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Impact of Word-of-Mouth Marketing and Viral Marketing on Continuous and Discontinuous Technological Innovation

Doctoral Thesis

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Declaration

I declare that I created the doctoral thesis *Impact of Word-of-Mouth Marketing and Viral Marketing on Continuous and Discontinuous Technological Innovation* on my own. Bibliography and background materials mentioned in my thesis are included in the sources of literature and addendum.

Munich, April 26, 2010

Prohlášení

Prohlašuji, že jsem doktorskou práci na téma *Impact of Word-of-Mouth Marketing and Viral Marketing on Continuous and Discontinuous Technological Innovation* vypracoval samostatně. Použitou literaturu a podkladové materiály uvádím v přiloženém seznamu literatury.

V Mnichově dne 26. dubna 2010

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Podpis

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1   Summary in a Way of Introduction

Marketing of technological innovation represents substantial different task than marketing of other categories of consumer goods. New technologies are not adopted in a random way, but in surprisingly predictable manner, which is described by Technology Adoption Life Cycle (TALC). The theoretical framework was originally developed already in 1957 at Iowa State College and its purpose was to track the purchase patterns of hybrid seed corn by farmers. Later on, Everett Rogers broadened the use of this model in his book, Diffusion of Innovations, which was published in 1962. The initial mathematical model for adoption rate of new innovative durable goods was developed by Frank M. Bass at Purdue University in 1969. He based his work on 2 pillars: mathematical concepts come from the contagion models which have found such widespread application in epidemiology. He assumed that everybody who purchased the product starts contagiously spreading the information to other potential users. Second, Bass simplified the model from Rogers and divided the population into 2 categories: Innovators (the same like Rogers) and Imitators who are mostly influenced by other people in their decision making – basically he postulated that social pressure of buying of new things increases over the time. For marketing purposes this fact means that Word-Of-Mouth marketing represents absolutely critical factor for adoption and diffusion of new technologies.

Mathematical model developed by Bass (and improved by many followers) researched specifically discontinuous innovation in their models. Most of discontinuous innovation happens to be technological innovation – it is obvious that technological innovation requires lot of learning before it can be adopted in

mass market. Mathematical model provided solid theoretical apparatus for researches, but only skimmed the surface of how to use them in practical marketing of technological innovation to consumers as well as businesses until 1995, when Geoffrey A. Moore published his book *Crossing the Chasm*. He postulates the "chasm" between early adopter of technology and majority of the people in discontinuous technology innovation. He provides directions, how to successfully market to two very different groups of people to make technology ubiquitous and successful. Those groups have very different motivations and have different psychological profiles - developing targeted marketing plans and messages for those different groups is the prerequisite of new technologies success.

On the contrary in continuous innovation products are upgraded and updated regularly in relatively small ways that make no great changes to the customer's buying behavior. It represents majority of everyday innovation of all companies; it is much easier to implement it most of innovations do succeed on the market, but financial rewards can (but don't have to be) much smaller. For individual buyer, there is no barrier or chasm in buying such technological innovation and so marketing of such innovation should resemble rather marketing of other categories of consumer goods. Word-Of-Mouth marketing is no longer critical for success. Although WOM marketing is no longer critical success factor for marketing of continuous innovation, it is still used and it certainly represents great potential to enhance traditional marketing promotions. As marketers in technological companies had to use WOM marketing in the stages of discontinuous innovation, they feel comfortable to use it (or sometimes rather over-use) also products reach mature stage. Is

this approach effective? Does marketing of technological products really resemble rather marketing of other categories of consumer goods? Are there differences between different kinds of consumer products? On top of that, ubiquitous access to Internet changed the nature of WOM marketing, because speed of information spreading dramatically increased, while cost substantially decreased. In that case people usually refer to the same phenomenon on as Viral Marketing – although as this thesis will argue, there are difference fundamental between WOM and Viral Marketing. Usage of both WOM and Viral Marketing keeps growing dramatically. Author of this thesis sees the main reason in assumed high efficiency through usage of Internet, as well as perceived low cost. Nevertheless, overall efficiency of any marketing campaign depends on effectiveness of the campaign, its reach and obviously at overall cost. For traditional TV advertising agencies, people usually talk about efficiency as advertising cost per reaching 1000 people or cost per *mille* (CPM). For WOM marketing, reach and effectiveness represents as important factors as for traditional marketing. Effectiveness plays the major role and research gives plenty of evidence that WOM marketing represent more effective tool than advertising. However, it is very difficult to ensure WOM and viral marketing really deliver desired reach and consequently overall impact.

So first, this thesis will analyze what is the effectiveness of WOM or viral marketing. In other words: Does WOM/viral marketing influence target audience more than traditional marketing? Author of this thesis has found plenty of research on this topic and the thesis will aspire to summarize it in most comprehensive way to provide useful tools to marketing experts.

Second critical point is the reach of WOM or viral marketing – how many people can be reached and touched by messages spread virally. Ideal scenario of marketing expert is following: he/she creates very interesting message, video, picture, Facebook page etc. and users will spread this message widely to their social contacts in no time. This thesis will cross-examine and try to postulate why this simple goal is so hard to achieve. By usage of mathematical models this thesis will prove why it is extremely difficult to create viral message and campaign with predictable broad reach. There are many of examples how messages do spread virally broadly and fast – but it is rather an exception than a rule. The research about why messages do spread virally remains only limited so far and this topic deserves much further research well beyond this thesis. Last but not least, viral marketing can be – but may not be necessarily cheap. For example, an amateurish looking video spread by millions of people may have been created by professional agency with high cost. Initial seeing of message to many people might have fairly cost – both financial as well as valuable time of company employees. Nevertheless, detailed cost comparisons between traditional and viral marketing will not be deeply researched.

Viral marketing should be an integral part of many marketing plans in continuous innovation as well as regular consumer products. However, viral marketing doesn't bring "magical solution" to diminishing marketing budgets on many companies and especially it cannot replace traditional marketing. By accepting and understanding inherent limitations of viral marketing, companies can use their overall marketing budgets more much more efficiently.

2 Thesis Goals

The goal of this thesis is as follows:

- Describe existing mathematical models for discontinuous innovation diffusion and differences vs. continuous innovation
- Describe and analyze what the differences between WOM marketing and viral marketing
- Evaluate existing mathematical models for information spreading through viral marketing and analyze why succesful viral marketing remains rare case
- Analyze which marketing messages do spread virally and depict major reasons why

Prove or Reject following Hypothesis of WOM/Viral marketing:

- H1: Consumer goods categories differ substantially in its propensity to and efficiency of WOM and viral marketing
- H2: WOM marketing of technological products in the stage of continuous innovation is more efficient than WOM marketing of other groups of consumer goods
- H3: Successful viral marketing represent very difficult and complicated discipline because ingrained constrains and resulting little ability to influence the final outcome
- H4: Viral marketing spreads extremely fast; successful viral campaign reaches its peak within 1 month from launch
- H5: Humorous messages do spread virally better than other types of messages

3   Discontinuous Innovation Marketing

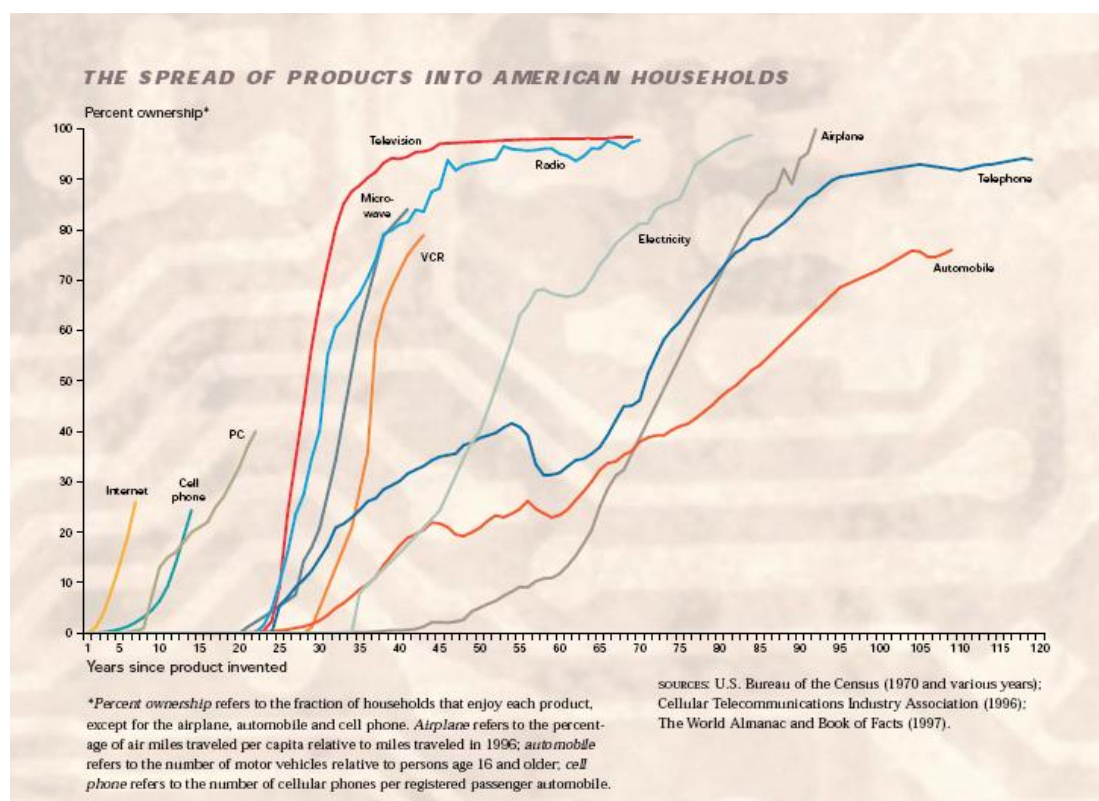### 3.1   New technology adoption

Technological innovation enhances the lives of the whole mankind. It enables one to travel faster and cheaper; to communicate across the globe instead of just one's neighborhood, solves difficult problems in days rather than in years and allows people across the world to realize their capabilities into full potential. Despite some negative consequences, technology brings positive impact to society on the whole. So why is the adoption of new technologies long, slow and mostly a difficult process?

"One of the greatest pains to human nature is the pain of a new idea. It is, as common people say, so 'upsetting;' it makes you think that, after all, your favourite notions may be wrong, your firmest beliefs ill-founded; it is certain that till now there was no place allotted in your mind to the new and startling inhabitant, and now that it has conquered an entrance, you do not at once see which of your old ideas it will or will not turn out, with which of them it can be reconciled, and with which it is at essential enmity. Naturally, therefore, common men hate a new idea, and are disposed more or less to ill-treat the original man who brings it", [1] wrote already in 1872 Walter Bagehot, social theorist and editor-in-chief of The Economist magazine. More than a century later, his description of human nature couldn't be more fitting.

Despite the natural resistance to change, adoption of new technologies keeps accelerating. It takes less and less time for new products to spread widely into the population. It took 46 years for a quarter of American homes to be wired for electricity. Getting phones to a fourth of America took 35 years; for cars 55. More recently the PC required only 16 years, the cellular phone 13. Even the microwave oven and VCR illustrate the speedup in

diffusion since the microchip's introduction in 1971. Though both products were invented in the early 1950s, as late as 1971 less than 1 percent of households had neither. Riding the cost-cutting wave of the microchip, however, a quarter of American homes enjoyed both by 1986. MP3 player market represents the latest major technological innovation. It is only 10 years old today, but booming in an incredible way. Based on Nielsen's research, 26.7% of US homes own or rent an MP3 player: in Q3'06 it took well less than 10 year to reach quarter of US households – faster than any other innovation.

Graph 3.1 Spread of Products into America Household

THE SPREAD OF PRODUCTS INTO AMERICAN HOUSEHOLDS

Percent ownership refers to the fraction of households that enjoy each product, except for the airplane, automobile and cell phone. *Airplane* refers to the percentage of air miles traveled per capita relative to miles traveled in 1996; *automobile* refers to the number of motor vehicles relative to persons age 16 and older; *cell phone* refers to the number of cellular phones per registered passenger automobile.

sources: U.S. Bureau of the Census (1970 and various years); Cellular Telecommunications Industry Association (1996); The World Almanac and Book of Facts (1997).

Source: 1996 Annual Report—Federal Reserve Bank of Dallas [1]

Diffusion of Internet shows the same trend in Europe, too. Based on the data from Eurostat [2] in Czech Republic, 54% of people uses Internet in 2009 vs. only 15% in 2003.

3.2   Diffusion of Innovations

As described in the introduction, new technologies are not adopted in a random way, but in a surprisingly predictable manner, which is described by Technology Adoption Life Cycle (TALC). The theoretical framework was originally developed already in 1957 at Iowa State College and its purpose was to track the purchase patterns of hybrid seed corn by farmers.[3] Later on, Everett Rogers broadened the use of this model in his book, Diffusion of Innovations [4] in 1962. Rogers postulated that adopters of any new innovation or idea are very different in their nature and they could be categorized as follows: Innovators, Early Adopters, Early Majority, Late Majority and Laggards. Each adopter's willingness and ability to adopt an innovation would depend on their awareness, interest, evaluation, trial, and adoption. Some of the characteristics of each category of adopter include:

- Innovators - venturesome, educated, multiple info sources, greater propensity to take risk
- Early adopters - social leaders, popular, educated
- Early majority - deliberate, many informal social contacts
- Late majority - skeptical, traditional, lower socio-economic status
- Laggards - neighbors and friends are main info sources, fear of debt

When Rogers conducted measurements in many areas of new inventions, he found out that the number of people in each category was approximately in line with the standard normal distribution function, better known as the Bell Curve. The percentage of people is given by first and second standard deviation.

Picture 3.2 Technology Adoption Life Cycle
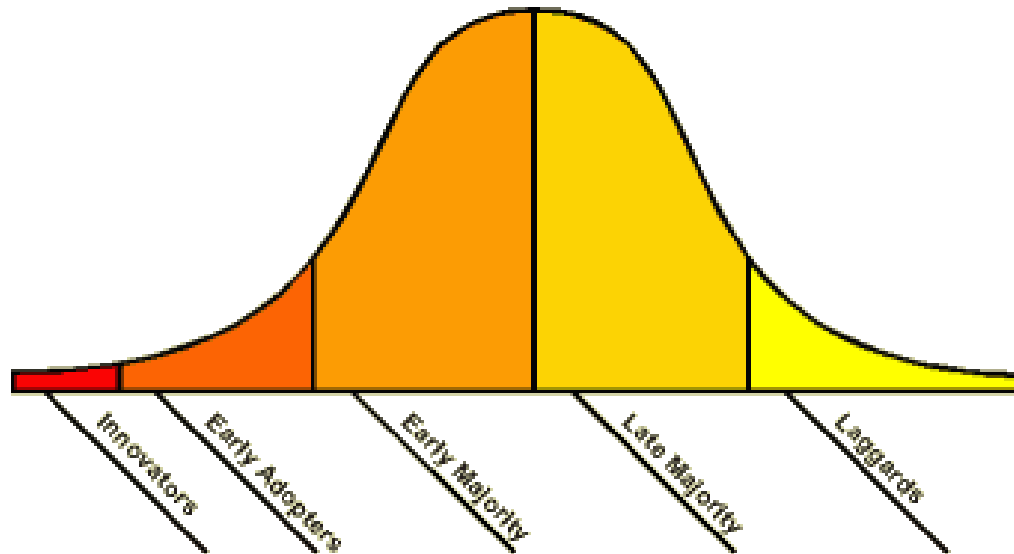
Source: Ed Brenegar Online as of March 29, 2010 [2]

First and second standard deviation provides following percentage results of people in population:

- Innovators (2.5%)
- Early Adopters (13.5%)
- Early Majority (34%)
- Late Majority (34%)
- Laggards (16%)

3.3   Definition of WOM communication

Because WOM term sounds obvious, lot of literature even doesn't define it – for instance Kotler and Keller in "Marketing Management" [5] write about word of mouth, but they doesn't provide any definition or glossary. This thesis wants to be very methodical and precise to define WOM communication (or just WOM as it will refer to this term from now on). Author of this thesis found many different definitions – but only few of them specific and concise. Probably best Word-of-Mouth (WOM)

communication has been defined as *'oral, person-to-person communication between a receiver and a communicator whom the receiver perceives as non-commercial, regarding a brand, product, or service'* [6] (Although this definition was attributed to Arndt, no such definition was found by author of this thesis). This thesis argues that WOM communication doesn't have to be necessarily oral, but it must be personal and independent from the company or its agents about company products. Second, WOM communication means that consumers share this opinion with other people based on their own experience with company's products – not based on recommendation of recommendation.

