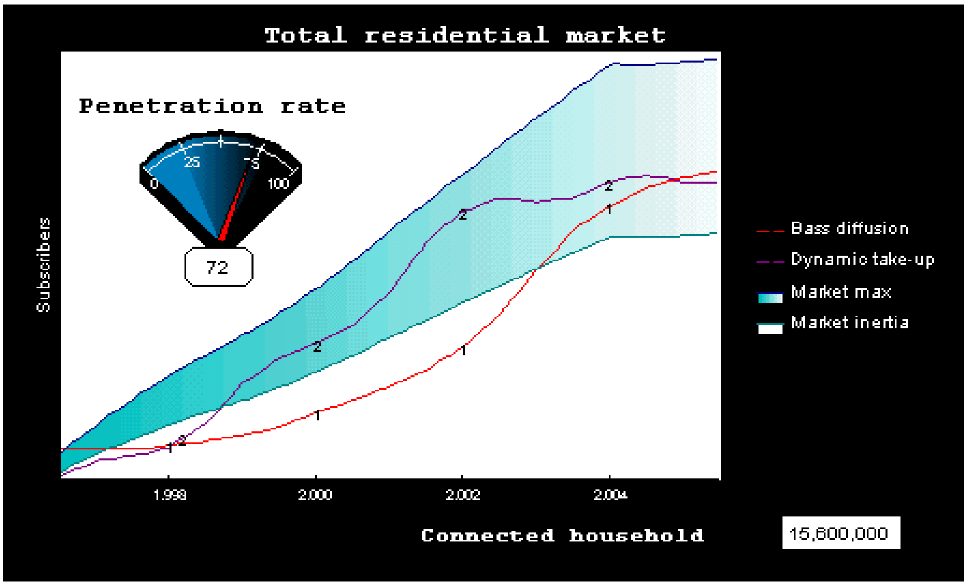

Figure 2. Total take-up for Internet services in country WE

Although it is possible for one household to own several access devices, the model is configured to avoid double counts. The lower blue line accounts for the market inertia, the limit after which ISPs will have captured the easiest part of the potential customers, (i.e. the innovators, early adopters and early imitators). Once this level of inertia reached, the total take-up curve (1) for the country considered will behave as if the market was entering its stage of maturity.

The traditional S curve should, however, be subject to variations inherent to the high volatility of the Internet market. Considering figure 2, the model shows the distortions that can be obtained by introducing internal soft-variables, such as customer experience and awareness or the overall state of the economic cycle, and their influences on subscriber responsiveness. The purple curve (2) has been simulated over different environmental conditions and also various price and quality incentives. These distortions need to be fully understood as the model will translate the Adoption Module's outputs into their effects on network load and the subsequent dimensioning requirements. It is central to this model to be able to show the impact of various policies and market turbulence on the aggregate take-up of services and their usage.

As the graph in figure 3 shows, special attention has also been paid to the responsiveness of the model. From the recent example derived from the introduction of free subscription Internet access, the model runs over monthly periods with a maximum delay in the response time for switching ISPs being one or two months, depending on the nature of the policy stimuli. To make full use of the model's interactivity, the Adoption Module should be considered to be an automated war game whereby six players take pro-active decisions to determine the strategy they each should follow, given the responsiveness and behaviours of rival companies.

The first data displayed in figure 3 represents actual, historical data up to and including the last quarter of 1998. In this specific scenario, it should be noted that all companies do react similarly as the market is subject to structural changes and turbulence.