3.4   Mathematical Models

3.4.1   Bass Model

The initial mathematical model for adoption rate of new innovative of durable goods was developed by Frank M. Bass at Purdue University in 1969. He based his work on 2 pillars: mathematical concepts come from the contagion models which have found such widespread application in epidemiology. He assumes that everybody who purchased the product starts contagiously spreading the information to other potential users. Second, Bass has simplified the model from Rogers and divided the population into 2 categories: Innovators (the same like Rogers) and he bundled all others (Early Adopters, Early Majority, Late Majority and Laggards) to category of Imitators. They are mostly influenced by other people in their decision making – basically he postulates that social pressure of buying of new things increases over the time. He defines it as: *"The probability that an initial purchase will be made at T given that no*

purchase has been made is a linear function of the number of previous buyers." [7]

$$P(T) = p + (q/m) \cdot Y(T)$$

Where constant *p* is the probability an initial purchase at T = 0 and its magnitude reflects the importance of innovation the social system. Parameter *q/m* is constant, where *q* represents coefficient of imitation and *m* total size of available market and Y(T) is number of previous buyers – so second part of equation represents growing social pressure on the imitators. This also means that *m* is constant in this initial period and represents total amount of purchases during initial time before repurchases start.

$$P(T) = p + (q/m) \cdot Y(T) = p + q \cdot F(T)$$

where F(T) is likelihood of purchase at T and

$$F(T) = \int_0^T F(t)dt \qquad F(0) = 0$$

Then sales at T are:

$$S(T) = m \cdot f(T) = P(T)\,[m - Y(T)] = [p + \frac{q}{m} \cdot \int_0^T S(t)\,dt] \cdot [m - \int_0^T S(t)dt]$$

$$S(T) = pm + (q - p) \cdot Y(T) - \frac{q}{m} \cdot [Y(T)]^2$$

Obviously initial purchases are done both by innovators and imitators, but the stimulus of the purchase is different for those groups. The simplification of the model is that innovators are not influenced in time by number of people, which previously bought it – while imitators are. This certainly means that influence of innovators is huge at the beginning, while decreasing over the time. In his (and many others) point of view, people imitators are

influenced by innovators by Word-of-Mouth (WOM) communication, which is implicitly assumed in his model.

Despite its wonderful simplicity, Bass proved him model to be very accurate. He compared his model with historical data for several different innovative products: air conditioners, refrigerators, B&W television, power lawnmowers, washing machines and dryers etc.; the actual and model data align with great precision.

At the same time, the model has some limitations. It focuses only on new innovations and first time purchases – and not repeated purchases at all. It also doesn't look at awareness of new inventions and focuses basically on Word-Of-Mouth of innovation – so we cannot really look at marketing spend there.

In addition, he assumes only positive influence from customers. As defined for the purpose of this thesis, the WOM is based on experience with products and it can certainly be both positive and negative. However, his work truly started mathematical modeling of sales and many following works from various authors were based on his work.

3.4.2   Dodson Muller - Model A

Dodson and Muller [8] starts with the same assumption as Bass: rate at which customers buy product is proportional to number, which already bought the product.

$$\frac{d(z)}{dt} = \gamma \cdot z(t)$$

Where z is number of purchases and γ is conversion constant. Solution of this equation is following:

$$z(t) = z_0 \cdot e^{\lambda t}$$

This assumes that initial growth is exponential - which soon must level off as number of potential customers x(t) (fixed in initial evaluation) is soon decreasing from total amount of customers N and so then:

$$z(t) + x(t) = N$$

On top of that he introduces another group of people who are aware of the product (y), but have not bought it yet. They might know about the product both from mass media as well as from the WOM source.

$$z(t) + y(t) + x(t) = N$$

So the full model can be formulated as:

$$\frac{dx(t)}{dt} = -\beta \cdot x(t) \cdot (y(t) + z(t)) - \mu \cdot x(t)$$

$$\frac{dy(t)}{dt} = \beta \cdot x(t) \cdot (y(t) + z(t)) + \mu \cdot x(t) - \gamma \cdot y(t)$$

$$\frac{dz(t)}{dt} = \gamma \cdot y(t)$$

Where β represents word-of-mouth impact and μ reflect mass marketing impact of promotional spend and γ represents conversion rate – both function of mass marketing and product innovativeness. So a sale of products is actually represented by change of z in time:

$$\frac{dz(t)}{dt} = s(t)$$

The solution of these equations is:

$$s(t) = \left(e^{-\gamma t}\right) \cdot \gamma N \cdot \left(1 + \lambda \rho \int_0^t \frac{e^{\gamma \tau}}{b + \mu e^{(b+\mu)\tau}} \cdot d\tau\right) - \frac{\gamma N \rho}{b + \mu e^{(b+\mu)t}}$$

Where $\rho = \beta N + \mu$ and b=βN is contact coefficient representing impact of diffusion process on the growth in sales

This model provides great insight into how mass marketing and WOM plays the role in introduction of new products. Limitations are that it just focuses on positive WOM and doesn't consider negative one. Second, it doesn't deal with the scenario of repeated purchases.

3.4.3 Dodson Muller - Model B

In the same paper, Dodson and Muller also include an example with repeated purchases.

$$\frac{dx(t)}{dt} = -\mu \cdot x(t)$$

$$\frac{dy(t)}{dt} = \mu \cdot x(t) - \gamma_1 \cdot y(t)$$

$$\frac{dz_i(t)}{dt} = \gamma_i \cdot y_{i-1}(t) - \gamma_{i+1} \cdot z_i(t)$$

where z_i is number of people buying product for i-th time. Certainly sales are then:

$$S(t) = \sum_{i=1}^{\infty} i \cdot z_i(t)$$

The solution for constant repeat rate is:

$$s(t) = \bar{\gamma} \cdot N + \frac{N}{(\gamma_1 - \mu)} \left(\gamma_1 (\mu - \bar{\gamma}) e^{-\mu t} - \mu(\gamma_1 - \bar{\gamma}) e^{-\gamma_1 t} \right)$$

Where μ represents awareness rate, γ1 reflects conversion rate and $\bar{\gamma}$ represents repeat rate. Relative values of those 3 parameters reflect impact of 3 different marketing efforts. Awareness is achieved mostly by mass advertising marketing;

conversion rate is influenced by promotion and pricing and repeat rate depends on perceived value of product and brand in market place. The authors conclude that it is valid *"for repeat sales when dealing with low priced, frequently purchased branded products or durable products for long enough time for repeat sales to become significant portion of total sales."* [8]

This thesis agrees with the authors regarding the first part of their statement – you certainly don't need a recommendation from a friend to buy a chocolate bar again. However, for durable goods this is not true especially for high priced product. Many people will listen to their trusted advisors for repeat purchase of a car, computer, Hi-Fi etc. For that reason parameter β representing word-of-mouth impact and its relationship γ1 is with very much missing here.

3.4.4 Mahajan, Muller, Kerin Model (MMK)

The Dodson Muller model provides a great mathematical apparatus for impact of marketing between advertising and WOM. Mahajan, Muller and Kerin [9] challenge one on of the key assumptions of Bass model: WOM is supposed to be only positive. In reality we all know that WOM can be not only positive or indifferent but negative as well. Arndt (l967) [22] reported that people receiving negative word-of-mouth comments about the product used were 24% points less likely to purchase the product than other individuals. By comparison, persons receiving positive word-of-mouth comments were only 12 percentage points more likely to purchase the product. It is apparent from these studies that negative word-of-mouth can have a harmful effect on the adoption of new products, or at the very least, retard the diffusion process. Negative WOM can

change successful innovation into failure even if initial buzz o hype was very positive. For example Segway, two-wheeled, self-balancing electric vehicle was supposed to change the way people live and move in the cities. However, based on initial experience with real transportation challenges (too fast for sidewalk, too slow for road) Segway has become niche product for few enthusiast users and useful tool for specific businesses like transportation is large warehouses.

MMK model proposes 5 groups of people: Unaware, Positive Potential Customers, Negative potential customers, Positive current tries, Negative tries and creates flow between them and describes each flow in following graph. Unaware people are changing to either positive of negative potential customers based on feedback from both potential customers as well as those, who already tried the product.

Graph 3.3 Customer Flaw Diagram for Products in Which Both Positive and Negative Types of Information are Circulated.
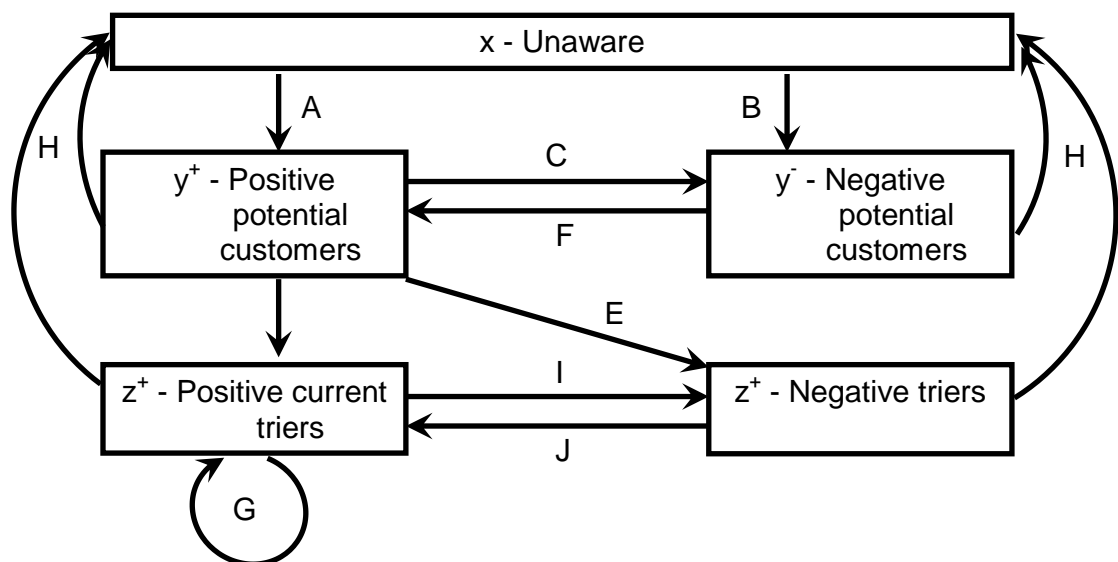
Source: Introduction Strategy for new products with positive and negative word of mouth, Page 1390 [9]

Table 3.4 Specification of Flow Diagram

FLOW	THE MODEL
A Advertising + w-o-m	Unaware to Positive Potential $ux + (k_1 y^+ + k_3 z^+)x$
B − w-o-m	Unaware to Negative Potential $(k_2 y^- + k_4 z^-)x$
C − w-o-m	Positive Potential to Negative Potential $(k_2 y^- + k_4 z^-)y^+$
D + trial	Positive Potential to Positive Triers $a^+ y^+$
E − trial	Positive Potential to Negative Triers $a^- y^+$
F + w-o-m	Negative Potential to Positive Potential $(k_1 y^+ + k_3 z^+)y^-$
G Repurchase	Positive Triers to Positive Triers $g z^+$
H Forgetting	Aware to Unaware $b_1 y^+ + b_2 y^- + b_3 z^+ + b_4 z^-$
I − w-o-m	Positive Triers to Negative Triers $k_4 z^- z^+$
J + w-o-m	Negative Triers to Positive Triers $k_3 z^+ z^-$

Source: Introduction Strategy for new products with positive and negative word of mouth, Page 1390 [9]

The outcome is summarized in following equations:

$$\frac{dx}{dt} = -ux - (k_1 \cdot y^+ + k_3 \cdot z^+)x - (k_2 \cdot y^- + k_4 \cdot z^-)x$$
$$+ b_1 y^+ + b_2 y^- + b_3 z^+ + b_4 z^-$$

$$\frac{dy^+}{dt} = ux + (k_1 \cdot y^+ + k_3 \cdot z^+)x - (k_1 \cdot y^+ + k_3 \cdot z^+)y^-$$

$$-(k_2 \cdot y^- + k_4 \cdot z^-)y^+ - (a^+ + a^- + b_1)y^+$$

$$\frac{dy^-}{dt} = (k_2 \cdot y^- + k_4 \cdot z^-)(x + y^-) - (k_1 \cdot y^+ + k_3 \cdot z^+)y^- - b_2 y^-$$

$$\frac{dz^+}{dt} = a^+ y^+ - \left(k_3 - k_4\right) z^+ z^- - b_3 z^+$$

$$\frac{dz^-}{dt} = a^- y^+ - \left(k_3 - k_4\right) z^+ z^- - b_4 z^-$$

$$z^+(t) + z^-(t) + y^+(t) + y^-(t) + x(t) = N$$

This model brings better description of reality by including negative WOM. The authors try to provide solution of optimal timing for advertising start in different scenarios:

- Purely negative WOM
- Positive and negative WOM
- Positive WOM

However, author of this thesis does not find this model very useful for several reasons. First, the authors conclude that in assumption of purely negative WOM it needs to start advertising well ahead so that negative WOM doesn't have time to discourage the others to buy product - not very surprising outcome. They calculate that negative WOM will soon slow down the sale of product so much that it is better to withdraw it from market. Not that this is completely impossible scenario in the market (authors provide example of movies with very bad reviews), but not very useful for research driven marketing departments, which certainly don't focus on that type of problem. Secondly, the conclusion is that the scenario for positive as well as negative WOM is too complex for analytical solution.

Third, the solution with only positive WOM collapses their model to Dodson Mueller model, which this thesis already described.

3.5 Discontinuous Innovation Marketing

Marketing of discontinuous technological innovation represents substantial different task than marketing of other categories of consumer goods. Word-Of-Mouth represents absolutely critical factor for adoption and diffusion of new technologies as already assumed by Bass and supported by all other evidence: *"Marketing a new technology is vastly different than marketing a consumer product that carries little or no risk. In the risky world of high tech, the customer will not rely on the word of the provider. The customer's decision process is based on finding objective information from reliable sources, something the vendor cannot provide. Have you ever had someone call and ask you what kind of computer to buy? This is a common method of lowering risk by gathering objective evidence. With low risk products, there is little or no penalty for making the wrong decision. Marketing low-risk products relies on name recognition, image and branding because most products in a given category are interchangeable, plus customers accept the claims of the provider at face value. When was the last time you called a trusted friend to ask what type of cereal or milk to buy? Or called the Coca Cola Company to ask if they offer 24-hour support?"* [10]

I already defined Word-Of Mouth Communication in previous chapter and I want to be as precise **WOM marketing**. It represents very similar concept, but it is not the same. For purpose of my thesis I will use the definition by Word-Of Mouth Marketing Association- in my opinion the best definition among all.

Word-of-Mouth Marketing: "Giving people a reason to talk about your products and services, and making it easier for that conversation to take place. It is the art and science of building active, mutually beneficial consumer-to-consumer and consumer-to-marketer communications." [11]

Unlike WOM (which the same source defined purely as "the act of consumers providing information to other consumers"), WOM marketing represents the active involvement of company to encourage and make it easy to spread positive WOM from satisfied customers. It still focuses on customer, who personally experienced the product – although if communication is made easy to users, it certainly encourages communication also from non-users, who did not buy the product yet.

Let's look how mathematical models can help us practically marketing of discontinuous innovation. Despite all effort to improve of original Bass model, I am convinced that the initial model provides great insights to marketing. Bass model certainly describes well only the **successful innovation** – so the one, which penetrates market to the extent that is large enough to sustain repeated purchases after initial adoption. There are 2 main reasons for unsuccessful innovation:

1. Major competitive technology competes more successfully for market share and doesn't allow the other similar technology to spread widely. Video recorded market provides great example with VHS (winning technology), Betamax (niche technology for professional usage only) and Video2000 (lost completely and was discontinued)

2. Innovation brings value only to innovators, while don't deliver any appealing value proposition to imitators. For instance Wireless Application Protocol (WAP), which enables access to the Mobile Web from a mobile phone, never grew beyond few technology innovators, because inherent limitations in content vs. full Internet content.

So what companies have to focus on to make sure the discontinuous innovation succeeds? Despite simplicity, initial Bass

model help dramatically to make the right marketing decisions – probably even more than many other complex models. It has just 3 variables, which we can influence by marketing: coefficient of innovation, coefficient of imitation and ultimate market potential.

1. Market potential m. This parameter simply reflects what kind of appeal brings the innovation to the society and initial price of the product. Considering no desire to decrease initial price, in this case the value of invention itself - so the PRODUCT in 4P of marketing - represents coefficient m. Promotion doesn't have any influence on total available market. So companies must make sure their innovative products deliver the real breakthrough.

2. As we described, coefficient of innovation represents how many people buy product in T=0. At that point, all the people, who buy this product, belong to group of innovators. At the same time we know that number of innovators in population is fairly low – based on previously mentioned Rogers's model innovators represent 2.5% of population. However, only those innovators, who are aware of the innovation, can buy the product. The conclusion is very simple: companies need to invest in marketing to those innovators so that they reach in ideal case 100% of awareness in this particular target audience from the launch of technology.

3. Coefficient of imitation represents Word-of-Mouth effect.

3.6 "Crossing the Chasm" Marketing

However, marketing to innovators only represents one of the potential traps, which were well described in 1995 by Geoffrey A. Moore in the book Crossing the Chasm [12] and follow on book

Chasm Companion [13] The books are still very true and relevant today. They show that motivations of the individual companies are different - the same way as individuals in Rogers' model – and they are divided into the same segments. Moore focused his book on marketing to the companies rather than individuals – but plenty of ideas are applicable also to marketing to individuals.

- Moore calls Innovator companies "Technology Enthusiasts". Their primary motivation is to learn about new innovation for their own sake of the innovation. They have strong interest for technical information; they like alpha/beta test products and they have no problems, if the solution has missing pieces. Those companies also represent the fundamental challenge: they want unrestricted access to top technologist and they ask for no-profit pricing or even for free.

- Early Adopter companies, also called Visionaries, strive to gain major competitive advantage via revolutionary breakthrough via new technology. Leaders of those companies demonstrate great imagination for strategic applications and they are attracted by high-risk high-reward propositions. They will commit to a supply of missing element; however, if an order of magnitude gains is possible, then they are not price sensitive. At the same time, they require rapid time-to-market and need high degree of customization and support.

- Early Majority companies also referred to as Pragmatists would like to gain sustainable improvements through evolutionary changes. They are concerned about real-world issues and trade-offs, focus on proven applications and prefer to buy market leaders' solutions. They insist on good

references from trusted colleagues and they want to see the solution in real production.

- Late Majority companies – or Conservatives – simply tend to avoid being at disadvantage relative to the main competitors in marketplace. They are risk averse, price-sensitive and often reliant on single trusted advisors. They need completely pre-assembled solutions and they would like to benefit from value added services, but do not want to pay for them.

- Laggard companies – also referred to as skeptics – have no interest in new technology, they want to keep status quo and they even spend effort to block purchases of new innovations. They have a strong mistrust in productivity improvements arguments and they are good at debunking marketing hypes. They are not really customers for any marketer.

In his book Moore suggests **the chasm** between Early Adopter and Early Majority markets in discontinuous technology innovation and so separating market into 2 distinct groups: First consisting of Innovators and Early Adopters and second combining Early Majority, Late Majority and Laggards. It provides directions, how to successfully market to two 2 very different groups of people to make technology ubiquitous and successful. As already described above, those 2 groups have very different motivations, need different messages, and have different psychological profiles - developing targeted marketing plans and messages for those different groups is the prerequisite of new technologies success.

Picture 3.5 Graphical Description of Chasm in Technology Adoption Life Cycle
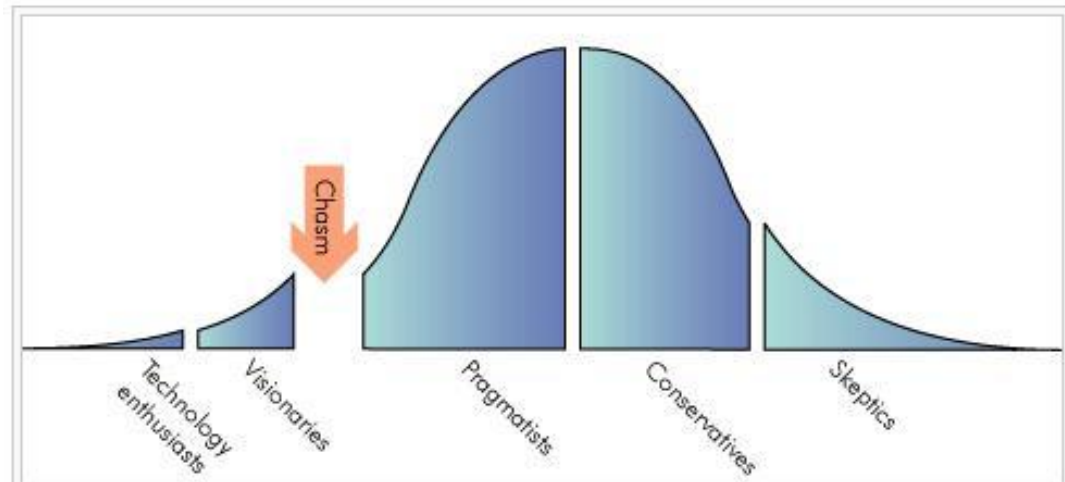
Source: Moore, Crossing the Chasm [12]

Moore argues that selling to early adopters represent reasonably simple task – they do want technology and they are willing to pay for it! The chasm represents a problem how to sell and market to Early Majority (Pragmatist) companies and move the sales to dramatically upward trajectory.

WOM marketing works extremely well among Early Adopters. Visionary companies like to spread the message to other visionary companies – companies don't have to convince them to do it. Major new technologies always provide many applications in variety of purposes and industries – for example electricity enabled light, powering engines in factories, heating, welding etc. This means they are useful to a very wide range of companies – so visionary companies have no objection to share the experience with those companies, they don't compete with. Not only they want to hear a feedback from those companies, but also they want to decrease cost of the technology for them; they know that nearly all new technologies tend to enjoy great economy of scale and so wider usage of such technology by other companies represent lower

prices for them. Thus visionary customers can become "virtual salesman" for technology innovation companies.

However, Early Majority – Pragmatist - customers are looking for examples of pragmatist mainstream customers. They ignore WOM from visionary customers; they don't trust case studies from Visionary companies, because they consider them too adventurous and irresponsible. This represents typical "chicken and egg problem" for any marketer. To cross this chasm, Moore suggests starting penetration of Early Majority market in industry specific solution, where pain of keeping current solution is higher than effort to adopt new technology. By doing so, that particular company is able to gain large market share in particular vertical market and only then start expanding to other vertical markets, one by one, until reaching full momentum across all industries. WOM marketing works well as long as the companies are non-competitive – although some companies don't have even trouble to share solutions with their competition.

Following example documents the sales and marketing approach on the table below: there are 10 potential customers for new technology interested in purchase of new technology. But they require 9 different improvements (called from A to I) to commit the purchase. Conventional approach of technological companies is usually to commit most common enhancement requests. In this particular example is represents A, B and C. However, this approach still doesn't fulfill any one customer wish-list – meaning still no new purchase. This approach based on Moore arguments leads to failure, because companies run out of money – assuming the providers of the technologies are start-up companies. In real life, many new technologies are also provided by established companies, where money doesn't necessarily represent major issue.

No matter that funding might be available from parent company; those new divisions of established companies simply run out of management patience with their new business and they are prematurely closed.

The correct solution is to focus on a single or few customer segments and build entire   product for that segment and use experience and additional funding to move on to similar segment. In our example in table 3.6, improvements E, G and I are the right ones – they enable to close the sale to customer 2 and 9.

Table 3.6 Example

Customer	Type of Required Solution Improvement								
	A	B	C	D	E	F	G	H	I
1	x	x	x			x			
2					**x**		**x**		**x**
3	x	x		x				x	
4	x	x	x	x			**x**		
5	x	x	x			x			
6	x	x	x				**x**		**x**
7	x	x	x					x	
8	x	x	x			x		x	
9					**x**		**x**		**x**
10	x	x	x			x		x	

Source: Author of the Thesis

Once companies succeed in marketing and establishing sales to Pragmatists companies, the technology drives on the track to become mainstream solution for many companies. It reaches the state of maturity- sustainable volumes with predictable profit margins. Companies enjoy dramatic sales growth, because it became appealing to many different market segments. Moore calls the state "Inside the Tornado" [13]. At this point, maturity and huge

profits of technology attracts many new entrants to the markets. Sales growth decelerates and profits start to decline. The market becomes fully mature with "standard" normal competitive marketing to many companies. At this point, specific approach to discontinuous marketing ends and traditional marketing starts.

3.6.1 "Killer Application"

The other approach to make technology mainstream is to identify, enable and promote "killer application". Author of this thesis did not find any broadly accepted definition for this term used neither by technological companies nor by pundits – the thesis defines it as: *"Killer application is specific application of technological innovation, which is so compelling, desirable and providing such a huge benefit that many new mainstream customers will buy it despite of potential high price, complexity or immaturity of the solutions"*. Philologically the name comes from the notion that those customers would be *"willing to kill to have it"*.

The following articles want to document how killer applications worked for several previous technological innovations. Invention of steam engine started industrial revolution in 18th century. The initial application of the engine was to power textile manufacturing. This application required only handful of large engines. Many more applications of steam engine came later on – but one "killer application" caused that steam engine was used broadly. Sail boats were critical in international trade until 18th century. However, they had 2 critical disadvantages – unpredictability of delivery time due to dependency on wind-power and second, they were little of use as river boats. New steam boats were initially much more expensive – but shipping companies started purchase them in volume anyway because they

were able to guarantee the delivery time as well as transportation along major rivers on the continent. We certainly cannot talk about any marketing efforts using the example of steam engine, as it simply happened to be so that steam boats became "killer application" for steam engine.

Adoption of electric power has interestingly two killer applications. T.A. Edison invented the light bulb in the late 19th century and at the same time his company had started building the electric power grid. Electric energy could obviously do many other useful applications – but the light bulb itself provided enough utility and justification for adoption. The implementation of electric grid consisted of Direct Current (DC). It was ideal for light bulbs: it could be directly connected with storage batteries, providing load-leveling and backup power in the case of failure of generators. Edison had also constructed a meter to allow customers to be billed for energy proportional to consumption, which only worked with DC. However, DC distribution works very poorly in 2 areas: it is hard to transform the voltage and so design efficient distribution for long distance as well as it is less efficient in converting electricity to mechanical movement – electric engine powered by Alternating Current (AC) is much more simple and efficient than DC. Edison started to lose the technological battle, but he was not only a great inventor, but also a tough salesman and marketer. He started a negative campaign against AC and its proponent, Westinghouse, saying that AC technology was unsafe to use. He started public demonstrations of executing animals by attaching them with a Westinghouse AC generator! [14] And he initiated spreading the horrific message to press through Public Relations, as well supported it by WOM marketing, irrespective of the fact   that DC is as dangerous as AC. He had also financed and

supported invention of the electric chair, which obviously used AC for the executions - what a brutal paradox to the meaning of "killer application"! At the end AC won the "battle of currents" despite all Edison's effort. Electric engines were killer applications for AC and bulb works with AC the same way as with DC. As described, there was a huge PR and WOM marketing effort in adoption of electric power grid and a "killer application" decided the battle at the end.

We can hardly imagine life without personal computer. Today it is ubiquitous and a cheap tool for every company and individual. There are thousands of PC applications, but one caused that PC became mainstream technology. When PC was introduced in the late 70's, it was an expensive machine with few applications – much less capable than mainframe computers, which companies had been using. Individual departments had to program the mathematical tasks and send them to central computing centre and wait for result for next day. Being able to calculate something immediately was an incredible value proposition for them – spending 10,000$ was cheap! Lotus 1-2-3 spreadsheet programs – predecessor of the current Excel – helped PC to become mainstream technology. PC manufactures started to pre-install these SW packages on PC to promote great use of the application as well as to lower the price reached by bundling. At the end PC became so cheap and ubiquitous that it replaced for instance typewriter. However, it would have never happened without a killer application of spreadsheet – nobody would have been willing to pay $10,000 for typewriter.

Finally, the "killer application" marketing strategy worked incredibly well for a broad adoption and diffusion of MP3 players. Those completely new devices for music consumption had been

introduced to the market already in the late 90s. Their penetration stayed low for a few years and there were many small players on the market. In 2001 Apple introduced today's already legendary iPOD – expensive device launching to the market in severe recession after dot.com bust. The early adopters enjoyed new concept of large amount of CDs possible to load and new easy to use touch-point control. Mainstream users found it difficult to load music to iPOD in the same way as in all other MP3 players. And many of them were deterred by not having the possibility to buy music legally on the Internet. They only stared to buy iPOD in 2003, when Apple had introduced iTunes software, which addressed both simplicity as well as offered legally available download of music. Apple and iPod became dominant player on the market of MP3 players by providing killer application for MP3 technology. And despite of increasing competition, Apple has kept its strong position until today.

3.6.2   WOM Marketing Role in Discontinuous Innovation

No matter which overall marketing strategy has been used for discontinuous product marketing, WOM marketing represents indispensable part of overall marketing promotion. Regardless of how innovative products are being brought to market, companies cannot let only WOM happen by chance – they need to encourage it, make it easy to make it happen. Advertising, Public Relations, sales promotion and all other parts of marketing promotion will not ultimately succeed without WOM marketing, because people need to get assurance about new technology from others.

3.7   Role of Opinion Leaders in WOM

Word-of-mouth sharing and propagation theory through influencers has been first described in a book titled Personal Influence [15], written already in 1955 by Paul Felix Lazarsfeld and Elihu Katz. The authors describe the communication process as a 'two-step' communication flow. Katz and Lazarsfeld propose to utilize power of advanced users "Opinion Leaders" or "Trusted Advisors" and capture their opinions to become "messengers" in amplifying the marketing message to the whole mass market of ordinary consumers.

Table 3.7 Graphical Representation of Personal Influence
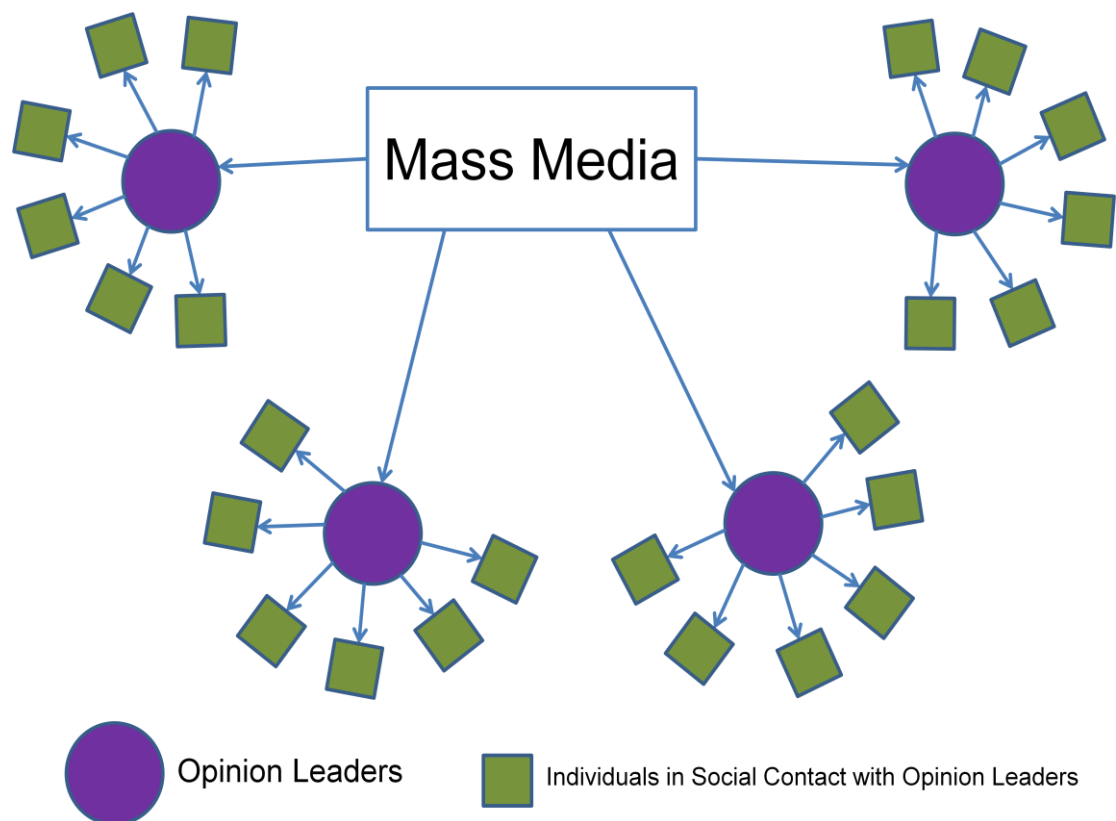
Source: Author of the Thesis

Katz and Lazarsfeld viewed   opinion leaders as broad range of people, who influence public opinion – not few overly influential people capable of changing the opinion of whole population.