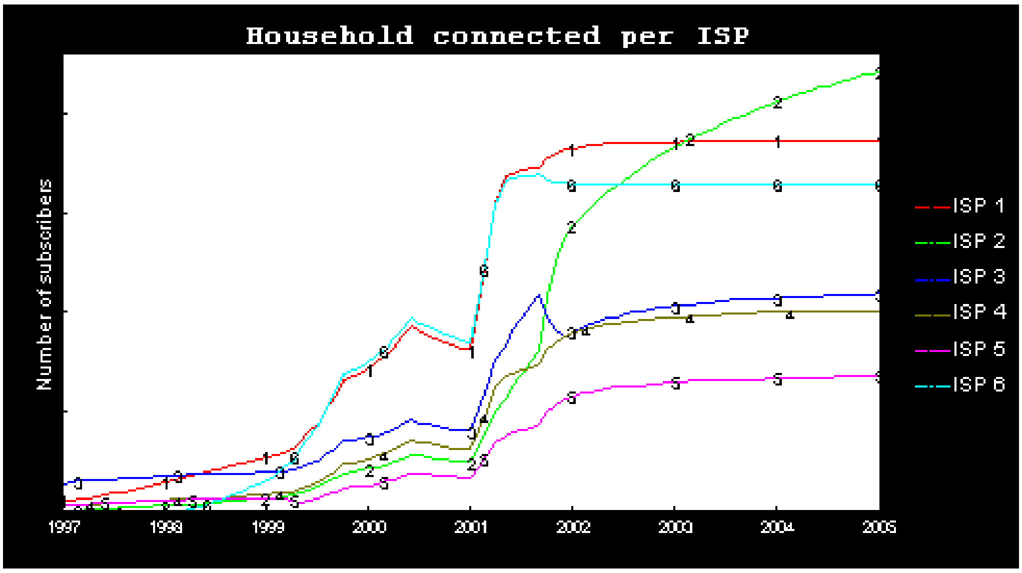

Figure 3. Cumulative Internet take-up split by ISPs

When individual decisions are enabled from 2001 to 2002, each company behaves in response to the policy adopted and the subsequent changes in the overall competitive situation, (in this case caused by a price war). When no new inputs are allowed into the model the simulation engine simply stretches the output from the last period linearly, as shown in figure 3 from period 2002 onwards.

b. Competition

From the early years of the Internet, the hype over the potential benefits promised to those who joined the bandwagon has shaped a very responsive marketplace. Because most ISPs fear the market consequences of missing even one opportunity, it is especially hard to differentiate between them, either commercially or technologically, on a sustainable time scale. The high level of competition watch has given rise to an extremely rapid catch up rate. This translates into the model partly through the attractiveness of one company to another and partly via the churn level.

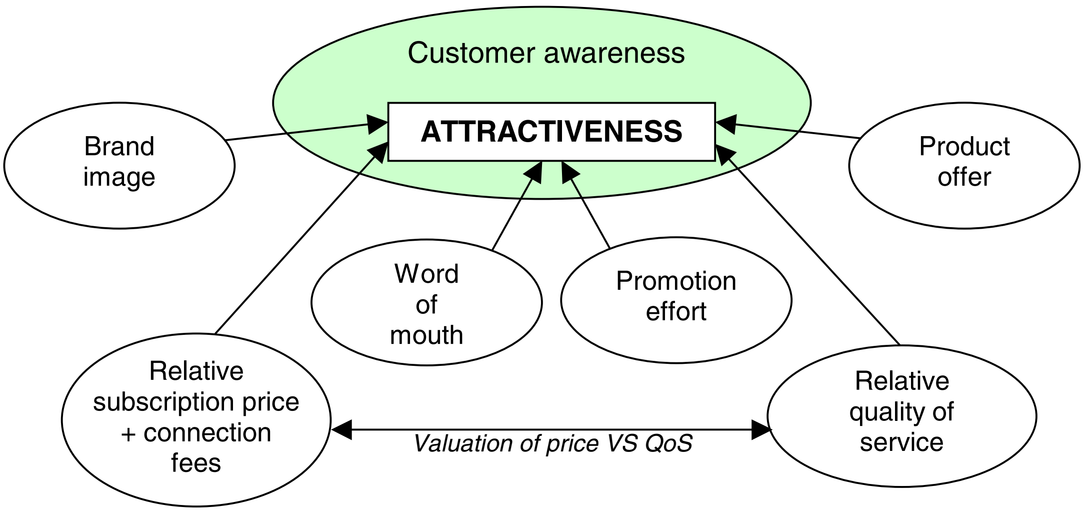

Figure 4. Factors contributing to an ISP attractiveness

Within the model, the potential customer base will be split according to each company's relative differential *attractiveness*. In that respect, the attraction factor encompasses the elements depicted in figure 4 above.