However, over the time the idea of few influential people capable of changing overall opinion, has become widely accepted by the WOM theory. The idea that few influential people play an indispensable role in WOM communication has become conventional wisdom used by many different authors in their books like for example "The Influentials: One American in Ten Tells the Other Nine How to Vote, Where to Eat, and What to Buy" by Jon Berry and Ed Keller.

The ultimate culmination of this approach represents the one of the most widely referenced book *"The Tipping Point: How Little Things Can Make a Big Difference"* [16] written by Malcolm Gladwell. He describes the "Tipping Point" as time, when very little action causes major sociological change in the whole society. He defines that this can happen as long as 3 conditions fulfilled:

1. "The Law of the Few". The "law" about the structure of our social network and how messages are passed through word of mouth. He describes as new major change can spread even if only few people with specific profiles are involved *"The success of any kind of social epidemic is heavily dependent on the involvement of people with a particular and rare set of social gifts"*. He attempts to classify three important types of people who affect the rapid spread of messages through the network as Connectors (people who have great social network), Mavens (people who have knowledge and they are trusted) and Salesmen (people with ability to persuade).

2. "The Stickiness Factor" – this "law" is about the actual information content and packaging of a message. Connections and the personal character of the people trying to spread a message can certainly help to spread it, but if the message is not worth spreading, then it is doomed to failure. The

stickiness factor says that messages must have a certain character which causes them to remain active in the recipients' minds. Moreover, they must be deemed worthy of being passed on.

3. The Power of Context: The law of context is a rule about the environment in which a message proliferates. Only small changes in the context or environment of a message can determine whether or not it causes the change. Thus, these social "epidemics" can fail if the location where they are introduced is not right or if the current mental state of the population is not ready to accept the message.

However, no matter how popular and frequently quoted this book is, it certainly doesn't represent scientific information with extensive quotations, formal definitions and especially experimental research to prove the "findings". To the contrary of influencer's models, we can find many empirical studies, where the authors dispute the value of influencers. Author of this thesis identified several scientific papers supported by extensive research, which disagree with critical role of opinion leaders.

Julia Harkola and Arent Greve concluded in their research that *"opinion leaders do affect diffusion although they have a moderate effect. Informal opinion leaders may have a larger influence than formal opinion leaders"* [17]

Gershon Feder and Sara Savastano from Development Research Group The World Bank on their paper "The role of opinion leaders in the diffusion of new knowledge" concluded that *"there is no clear evidence on whether opinion leaders are more effective if they are similar in socioeconomic attributes to the other farmers rather than superior to would be followers"* [18]

Many other researchers (incl. Mersham and Skinner) have criticized the two-step theory because it implies that all opinion leaders are active recipients and that all followers are passive consumers. [19]

One of the most extensive researches in the field impact of influential people for dissemination of information was done by Duncan J. Watts and Peter Sheridan Dodds. In their paper "Influentials, Networks, and Public Opinion" [20] they did not find any above the average importance of opinion leaders, which they call "influentials": *"In fact, while any assertion regarding the lack of importance of influentials is necessarily speculative, based on our results, we would go as far as to suggest that in focusing on the properties of a few "special" individuals, the influentials hypothesis is in some important respects a misleading model for social change. Under most conditions, we would argue, cascades do not succeed because of a few highly influential individuals influencing everyone else but rather on account of a critical mass of easily influenced individuals influencing other easy-to-influence people. In our models, influentials have a greater than average chance of triggering this critical mass, when it exists, but only modestly greater and usually not even proportional to the number of people they influence directly. They may also participate in the critical mass, especially when they are simultaneously hyperinfluential and easily influenced, but under most conditions they do not. Thus, to the extent that particular individuals appear, after the fact, to have been disproportionately responsible for initiating a large cascade or sustaining it in its early stages, the identities and even characteristics of those individuals are liable to be accidents of timing and location, not evidence of any special capabilities or superior influence."* [20]

Based on the above mentioned facts (and numerous other literature), this thesis concludes that marketing models based on few highly influential people don't represent fully experimentally proven models useful for WOM marketing. It is obvious that targeting opinion leaders and capturing their WOM may provide better results than complete randomness – it is a very pragmatic and sound WOM marketing strategy. The author of the thesis doesn't even dispute that sometimes much unexpected things happen and few people may change opinion about company and they products – there are certainly examples in the sense of Tipping Point that Malcolm Gladwell describes.

However, there is no proper mathematical analysis of such behavior – neither are there examples of how a marketing manager could properly utilize experience provided by this popular concept. This thesis considers Gladwell's book a non-scientific, yet highly readable and interesting work. These events rather resemble the "Black Swan", an expression coined by Nassim Nicholas Taleb for *"highly improbable events that have massive impact"*[21]. In his opinion, the principal characteristics of those events are that they are <u>unpredictable</u>. From epistemological principle the author argues: *"to understand the future to the point to being able to predict it, you need to incorporate the elements from this future itself"* [21]

In summary, Word-of-Mouth marketing has to reach much broader range of people than just a few highly influential people to succeed and create a market wide impact. Mathematical models thus can be simplified and assume more homogenous population. From epistemological principle, they cannot capture those special events anyway.

4 Effectiveness of WOM Communication

4.1 Introduction and Definition

Do we trust recommendation from our friends regarding which product to buy more than advice given by TV advertising? This sounds like too trivial a question and obviously the answer is YES. WOM communication certainly influences target audience more than traditional marketing. This thesis has found plenty of research on this topic and it will aspire to summarize it in most comprehensive way to provide useful tools to marketing experts. **The thesis refers to effectiveness of WOM as measured by how larger impact WOM exerts vs. impact of traditional marketing promotion.** Certainly, promotion has several forms from sales promotion, public relations and various types of advertising - but obviously most prominent form of traditional marketing is TV advertising. The word "impact" in this sense represents many meanings, which we can divide into 2 categories:

1. Brand Metrics: brand awareness, relevance, preference, purchase intend, brand equity, customer loyalty etc.
2. Business Metrics: sales, profitability, customer acquisition, customer life time value, etc.

Last but not least, effectiveness of WOM communication brings double edge-sword. By nature all traditional marketing delivers positive message to target audience crafted carefully by company. WOM communication can deliver both positive as well as negative messages. WOM marketing can only encourage positive communication about a product, but a company cannot ultimately control the tone of WOM communication.

4.2 Positive vs. Negative

Initial research was done by Jonan Arndt [22], who focused on the comparison between positive and negative WOM communication only – not on comparison of WOM communication advertising. He has found a positive correlation between WOM vs. non-exposed. However, he has experienced even a stronger impact of negative WOM vs. a positive one. "*Though the respondents were eight times as likely to receive favorable as unfavorable word of mouth, the results suggest that unfavorable word of mouth was more effective. Hence, compared with the none-exposed group, the receivers of unfavorable word of mouth were 24 percentage points less likely to buy the new product; those receiving favorable word of mouth were 12 percentage points more likely to buy*". [22] He concludes that WOM has a much greater impact than media communications on those who are exposed, because there is an opportunity for feedback and clarification, WOM is regarded as providing more trustworthy advice, and personal contacts are generally able to offer social support and encouragement.

Mahajan, Muller and Kerin in above mentioned paper [9] also conclude strong impact of especially negative WOM. They also advice how to start advertising to minimize negative WOM impact on the consumers with repeat purchase items: "*the policy calls for reaching the level as quickly as possible by advertising at capacity when releasing the product. Once the desired level is reached, maintenance advertising is called for, as it maintains the desired level at a constant state. In the case where negative information is dominant, there is a desired level of awareness to be reached as quickly as possible by advertising before the product release time. This helps delay the word-of-mouth flow and build quickly die aware group.*" [9]

House, House and Mullady from Food and Resource Economics Department, University of Florida, Gainesville researched recommendations of food products. Their findings confirm the importance of recommendation from social networks: *"social network variables are a significant influence on a person's willingness to listen to a recommendation from someone else within their social network. Both the subject and the recommender's position in the network are influential."* [23]

4.3   New vs. Existing Products

Common sense generally supports the conclusion that media communications are most effective in creating awareness and providing information about a product or company, while WOM communications are more influential in forming or reinforcing attitudes once advertising reaches consumer a person. Initial research done by Engel, Kollat, and Blackwell clearly supports that [24] it can be argued that the minimal risks associated with this type of products don't justify the high acquisition costs of word of mouth information. On these grounds, word of mouth should have lower aggregate influence on low risk purchases.

Horsky and Simon[25] in 1983 come to the same conclusion as Mahajan Muller and Kerin that strong advertising combined with follow-on WOM marketing delivers the optimal marketing result in introduction of new products. *"The optimal advertising policy was derived and it was shown that the firm should advertise heavily in the initial periods, informing all innovators early about the existence of the new product. As these innovators adopt the product and turn into word-of-mouth carriers, the level of advertising can be gradually reduced. Such a policy would cause the peak in sales to be higher and to occur earlier than would have been the case if no advertising was*

used. This advertising policy, apart from being consistent with observed policies of producers of new products, also highlights the investment aspects of new product introductions." [25]

4.4 WOM vs. Advertising

4.4.1 Advertising vs. WOM Impact

Many studies show that WOM has more positive impact that advertising and other marketer controlled sources. Let's look at several empirical studies. Francis Buttle concludes that WOM is much more important input to the decision process when purchasing services, rather than goods. "Service consumers prefer to seek information from family, friends and peers rather than sponsored promotional sources. Services are high in credence properties which are difficult to evaluate prior to consumption." [26] Herr, Kardes and Kim [27] even observed that WOM can be more influential than paid consumer recommendation sources like Consumer Report [28]

Goldenberg, Libai, and Muller argue that marketing effectiveness for WOM grows over the time, while marketing effort is critical at the beginning of marketing campaign. *"External marketing efforts (e.g. advertising) are effective. However, beyond a relatively early stage of the growth cycle of the new product, their efficacy quickly diminishes and strong and weak ties become the main forces propelling growth. The results clearly indicate that information dissemination is dominated by both weak and strong w-o-m, rather than by advertising."* [29] Most recently Trusov, Bucklin, Pauwels modeled sign up of members for major social networking site and compared it with marketing activity of the same (company prefered to remain anonymous). The data set contains 36 weeks of the daily number of sign-ups and referrals in period from

February 1 to October 16, 2005. The study provide not only clear conclusion, but also quantifies how WOM impact vs. advertising impact. *"We find that WOM referrals have a strong impact on new customer acquisition. The long-term elasticity of signups with respect to WOM is estimated to be .53 (substantially larger than the average advertising elasticities reported in the literature). The elasticity for WOM is approximately 20 times higher than that for marketing events and 30 times that of media appearances."*[30]

4.4.2   Advertising Impact on WOM

Several previously studies (Horsky, Mahajan) prove that advertising has positive impact on WOM communication. Basically effective advertising also stimulates positive WOM communication and this way companies benefit from advertising by additional positive effect. All previously executed studies mostly focused on mature markets (especially USA). The situation looks to be even more positive in emerging markets. Xue-cheng Yang, Xiao-hang Zhang, Feng Zuo conducted a survey in mobile phone users[31], and tested relationships between Marketing Effort, Customer Satisfaction and WOM. They demonstrate that marketing efforts have positive impact on consumers' WOM spread behavior and customer satisfaction plays an important role among the relationship between marketing efforts and WOM. They quantify the findings: *"Total Effects of Marketing Efforts to Word of Mouth is 0.646 which means every percent increase of the customer's evaluation to companies' marketing activity would raise the possibility of positive WOM 0.526%. Moreover, there is not only the Direct Effects 0.526 from marketing to Word of Mouth; also Indirect Effects via Customer Satisfaction 0.082 exists. Therefore, the mediating variable role of*

Customer Satisfaction between Marketing and WOM is thoroughly proved" [31]

Interesting study comes also from advertising industry, where we could expect bias towards paid advertising and disparaging WOM. On the contrary recent research from Rubicon [32] shows that personal advice and online comments by buyer carry much stronger influence than advertising.

Graph 4.1 Influence of Sources of Information on Purchasing
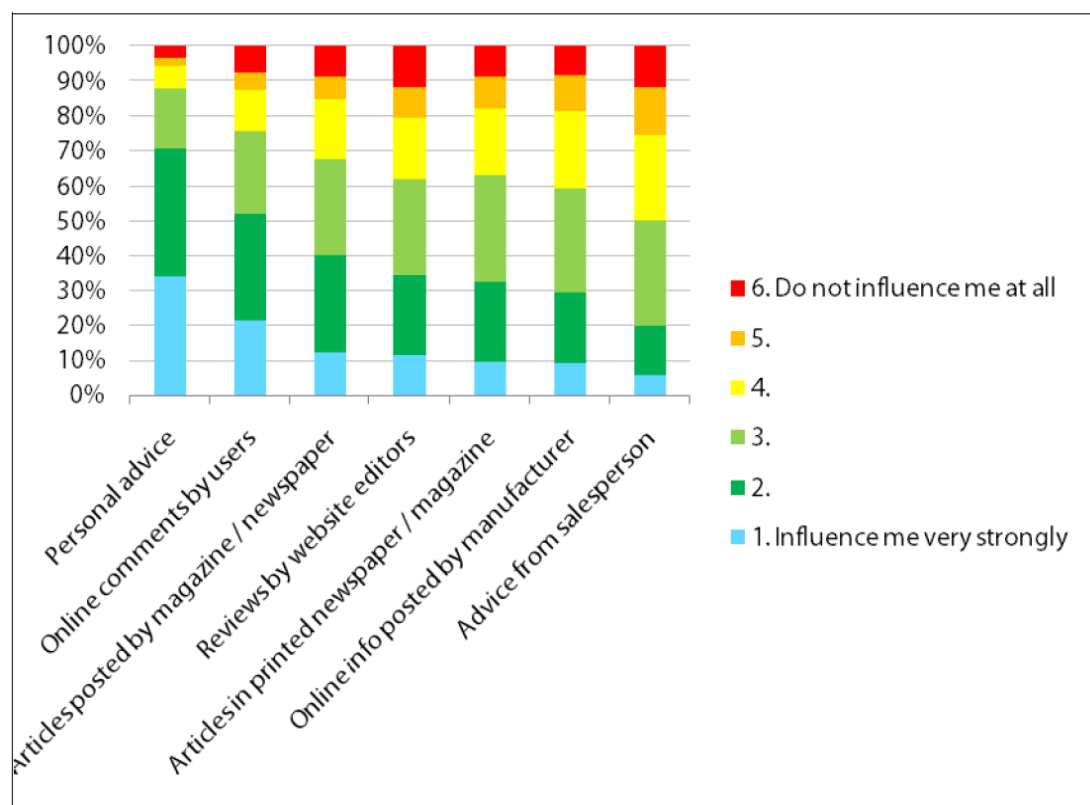
Source: Rubicon: Online Communities and Their Impact on Business. Ignore at Your Peril. October 22, 2008 [4]

4.4.3 Customer Acquisition and Long-term Value

Effectiveness of WOM vs. advertising can be described even better by quantifying of customer value. Villanueva, Yoo and Hanssens prove the financial long-term value of the customer acquired by marketing versus WOM varies in timescale.