The model will consider the ISP's respective growth ratio as the mechanism that triggers "word of mouth" changes in customer base rather than using market share to do so. This is because, from a customer point of view, choosing an ISP is often the result of following mass opinion. In that respect, a fast growing company will benefit from general media coverage, which translates in the model by a boost in its attractiveness and the resulting customer awareness of that brand. It is also being suggested that an ISP will hit a large number of its targeted audience by advertising through traditional media channel, such as television. The *promotion* effort takes these parameters into consideration. However, the low churn observed until 1998 amongst the industry has highlighted the lack of comparative information to support customers' buying decisions. This suggests that the differential attractiveness factor should be weighted by the average awareness within each socio-demographic segment.

Although customer churn could initially be applied as an average monthly percentage to turn around the lack of commercial data, it would not reflect the high volatility that characterises today's Internet marketplace. With number and email portability as well as the emergence of brokers, it is very convenient and cost effective to swap from one ISP to another. As a result, the delay between a significant variation in price or QoS within an ISP offer and the resulting reaction in customer churn will only be of one period, i.e. a month. An example of this is shown in figure 5. Here, ISP3 modifies its commercial offer in the first semester 2000, as a result of its bad churn performance recorded during previous periods. In a competitive marketplace, rival companies are expected to follow the same tactics on a responsive basis, unless they opt for a different strategy.

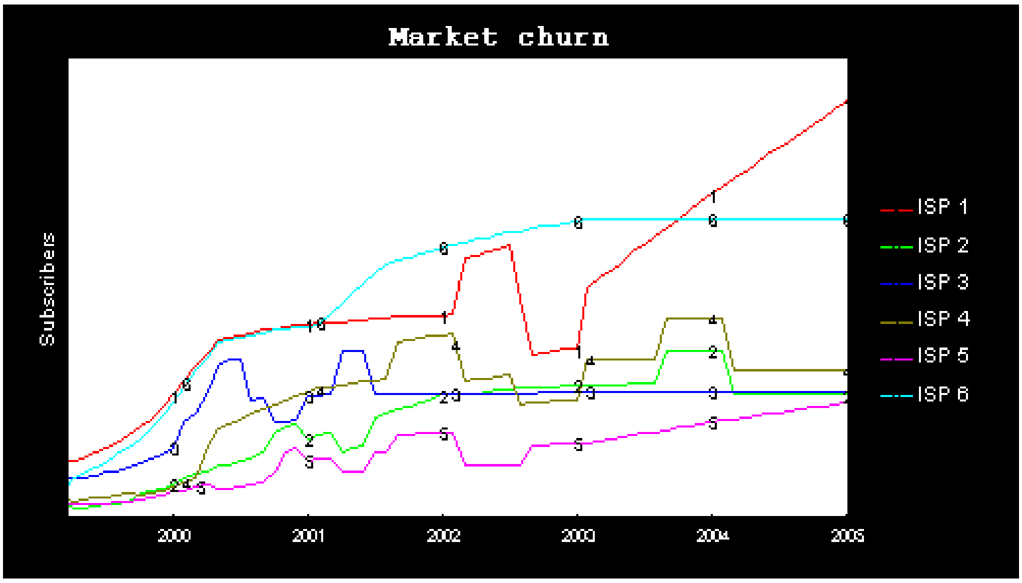

Figure 5. Periodic churn rate split up by ISPs

However, if a "gap" between two ISP offers remains for too long, (in this model no more than two periods), this will be translated into a brutal increase in customer migration towards the most appealing commercial offer. Here, ISPs 2 and 5 lose subscribers to ISP 3.