Marketing acquisition is obviously faster as long as the company spends substantial amount of money vs. WOM customer acquisition. This way companies are able to increase short-term revenue from their customers much faster than through WOM. However in the long run (in their definition more than ten weeks), customer acquired by WOM delivers a greater financial impact than customer acquired by marketing. The main reason for this difference is that customers acquired through WOM tend to stay longer as active customers and thus generate more value over time. On top of that, cost of acquisition through marketing is obviously higher than WOM. They conclude: *"the difference becomes even more pronounced when we consider such costs. For example, if the firm needs to spend $10 per new customer acquisition through MKT channels, the net value of one MKT customer is $1.76, whereas that of one WOM customer (assuming that there is no cost associated with WOM acquisition) is $23.48. Therefore, managers can use such simulation results to determine an appropriate level of customer acquisition spending. As an illustration, if the firm wants to use financial incentives to boost WOM acquisitions, incentives of up to $23 per acquired customer would be justified."* [33]

4.4.4 Trust Advertising vs. WOM

Last but not least, traditional advertising remains less credible source of information than personal recommendation. This phenomenon becomes even more exacerbated within young generation of "digital natives". Those consumers grew up with Internet and social media and they see adverting as intrusive and non-credible. Nielsen Global Online Consumer Survey Study from July 2009 shows that 34% people trust recommendation from people I know versus 8% of people, who trust TV advertising. [34]

Picture 4.2 Global Consumer Trust in Advertising by Channel
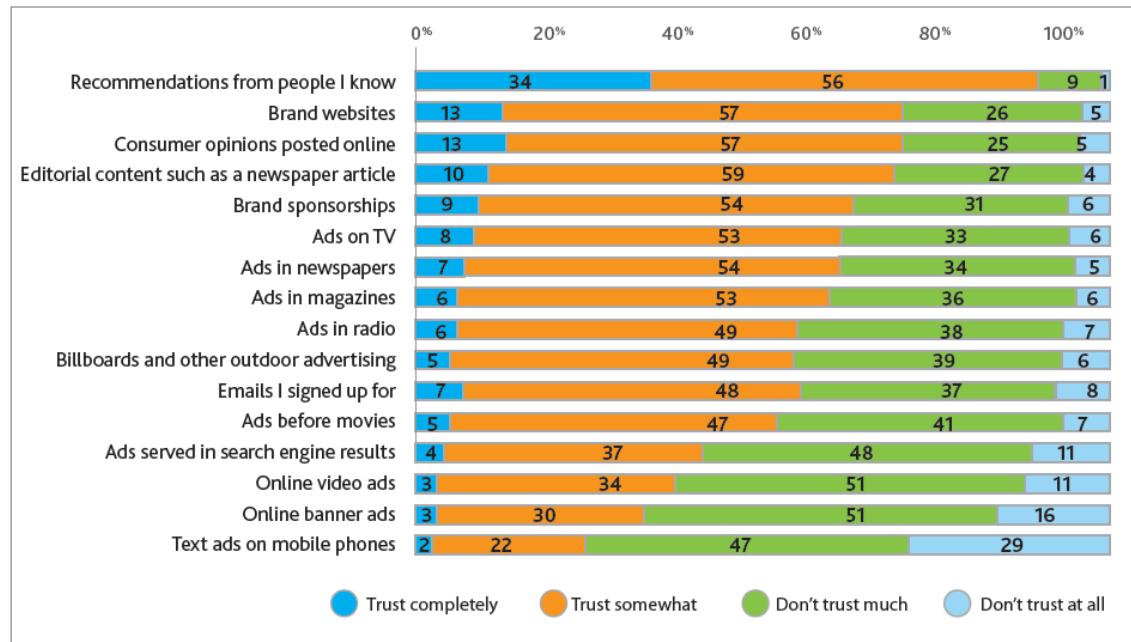
Source: Nielsen Global Online Consumer Survey July 2009. [5]

However, interestingly enough, people see TV advertising more trustworthy than online advertising. Online banner ads score very poorly vs TV adverting – only emerging mobile phone advertising scores worse. This thesis explanation is following: majority of time spend on Internet belongs to social media. [89] And people do see social media as personal space rather than public space of TV (and not surprisingly phone even more personal device). Another Nielsen report summarize that idea as following: *A key reason why advertising on social networks hasn't been as successful as on the more 'traditional' publishers is because social networkers serve a dual role as both the suppliers and consumers of content. In the traditional model they simply consume the content supplied by the publisher. Therefore, members have a greater sense of 'ownership' around the personal content they provide and are less inclined to accept advertising around it.* [90]

4.5 WOM Effectiveness Conclusion

Common sense tells us that personal recommendation represents more effective source of information than advertising. Based on all research, this thesis concludes that WOM marketing is truly more effective than traditional marketing in measurable way. People are more influenced by personal recommendation than by adverting campaign in nearly all aspects and measurement of marketing campaign – from awareness, preference, purchase intend, brand equity, customer loyalty up to business metrics of sales, profitability, customer acquisition and customer life time value. The only area, where WOM communication and so WOM marketing lags behind traditional advertising, is speed of reaching of broad market. WOM marketing (but not viral marketing) requires time to proliferate, while heavy marketing campaign with substantial spending can achieve the results faster. Despite of TV channel fragmentation and diminishing number of magazines, paid advertising as well as sponsorships can reach broad audience. Super Bowl advertising demonstrates perfect example about the great value of reaching broad audience. While even the most succesful TV show attracts low % of US population, the latest Super Bowl 2010 attracted 106 million viewers in USA and many more around the world. For that particular reach companies are willing to pay over 2 million $ per 30 second commercial TV spot. For the same reasons, sponsors are willing to pay huge sums of money for Soccer Championship sponsorship – reaching the worldwide audience in short period of time. Finally, there should never be a question about WOM marketing vs. traditional advertising in planning overall marketing campaign. They reinforce each other and together provide better overall influence than each other separately.

5   Continuous Innovation WOM

5.1   Consumer Goods vs. Technology Marketing

As previously stated, there are huge differences between continuous and discontinuous technological innovation – both mathematical models and marketing. However, once customers are familiar with particular technology, they don't require any major learning time to use the new innovation. At the discontinuous stage, marketing of technological goods require WOM marketing and for that reason technological companies like to use WOM marketing. On top of that WOM communication these days happens much more on Internet that face-to-face (this thesis will cover the differences and specific definition later), which makes it ever more familiar to marketers in technological companies – in many cases leading to over usage of this part of marketing promotion.

The fundamental question is: How does then WOM marketing of technological products differ to WOM marketing of any other type of consumer goods marketing? So is there any difference between audience receptions of messages of technological vs. normal products? Are there measurable differences between various types of consumer products?

To answer these questions this thesis will analyze the following: what is the impact of WOM marketing for different types of products. If the WOM marketing has statistically meaningful difference for marketing of continuous technological innovations vs. the other categories of products, then obviously technological product represent special category and marketing of those products needs to be treated differently than traditional categories. If there is no statistically meaningful difference, then marketing of technological products improved by continuous innovation can be

treated the same way as marketing of all other types of consumer goods. This thesis will analyze WOM marketing impact of different types of consumer marketing good and author of this thesis will suggest which types of products are most suitable to WOM or viral marketing.

5.2   Choice of Data Source

Any researcher has to inevitably make a choice between usages of primary or secondary data. Primary data is a data which is created by researcher.[35] He/she designs the questioner's methodology and executes such research for the first time. There is no previous source of such data available and naturally this is considered prefered source of data for any scientific research. On the other hand, the major disadvantage of primary data is that the design of survey must result in providing statistically meaningful data. Researcher must ensure that the respondents don't give fake, socially acceptable answers and try to cover up the reality. The sample of surveyed people must be large enough and it must represent the distribution of general population. There must be rigorous control over the data collection method. Overall the primary source data gathering usually requires extensive funding needs.

Secondary data [35] is a readily available data like data from trade directories, statistics from government agencies or specific research shared broadly by research institutes. The other type of secondary data is result of data analysis and interpretation of primary sources. Those secondary sources are often produced well after the events or primary sources they comment upon, and their authors tend to be modern scholars or commentators rather than

eyewitnesses of what they write about. Typical secondary sources include scholarly books, articles in journals, and textbooks.

Author of this thesis decided to use secondary data with many features of primary data. The source of data <u>doesn't</u> represent subjective interpretation of data, but truly raw data from the source. The data gathering methodology is fully documented and the data is not generally available. Overall it represents statistically meaningful dataset for the thesis – author of this thesis doesn't envision any other methodology, which would enable to get similar data without large funding far beyond PhD student means. Overall the dataset has all the characteristics of primary data with exception that the research was not designed and executed by me, but external company. Based on all information, author of this thesis is convinced that he used best possible and representative data for the thesis.

5.3   Data Source

The data source for this thesis is "Market & Media & Lifestyle, TGI MEDIAN, 2007 3rd stage and 2007 4th stage", which I was allowed to use for my thesis as a courtesy of the Median Czech Republic company.[36] Market & Media & Lifestyle (MML-TGI) database provides comprehensive information in Czech Republic market about consumer household behavior, media exposure and lifestyle. The products utilize licensed methodology from Great Britain, by BMRB International with custom-written questionnaire for the Czech Republic and so provide with representative sample of respondents for the Czech Republic. The households are randomly selected and the questioners measure TV-viewing, radio-listening and print-media consumption information, and especially attitudinal data from lifestyle statements. Beside the media data,

the database contains information about people WOM communication about specific type of consumer products.

The in-field data acquisition was completed within the dates of the term 25.6. 2007 - 9.12. 2007. (Time suitability of data will be explained later). The data was gathered by using MEDIAN own interviewer network. The sample comprised inhabitants of the Czech Republic between 12–79 years. The selection of the respondents was performed by the random sampling method. The sample size was 7084 respondents. Since 2007 is reweighted quarter selection set on 3750 respondents.

The research was performed by employing the method of questioner / respondent personal interviews (face-to-face), combined with an independent questionnaire fill-out form done by the respondents. The completed questionnaires were picked up personally by the interviewers, and sent off to the Research Provider address.

The analyzed database contains the data, which is sourced from end of 2007 and this thesis used it for the analysis conducted in year 2009; the delay is simply caused by the lag of the research dates gathering, final compilation of data and ultimate availability of MML-TGI database for educational non-commercial purposes at Faculty of Business Administration University of Economics, Prague. At the time of finishing of this thesis, there will be more recent data available. However, data about personal WOM communication certainly don't change much with time – they represent personal psychological characteristics of individuals, which change only slightly at individual level. Even more in overall population they change even less as attitudes of overall population represent huge inertia. To prove the point with

quantitative data, the thesis compared previous data from MML-TGI database from year 1999 and 2005. The results show that there were no significant differences in attitudes of population to personal WOM communication. Obviously, data such as media consumption do change quite substantially over the time, but this data-set was neither required nor utilized in this research work. See all the details about MML-TGI database addendum 12.3.

5.4   Technological Products Definition

The MML-TGI database contains 11 categorized of consumer products summarized in the following table:

Table 5.1 Categories of Products in MML-TGI Database

1	Clothing
2	Mobile phones
3	Cars
4	Food
5	TV/video/audio
6	Alcoholic beverages
7	Cosmetics
8	Household supplies
9	Household appliances
10	Pharmaceutical products
11	Financial Services

Source: Created by Author of the Thesis from MML-TGI Database

This thesis defines following 3 categories of products as Technological products: **Cars, Mobile phones and TV/video/audio.**

They all 3 represent categories of the products, which are clearly in the stage of market maturity and only continuous innovation happens. Penetration of mobile phones and TV/video/audio devices reached levels well over 100% of all households – actually with multiple devices not only per households, but also per individual. For instance mobile phone penetration in Czech Republic reached 134 subscriptions per 100 people [37]. In the world-wide scale we see the same status: there are 65 countries, where mobile phone subscriptions outweigh number of people. Czech Republic listed at 19th place, while United Arab Emirates lead the world ranking by 209 subscriptions per 100 people. [37]

Car ownership penetration demonstrates much lower levels – only 50% households own at least one car, while multiple cars ownership is well below 10%.

Table 5.2 Categories of Products in MML-TGI Database

Question: Do you have car in your household?	
YES - 1 car	50.2%
YES - 2 cars	7.8%
YES - 3 cars	0.8%
NO	41.2%

Source: Created by Author of the Thesis from MML-TGI Database

However, we can certainly assume that lower ownership of cars is not caused by car being something new to individuals, but rather affordability of such a major purchase. So the thesis includes cars as technological category in continuous innovation stage.

5.5 MML-TGI Data Structures

The data about WOM communication are portrayed by specific part of the questionnaire. They ask the following questions and suggest several possible answers.

Table 5.3 WOM Specific Dataset in MML-TGI database

Questions	Answers				
With how many people did you talk in last 12 months about these types of products?	With many people	With few friends and family	1 or 2 people	nobody	
How much information were you able to provide them?	a lot	medium	little	very little or nothing	
Is it probable that you have convinced them about your opinion?	very probable	quite probable	yes and no	rather not	Certa-inly not

Source: Created by Author of the Thesis from MML-TGI Database

5.6 MML-TGI Data Limitations

To summarize table 5.3, the questionnaire provides quantitative data points regarding following information of WOM communication among the population of Czech Republic:

1. Volume of WOM communication
2. Quantity of information on specific topic
3. Perceived persuasiveness

Author of this thesis is well aware that the MML-TGI database carries certain limitations. First, the answers don't provide exact quantified number of people, which particular respondent shares the experience with – just provides approximations like "many people" or "With few friends and family". It limits potential modeling details of WOM communication of different product categories. However, exact number of people, to whom information is communicated to, is not necessary information for proving the hypothesis and it will not represent major obstacle in reaching the goals of this thesis.

Second, it is very clear that question #3 doesn't provide answer to actual persuasiveness from recipient point of view, but rather perception of persuasiveness from sender point of view. In this sense, it doesn't measure the impact of persuasion to the recipient of the advice. This limitation causes that MML-TGI dataset doesn't enable to model effectiveness of WOM marketing. However, WOM marketing effectiveness was researched in high level of details in many other papers and it was summarized already in previous Chapter 4 with clear conclusion. It is certainly pity that more specific information is missing - however it is not required to verify hypothesis of this thesis.

5.7 Volume of WOM Recommendation

The volume of WOM recommendation about particular topic provides critical baseline for studying WOM communication in population of Czech Republic. We can see that questionnaire delivers specific answers for all categories with very low amount of not answered questions resulting in high quality data for WOM marketing research.

Table 5.4 Volume of WOM Recommendation Summary

With how many people did you talk in last 12 months about these types of products?	With many people	With few friends and family	1 or 2 people	Nobody	Not stated
Clothing	16.4%	39.2%	25.0%	17.8%	1.6%
Mobile phones	14.0%	30.6%	24.6%	28.9%	1.9%
Cars	12.6%	24.6%	21.8%	38.9%	2.2%
Food	12.0%	43.4%	27.3%	15.8%	1.4%
TV/video/audio	10.8%	29.6%	23.3%	34.1%	2.1%
Alcoholic beverages	10.7%	25.4%	24.6%	37.0%	2.2%
Cosmetics	10.0%	28.6%	26.4%	32.9%	2.1%
Household supplies	8.4%	31.0%	27.9%	31.0%	1.8%
Household appliances	8.0%	36.5%	25.3%	28.4%	1.9%
Pharmaceutical products	7.5%	25.4%	29.5%	35.6%	2.1%
Financial Services	6.4%	25.5%	26.6%	39.3%	2.2%

Source: Created by Author of the Thesis from MML-TGI Database

The table 5.4 provides at first look simple, but important outcome: **Level of WOM recommendation dramatically differs in various consumer goods categories described in MML-TGI data.** If we consider highest levels of recommendation ("With many people") the difference between the highest (Clothing category) and lowest (Financial services) is whopping 256%! Clearly marketers have to take this fact into the consideration, when they design both traditional as well as WOM campaigns. Propensity of general population to WOM recommendations for especially pharmaceutical products and financial services will require much

more effort to create desired WOM spread effect in those categories. Let's evaluate now, if mature technological products improved by continuous innovation represent special case for WOM sharing or they tend to behave in similar way as other categories of products.

5.7.1 Highest Recommendation

The graph below describes percentage of people, who share the topics "with many people" i.e. the highest level of recommendation. All three technological categories are all in top half o of the graph and so show higher than average level of recommendation than average. At the same time, they don't represent fully distinguishable level of WOM recommendation – for example the clothing (certainly very old and traditional category) exhibits highest level of recommendation.

Graph 5.5 Volume of WOM Recommendation "with many people"
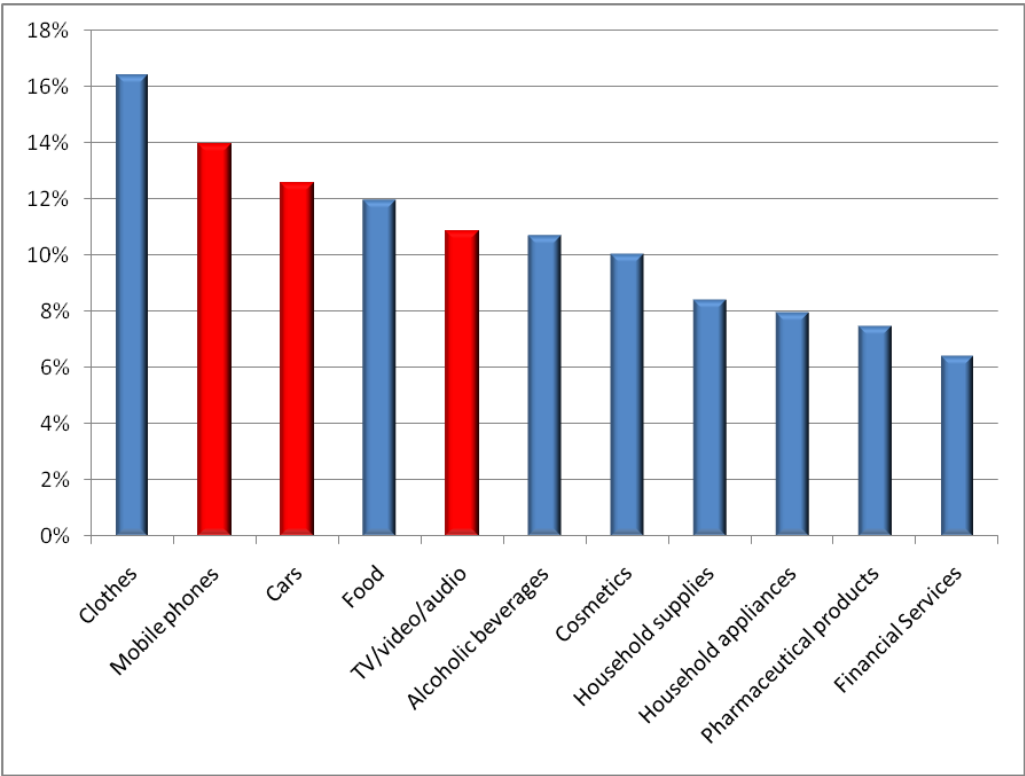
Source: Created by Author of the Thesis from MML-TGI Database

These data point to show tendency of technological goods to have above average recommendation, but they don't prove any conclusive outcome of specialty of WOM for technological categories of goods.

5.7.2 Highest + High Recommendation

The other view is to sum up both top categories of recommendations: "With many people" and "With few friends and family" and compare different categories. For the purpose of this thesis this grouping represents even more suitable view-point as it covers broader and more mainstream audience – it decreases the weight of people with high recommendation levels.

Graph 5.6 Volume of WOM recommendation - "With many people" + "With few friends and family"
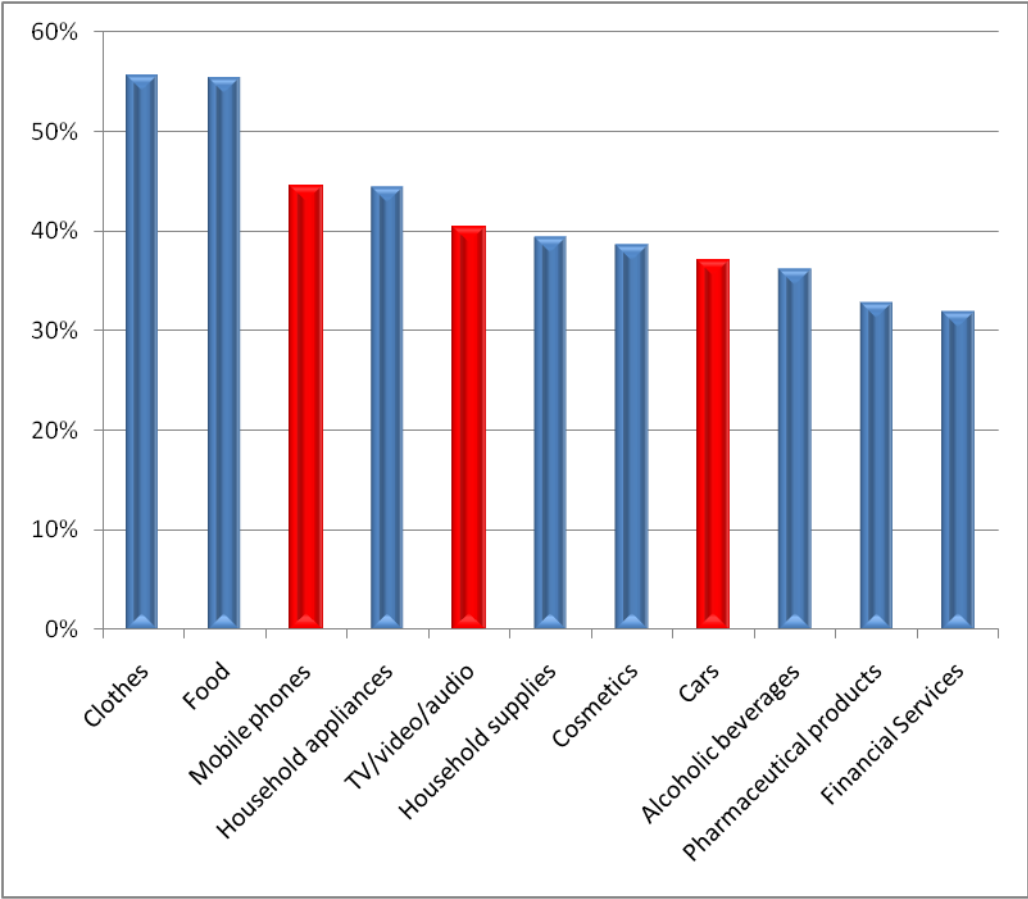
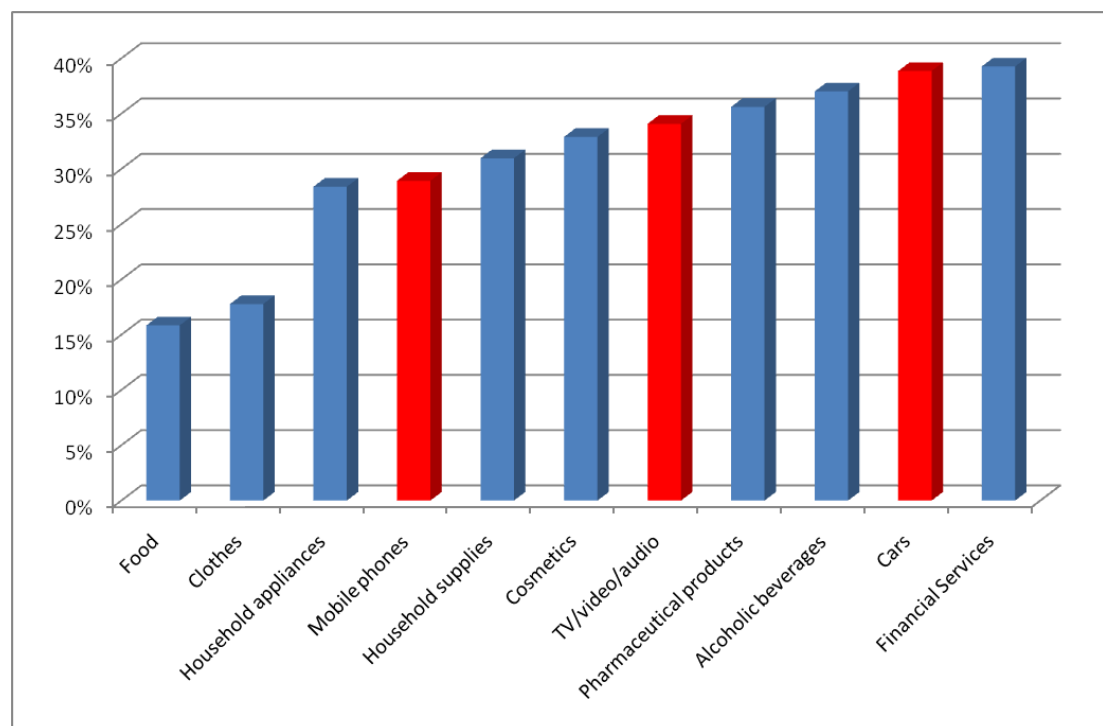Source: Created by Author of the Thesis from MML-TGI Database

These data points show NO tendency of technological goods to have any higher level of recommendation – they are truly average in comparison to all other good. Surprisingly (or naturally?) the top level of recommendation is occupied by goods of everyday usage and consumption – food and clothing.

5.7.3 Non - Recommendation

The last point of view is to compare non-recommendation levels for the different types of goods and find out if there is any conclusive evidence.

Graph 5.7 Volume of WOM Recommendation – "with nobody"

Source: Created by Author of the Thesis from MML-TGI Database

Technological products actually exhibit slightly higher level of non-recommendation vs. other types of consumer goods. That means that percentage of people NOT communicating about this topic to other people is actually slightly higher than average.

Obviously high car WOM recommendation is caused by gender skewing [12.2] , but the remaining categories don't show any specific lower level of non-recommendation.

5.8   Quantity of Information

Quantity of information is interesting data point. Considering technology being more complicated than other types of consumer goods, it would not be surprising, if people provided more information about it than about others. All 3 categories have above levels of quantity of information about it.

Table 5.8 Quantity of Information about Topics

How much information were you able to provide them?	a lot	medium	little	very little or nothing	not stated
Food	17.9%	42.4%	27.6%	10.6%	1.5%
Clothing	12.2%	41.6%	32.7%	12.0%	1.5%
Cars	**10.0%**	**24.4%**	**29.3%**	**34.3%**	**2.0%**
Mobile phones	**9.6%**	**28.0%**	**32.7%**	**27.8%**	**1.9%**
Household supplies	8.7%	36.0%	35.3%	18.3%	1.8%
TV/video/audio	**8.2%**	**28.2%**	**31.6%**	**30.2%**	**1.8%**
Cosmetics	7.8%	31.3%	36.9%	21.9%	2.1%
Household appliances	6.9%	38.6%	34.8%	17.9%	1.8%
Alcoholic beverages	6.6%	28.6%	36.6%	26.2%	2.0%
Financial Services	4.7%	21.9%	37.5%	33.9%	2.0%
Pharmaceutical products	4.5%	23.5%	41.4%	28.7%	2.0%

Source: Created by Author of the Thesis from MML-TGI Database

Technological categories do score in top half of all 11 categories – however not in statistically meaningful way. The table 5.8 supports the hypothesis that technological categories are more prone to share large quantity of information with other people. In the same manner as in previous tables, there is no conclusive evidence that technological products would guarantee significantly different WOM communication levels than other types of traditional consumer goods – couple of traditional categories (food and clothing categories) score even much higher than defined technological products. This thesis will not analyze this category any more for this particular reason.

5.9 Perceived Persuasiveness

On the contrary perceived persuasiveness represents extremely important category differentiation. As this thesis already described, the persuasiveness is measured by opinion of a sender of this information and not by the reception of recipient. It would be better to have both data points and provide comparison – however it is not possible to find out this information from available MML-TGI data sources.

The overall perceived persuasiveness recommendation can be summarized in comprehensive table 5.9 – from very high probability of persuasion to no persuasion at all. As in volume of recommendation, MML-TGI dataset contains only very low amount of non-answers, which makes the data more valuable. As following, this thesis will analyze data in the table in more comprehensive way and demonstrate findings at comprehensive, simple and clear graphical representation.

Table 5.9 Perceived Persuasiveness

Is it probable that you have convinced them about your opinion?	Very pro-bable	Quite pro-bable	Yes and no	rather not	Certa-inly not	not stated
Food	8.1%	29.5%	28.3%	20.3%	12.1%	1.6%
Clothing	7.8%	22.2%	30.7%	24.2%	13.6%	1.5%
Cars	5.2%	16.0%	21.6%	22.1%	32.9%	2.2%
Mobile phones	5.1%	16.9%	24.1%	24.3%	27.6%	2.0%
Cosmetics	4.5%	18.5%	27.0%	27.3%	20.5%	2.1%
Household supplies	4.5%	20.9%	29.1%	26.1%	17.5%	1.9%
TV/video/audio	4.3%	16.9%	23.5%	24.5%	28.8%	2.0%
Household appliances	3.8%	20.1%	30.8%	25.1%	18.0%	2.1%
Alcoholic beverages	3.6%	16.7%	26.2%	26.5%	24.6%	2.3%
Pharmaceutical products	2.7%	12.9%	26.9%	30.2%	24.9%	2.3%
Financial Services	2.7%	11.3%	23.8%	28.2%	31.7%	2.2%

Source: Created by Author of the Thesis from MML-TGI Database

The important outcome: perceived persuasiveness dramatically differs in various consumer goods categories and it is even more dramatic than in volume of WOM. If we consider highest levels persuasiveness ("Very probable") the difference between the highest (Food category) and lowest (Financial services) is even higher: 297%! Food and financial services remain maximum and minimum also for second highest level of persuasiveness ("Quite probable"). The difference looks again very similar – food category approximately 3x higher than financial services.

5.9.1 Highest Perceived Persuasiveness

For technology products don't exhibit any special level of persuasiveness. They are tiny bit above average vs. other consumer goods products, with food and clothing categories on the top. However, this data provides no statistically meaningful evidence about higher persuasiveness of technological categories.

*Graph 5.10 Perceives Persuasiveness – "Very probable"*
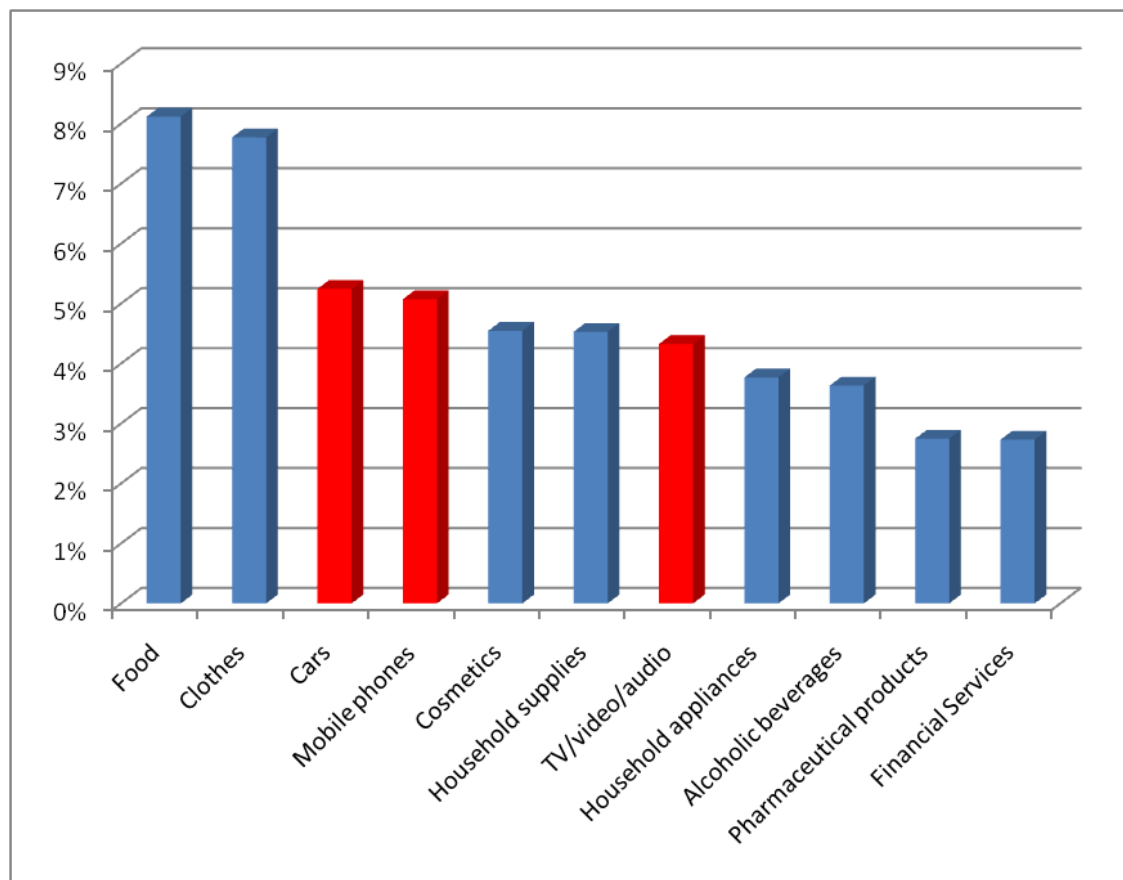
Source: Created by Author of the Thesis from MML-TGI Database

5.9.2 Highest + High/Medium Perceived Persuasiveness

However, if we look at top 2 levels of WOM perceived persuasiveness, the situation for technological products gets even worse: they score below average in bottom part among all categories.