As a result, customer volatility can have a dramatic effect on ISP performances due to the little delay introduced by the ISP in response to changes in the market [4]. There is however a longer delay when it comes to switching customer focus from one area to another, e.g. from price to quality. Finally, when the market reaches a state of equilibrium beyond 2004, the churn rate behaves as a factor of growth only. This resilient churn is indeed the result of the constant flow of volatile customers in and out of ISPs' customer base.

c. Corporate decisions

As we saw in the previous sections of this paper, the take-up of Internet services is partly a function of price, quality of services (connection failures, connection rate, customer support, ability to customise billing) and availability (whether the customer is passed by some access infrastructure, or whether the service is available from one ISP). The market bears low product differentiation. The ability to attract customers will be down to the combined used of these variables based on a sensitivity analysis to point out the primary affecting factors.

Although the above variables are the most influential in the players' ability to increase their market share throughout the model simulation, promotion and branding are also of significant importance. Another way to consider the objective of the simulation, apart from optimising the total number of customers should be to increase the customer's respective value for the company, i.e. the share of customer [5]. As long as the number of new subscribers exceeds customer churn, the balance remains positive. However, when the market enters its maturity phase, the model emphasises the importance of retaining customers and increasing their spend throughout their stay with the company.

Amongst the performance ratios available to monitor the development of one competitor, i.e. market share, benefits, churn rate, cost per subscribers, see figure 6, the one that will increasingly attract attention is the customer value to the company. ISPs would rather benefit from loyal, frequent user subscribers than from volatile customers who follow the most appealing offer. In the model, this takes the form of a *portal* ratio, i.e. the ability of an ISP to grow a more stable customer base. This ratio is based on whether the ISP provides content services, a search engine mechanism, news partners, online ticket booking service, etc. The general perception of a brand and the level of investment in advertising campaigns will also affect this ratio. A high *portal* ratio will in turn limit the effect of volatile churn. While the aggregate number of customers matters when calculating market shares, the split between in-frequent/frequent users will be vital to calibrate the input to the Network Module so as to look at usage patterns across a carrier's network.