Graph 5.11 Perceives Persuasiveness – "Very probable"+ "Quite probable"
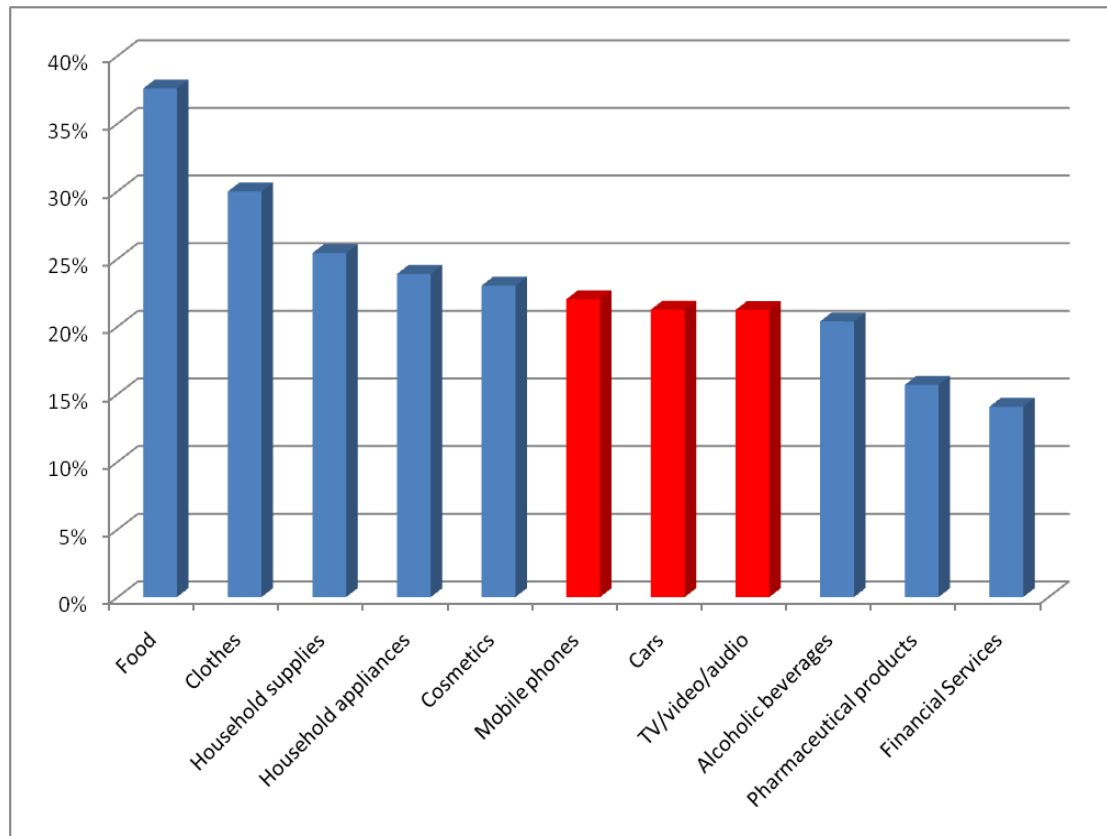
Source: Created by Author of the Thesis from MML-TGI Database

The explanation can be following: people, who know a lot about technological products, know that other people will not really appreciate their advice. People, who love high-end Hi-Fi equipment or mobile phones, understand that majority of people will not really need or require such products for their everyday usage. It is expensive and unnecessary high quality for average user. So despite their high knowledge, they don't assume that their recommendation can change the mind of the other people. This thesis has no intention to further prove this point with researched data and facts – so it needs to stay only in the stage unproven hypothesis.

5.10 Correlation Analysis

Upon data-analyses the volume of WOM and perceived persuasiveness, the author of this thesis realized the correlation between both factors. And logically it makes sense: if you are sharing more about particular topic or product, you also believe that you are more persuasive. See the comparison in the graph below between top categories of volume of WOM communication and top level of perceived persuasiveness.

Graph 5.12 Correlation between Top Level WOM Recommendation and Top Level of Persuasiveness
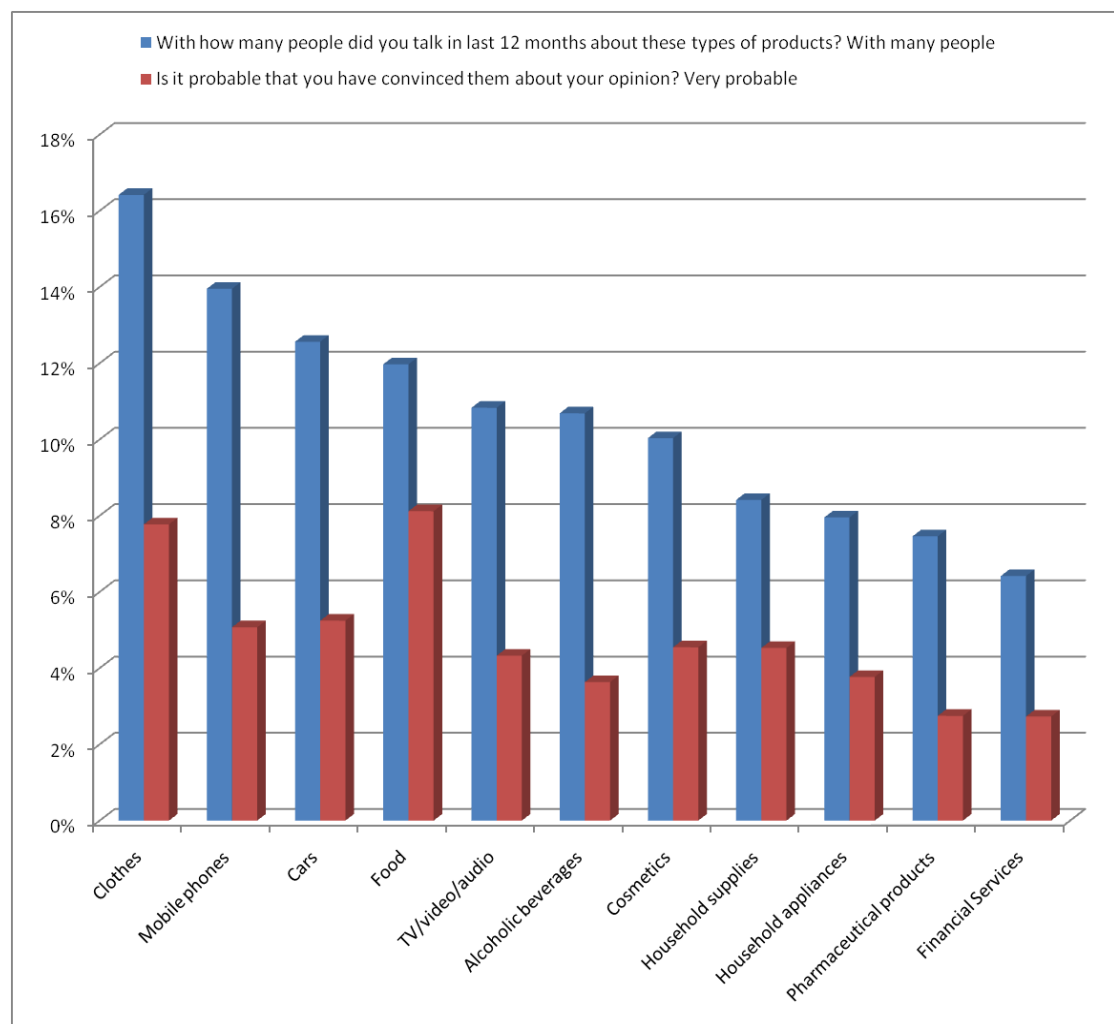
Source: Created by Author of the Thesis from MML-TGI Database

The graph shows some level of correlation. For analytical purposes, this thesis used the most common measurement of correlation called "product-moment coefficient" of correlation or Pearson's correlation. It measures the linear dependence between two variables X and Y, giving a value between +1 and −1 as a result. The results are interpreted as follows:

- to -0.7 strong negative association
- -0.7 to -0.3 weak negative association
- -0.3 to +0.3 little or no association
- +0.3 to +0.7 weak positive association
- +0.7 to +1.0 strong positive association

The result of Pearson's correlation from graph 5.12 is **0.79** indicating strong positive correlation and preliminary confirming that the data interpretation was correct.

Let's also analyze the correlation of top 2 categories of volume of WOM communication and top 2 levels of perceived persuasiveness to have either stronger proof-point or potentially falsify the outcome of correlation analysis from graph 5.12. This correlation provides better overall picture, because it eliminates disproportionate influence strongly WOM communicating individuals and focuses more on voice of "average" consumers, who are critical for success of WOM marketing.

Graph 5.13 Correlation between Top Level WOM Recommendation and Top Level of Persuasiveness
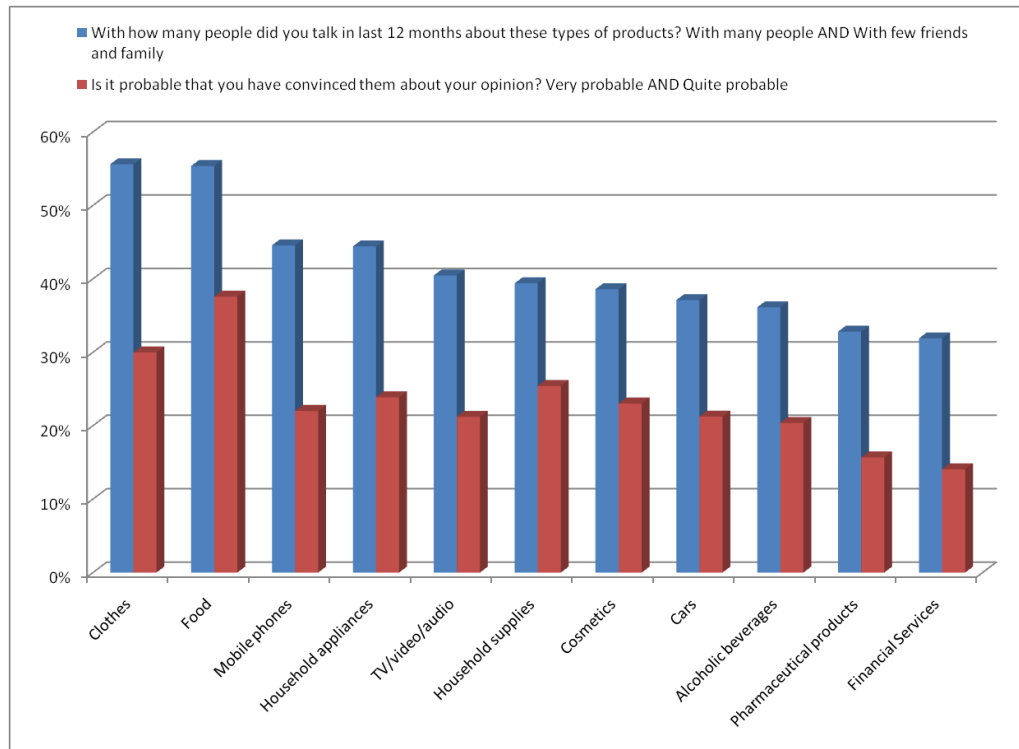
Source: Created by Author of the Thesis from MML-TGI Database

The result of Pearson's correlation from graph 5.13 is **0.91**, which shows that correlation is even stronger and so fully supporting initial analysis from graph 5.12.

5.11 Combined Analysis

The last analysis focuses on people who BOTH have top 2 levels of recommendations and at the same time believe that they convinced the recipient of information "Very probably" or "Quite probably". There is no above average WOM volume as well as influence for technological products – they keep average scores.

Graph 5.14 Top 2 levels of WOM Recommendation Volume and Top 2 Levels of Persuasiveness
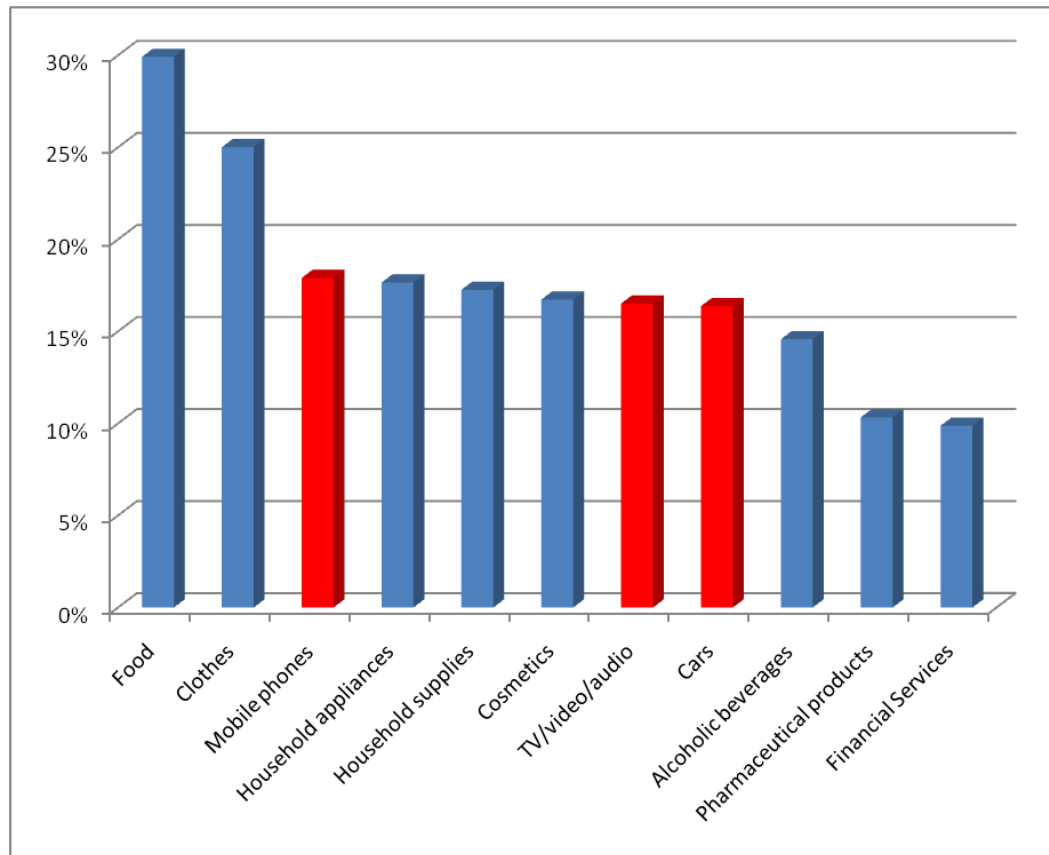
Source: Created by Author of the Thesis from MML-TGI Database

5.12 Chapter 5 Conclusions and Summary

Based on all the above data analysis, the conclusion is very clear and straightforward. Marketing continuous technological innovation represents NO special case of marketing vs. other types of consumer goods. Fundamental difference exists between level and effectiveness of WOM sharing among different types of consumer goods. **Food and clothing** represent by far the highest opportunity for WOM marketing as addition to traditional marketing. Cars represent increased opportunity of WOM sharing, however, only if targets audience is only males. Financial services and pharmaceutical products represent lowest opportunity of WOM marketing.

6   Viral Marketing

The popularity of viral marketing has its roots in experiments performed by the social psychologist Stanley Milgram in the 1960s to trace out short paths through the social networks of the United States. Milgram investigated the so-called "small-world problem" [38] - the hypothesis that we are all on the planet connected just by few intermediaries. In his experiment, a several hundred people from Omaha tried to deliver a letter to a target - a complete stranger in Boston. But they could only send the letter to a personal friend and ask him/her to send it to that person – certainly to that person, which they expected he/she was somehow closer to the target than they were. When he examined the letters that reached the person, he found that they needed only six intermediaries to reach the target. This finding has since been perpetuated in the notion that everyone is connected to anyone through chains of friends or acquaintances only six links long. Peter Sheridan Dodds, Roby Muhamad and Duncan J. Watts conducted a global social-search experiment with more than 60,000 e-mail users with the goal to reach one of 18 target persons in 13 countries by forwarding messages to friends acquaintances [39] – one of the main goals was to confirm or reject noting of Stanley Milgram 6 degrees of linkage concept. This experiment confirmed that successful social contact connections are shared through intermediate to weak strength ties. However, other findings were quite to the contrary of Milgram. They concluded that effective sharing and propagation does not require highly connected influencer people to succeed. Before any further discussion about viral marketing let's first define viral marketing.