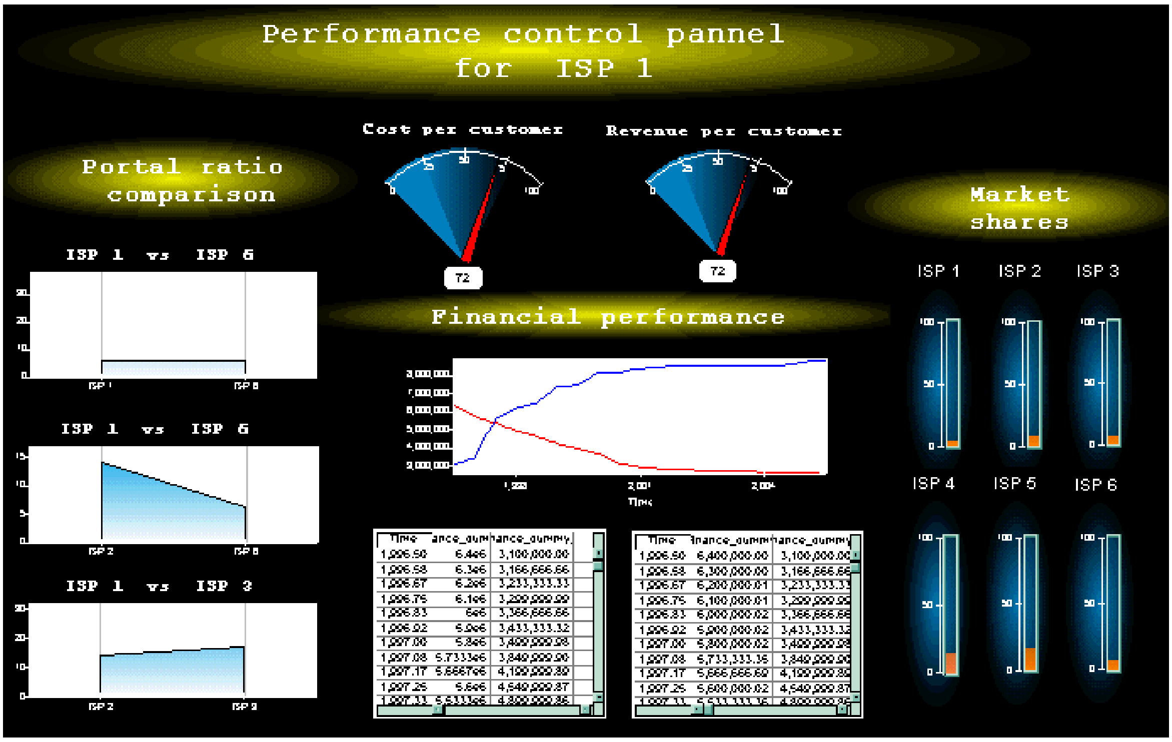

Figure 6. Performance control panel for ISP 1

Calibration of the outputs

Customers do not respond to minor changes in policies. That is, if a new ISP enters the market following a strategy of imitation with no particular perceived utility benefits to the customer, the market will remain unchanged. As a new entrant, a free subscription ISP offers sufficient market appeal to trigger migration to this service offering. The magnitude of the migration is a matter of how significant the change is compared to previous historical variations and customer preferences.

Within the model, it has also been assumed that there is no structural limitation to the number of subscribers that can join one ISP. Although there is a physical break point in the network access load, the extra flow of subscribers will be passed onto a carrier's network. The implication of a consequent migration flow from one, or more, ISPs to another will appear in the Economic Module where interconnect fees heavily weight the OPEX [6]. Additionally, a degradation effect is introduced into the QoS ratio as a result of too many customers asking for support where the optimum service has been under-dimensioned.

Delays within the model have been calibrated with current examples from the Internet industry. Unlike in other industries, the response delay decreases as the marketplace becomes more educated to the services and their functionality. Customer awareness acts in the model as an attribute of delay in responding to the market stimuli. Once again, the model relies on market research and analysis to ascertain which of the reaction mechanisms within the model behave as in a real market situation.

Conclusion

The use of System Dynamics has proven to be valuable in mapping the dynamics of the Internet into an interactive model. The model allows decision-makers to run various scenarios to enable them to assess the implications of their tactics on long-term network and cost issues. From an incumbent point of view, this simulation tool can produce numerous and varied insights into the type of strategies that ISPs could deploy as they face a wealth of tougher competition and cutting edge innovation. This model provides a dynamic learning environment to understand the technological, behavioural and strategic issues that we will increasingly have to face in the information age.

Acknowledgements

I wish to thank Ann Matthews for her help and time as well as her understanding in discussing this paper.

I wish to thank Mike Matthews for reviewing this paper and authorising its publication.

Notes

[1] Best viewed in colour to aid clarity of the graphs.
[2] The Internet is to be understood as the digital platform for the global information infrastructure that conveys both voice and data services.
[3] In contrast to market share, share of customer refers to the percentage of a customer's/business' expenses that a company will be able to acquire during the relationship established with them.
[4] In figure 5, the phenomenon has been amplified in its magnitude for clarity purposes.
[5] In contrast to market share, share of customer refers to the percentage of a customer's/business' expenses that a company will be able to acquire during the relationship established with them.
[6] OPEX stands for OPerational EXpenditures as opposed to CAPEX, CApital EXpenditure.