6.1   Definition of Viral Marketing

The term of Viral Marketing was coined by Steve Jurvetson and Tim Draper (the venture capitalist company, which enabled start-up of Hotmail, later sold to Microsoft) in a Netscape newsletter, They postulated that *"new companies can structure their businesses in a way that allows them to grow like a virus and lock out the existing bricks and mortar competitors through innovative pricing and exploitation of these competitors' legacy distribution channel conflict."* [40] Since then there were hundreds of definitions of viral marketing, but hardly any broad agreement about what it really represents. Rosen[41] defines viral (or also buzz marketing) as *"the word of mouth about a brand"*. It's the aggregate of all person-to-person communication about a particular product, service, or company at any point in time. On the other hand, Modzelewski [42] suggests that viral marketing differs from traditional word-of-mouth due to the positive network externalities. *"true viral marketing differs from word-of-mouth in that the value of the virus to the original consumer is directly related to the number of other users it attracts"*. Montgomery [43] defined viral marketing as: *"a type of marketing that infects its customers with an advertising message, which passes from one customer to the next like a rampant flu virus"*. Phelps, Lewis, Mobilio, Perry and Raman[44] write about viral marketing as *"the process of encouraging honest communication among consumer networks"*. De Bruyn and Lilien[45] define goal of viral marketing as *"goal of electronic referral marketing is to use consumer-to-consumer (or peer-to-peer) communications, as opposed to company-to-consumer communications, to disseminate information about a product or service, hence leading to its rapid and cost effective market adoption"*. Kaikati and Kaikati [46] consider viral marketing as one type of six different stealth marketing techniques (others being brand pushers, celebrity

marketing, bait-and-tease marketing, marketing in video games, and marketing in pop and rap music). Subramani and Rajagopalan's definition is following: *"viral marketing, sometimes described as word of mouse publicity, is a tactic that leverages the considerable power of individuals to influence others in their online social networks using computer aided communication media such as email, instant messaging and online chat"* [47] On the other hand, Kotler and Keller in Marketing Management [5] define viral marketing as: *"using the Internet to create word of mouth effects to support marketing efforts and goals.* Last but not least, Word-Of-Mouth Marketing Association (WOMMA) defines Viral Marketing as: *"Creating entertaining or informative messages that are designed to be passed along in an exponential fashion, often electronically or by email.* [48]

As has been already stated in this thesis, definitions vary broadly and it is necessary to define viral marketing for purpose of this thesis and especially in comparison to WOM marketing. This thesis insists that WOM communication means that ***"consumers share this opinion with other people based on their own experience with company's products"*** (NOT based on recommendation of recommendation) regardless of means of communication. Viral marketing on the other hand doesn't require experience with the product. At the same time, viral communication requires electronic means for broad, cheap and especially fast distribution; it is especially thanks to broad diffusion of computers and Internet, but certainly mobile phones start to serve the computer role as well. For instance, based on Morgan Stanley research, access from mobile phones to Internet will surpass the PC Internet access in only 5 Years. [49]
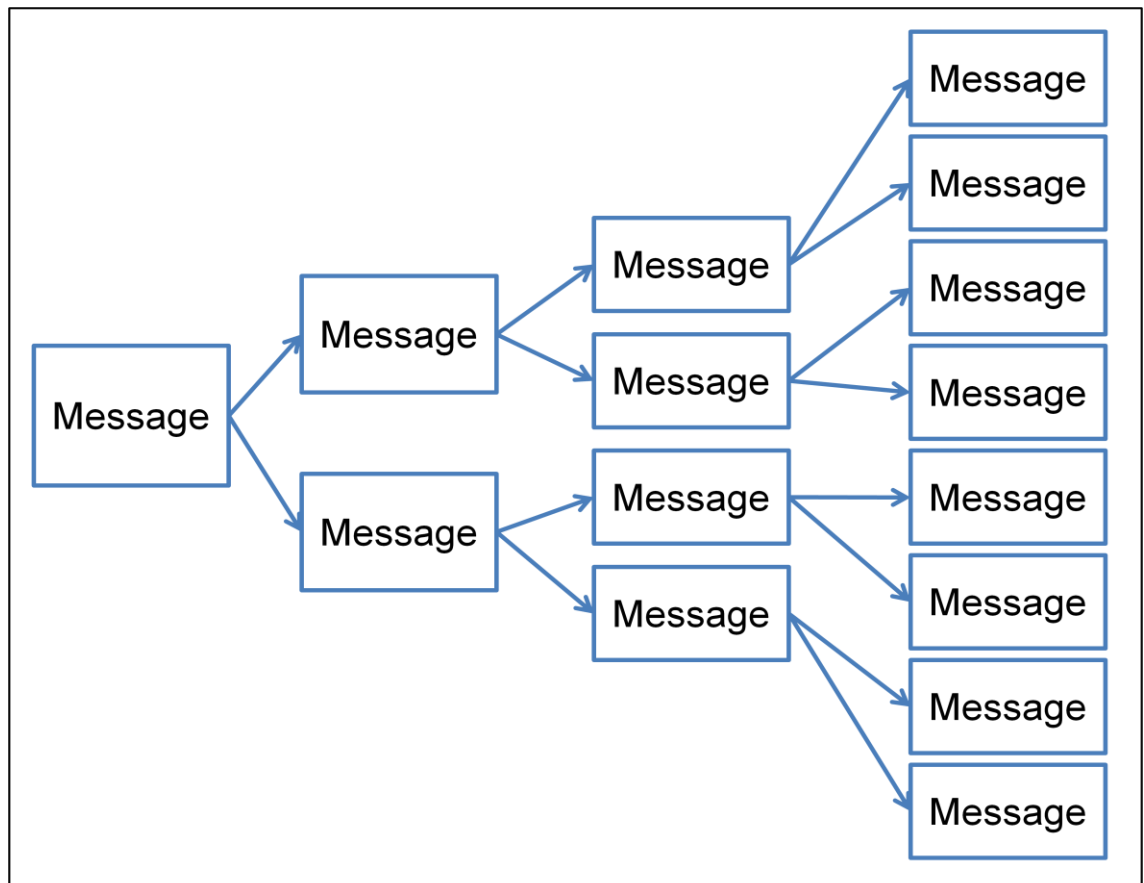
Let's see both definitions in graphical manner below (simplified for contact number 2.

Picture 6.1 WOM Marketing
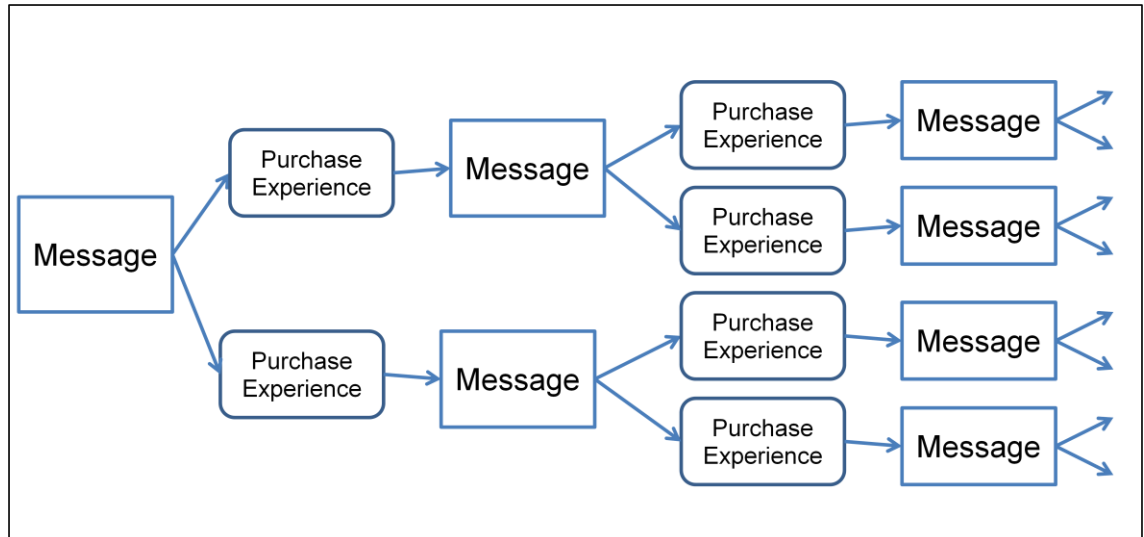
Source: Created by Author of the Thesis

Picture 6.2 Viral Marketing

Source: Created by Author of the Thesis

Viral marketing can be characterized as *"specific form of WOM marketing with electronic referrals and without need for neither experience with company's products nor new product purchase".* The referrals are electronic and so they differ from their "offline" counterparts in two ways:

1. Being electronic obviously means there is no face-to-face communication between sender and recipient
2. Much higher percentage of viral messages are unsolicited than in WOM marketing - they are sent to recipients who are not necessarily interested in this information

One of the main implications of that fact is that reach of viral marketing is much broader and faster than personal WOM. On top of that effectiveness of WOM marketing must be necessarily different from viral marketing this thesis will provide more detail in the future chapters.

Finally let's quote Seth Godin in his blog, which was rated by Time magazine as 19th best blog in year 2009 [50] He shares the same opinion about the differences *"Viral marketing [does not equal] word of mouth. Here's why: Word of mouth is a decaying function. A marketer does something and a consumer tells five or ten friends. And that's it. It amplifies the marketing action and then fades, usually quickly. A lousy flight on United Airlines is word of mouth. A great meal at Momofuku is word of mouth. Viral marketing is a compounding function. A marketer does something and then a consumer tells five or ten people. Then then they tell five or ten people. And it repeats. And grows and grows. Like a virus spreading through a population. The marketer doesn't have to actually do anything else. (They can help by making it easier for the word to spread, but in the classic examples, the marketer is out of the loop.) The Mona Lisa is an idea-virus. This distinction is vital. For one thing, it means that constant harassment of the population doesn't*

increase the chances of something becoming viral. It means that most organizations should realize that they have a better chance with word of mouth (more likely to occur, more manageable, more flexible) and focus on that. [51]

6.2   Unintentional Viral Marketing

Spreading of message can be either intentional or unintentional. In the latter case, consumers spread the marketing message by smart design of marketer and mostly he/she doesn't know about it. Hotmail represents widely described example of unintentional dissemination, where each outgoing e-mail sent via free Web-based service contained a line promoting the service *("Get Your Private, Free E-mail at http://www.hotmail.com")*. So users sending e-mails from a Hotmail automatically promote the service to every person they send a mail to. Launched in July 1996, 12 million users signed-up for Hotmail within 2 years. The referred marketing budget were at the same time $500,000 per year[40]. The other sources used even number of $50,000 – no matter which example we use, cost of acquisition per one customer remains incredibly low. "*In just under two and a half years, Sabeer [founder of Hotmail] has built Hotmail's user base faster than any media company in history - faster than CNN, faster than America Online, faster even than the audience grew for Seinfeld. Truly mind-boggling.*" [52]

Another successful example is e-mail mobile phone software solution from Goodlink, where each e-mail send contains line *"Sent from my GoodLink synchronized handheld (www.good.com)"*

This marketing strategy of using people as unintentional *"virus-carriers"* worked very well at the beginning of e-mail and Internet growth. People were not sophisticated users and majority did not

even realize that they were used as a carriers. However, with ongoing usage of e-mail and Internet, consumers became much more sophisticated. They do realize that they are being used as carriers of unwanted message and obviously few like it. So the companies had to give customers a choice – first opt-out, and then opt-in and in many cases stopped this way of spreading of message completely. Even after comprehensive research author of this thesis did not find any recent successful example of unintentional viral marketing. For that reason this thesis will focus only on intentional viral marketing, where recipient actively spreads messages to other people. And the term of Viral Marketing will be used for intentional version.

6.3 History of Viral Marketing

Probably one of the first ever viral video [53] has been spreading widely already in 1997. At that time, the videos had to be sent to other people as e-mail attachment – so they has to be short and compact size, which limited quality and length of the viral videos. The real breakthrough came in 2005, when YouTube [54] was launched by Chad Hurley and Steve Chen, former managers at Paypal. The idea was very simpler: loading videos at Internet was already possible at that time, but it was very difficult – they just made the sharing very simple. Their chief of marketing Julie Supan described it as following: *"The reasons that YouTube emerged atop the pile because of one simple fact: It built a better mousetrap. "The reality is that when you look at all the different sites, each one has a different model," she said. YouTube's distinction? Short-form content in a free community that doesn't need any extra software. Instead, to watch a video a user just hits the "play" button; posting is as easy as sending an*

e-mail with an attachment. The difference helped Supan & Co. stand out." [55]

The success of this website itself was enabled not surprisingly by viral marketing. Ability to share it easy was major factor to success and people wanted to share it with others. Website thus enjoyed exponential growth and became predominant video user created content website. No surprise that the company had already been bought in 2006 by Google (Despite that Google developed their own video sharing website, which never become successful).

At the beginning of Internet, people were driven to share content through an explicit incentive – either financial incentives or by need to create network externalities. For example, PayPal, by providing financial incentive to have members recommend members, acquired more than three million users in its first nine months of operation. The reward doesn't have to be monetary. Nearly all airlines in their frequent flyer programs offer the opportunity to people sign up their relatives of friends to receive additional miles to members account. [56]

On the other hand, ICQ (name was based on play on words "I seek you"), a free instant-messaging service, offered an option to invite one's friends automatically to join. And people were motivated to do that because of network externalities of their choice. Those positive network externalities are best described by so called Metcalfe Law, defined by Bob Metcalfe, founder of 3Com Corporation and major designer of Ethernet. *"The value of a network increases exponentially with the number of nodes." A network becomes more useful as more users are connected. A primary example is the Internet. It fostered global e-mail, which becomes more valuable as more users are connected.* [57]

6.4 Why Viral Marketing

Usage of both WOM and Viral Marketing keeps growing dramatically. When marketing budgets are dramatically cut this sounds like fantastic opportunity of cheap and efficient advertising. The idea usually starts as following: "Let's create one REALLY funny video with our home camcorder, post it on YouTube and send the link to few people. They will just pass it through to all their friends and in no time people get our message nearly for free" Basically the main reason in **assumed high efficiency** through usage of Internet as well as **perceived low cost** and thus achieving incredible efficiency of marketing. This thesis will research and evaluate how much those assumptions are true vs. how much they represent pure myths perpetuated among marketing community.

Author of this thesis tried to find out any formula for overall marketing efficiency. By marketing efficiency, this thesis rather means promotional efficiency, because it doesn't really try to evaluate of efficiency of all 4Ps of marketing. Despite profound research, author of this thesis did not find any formula of marketing efficiency measurement, which is agreed on among academic community. At the same time, for traditional TV advertising agencies, people usually talk about efficiency as advertising cost per reaching 1000 people or cost per mille (CPM) They purely focus on agency deliverables to the target audience and not really impact of such reach. So due to lack of commonly agreed definitions, this thesis want to define marketing efficiency. Obviously it would be extremely difficult to define absolute value of marketing efficiency as anybody could dispute the unit of measurement. On top of that, absolutely value of marketing efficiency isn't necessarily required as marketing

managers usually want to know: "Is my current campaign more efficient than the previous one? Are my marketing campaigns more efficient than industry average and better than my competitors? Relative efficiency provides useful and suitable answers. Efficiency based on definition of this thesis function of 3 values: effectiveness, reach and cost. It is directly proportional to effectiveness of promotion and number of people reached, while indirectly proportional to cost of reaching.

$$EFFICIENCY = f\left(\frac{EFFECTIVENESS \; . \; REACH}{COST}\right)$$

Relative efficiency must be then % difference between efficiencies 2 different marketing campaigns. As described previously, this thesis will fully research only first 2 parameters and refer to them together as impact. We know that cost of traditional advertising must be definitely much higher. The quantification faces complexity of different types of viral marketing campaign – from professional designed viral campaigns to amateurish video posted on YouTube.

6.5 Effectiveness of Viral vs. WOM Marketing

The effectiveness of WOM marketing vs. traditional marketing was already analyzed in chapter 4 with straightforward answer that WOM communication affects behavior of consumers more effectively than traditional marketing. As we defined previously the WOM marketing and viral marketing are similar, but not the same. So now we need to analyze how effectively does viral marketing influence target audience in relation to WOM marketing as well as traditional marketing.

There are several studies touching this particular topic. Walter J. Carl [58] studied impact of "everyday" WOM (done by ordinary people based on their experience) versus "institutional WOM"

(done by paid agents). In the definition of this thesis, the former represented WOM marketing, while the latter viral marketing. In this context WOM communication deliver much higher effectiveness than viral marketing. *"A key finding was that a significant majority of agents' WOM episodes were everyday in nature, meaning that they were not part of an institutionally sponsored buzz marketing campaign. There are three important implications of this finding. First, some social commentators have expressed reservations about buzz marketing on the grounds that social networks would be flooded with buzz and that agents would continually and strategically be looking forways to build in buzz to their conversations (Vranica, 2005; Walker, 2004). The results of the current study do not support this argument. Although agents clearly engaged in more WOM than everyday people, this WOM was not always, or not even primarily, regarding a product or service they were buzzing* [58]. Allsop, Basset and Hoskins [59] confirm the finding that WOM communication (in their definition s similar to viral marketing) affects consumers more than advertising from the company. Nevertheless it also quantifies the difference and the results don't show dramatic difference between WOM and advertising.

Table 6.3 Sources of Influence and Credibility

Information Source	My Perceptions are Influenced to a Positive Extent by This Source	This is a Very Credible Source
WOM	81%	34%
Advertising for the company	77%	16%
Company public relations activities	67%	15%
My own personal experience with the company	85%	70%
Opinions of the company's employees	66%	33%
Media stories about the company	68%	15%

Source: Harris Interactive Annual RQ℠ Online survey [6]

In other study, Walter J. Carl[60] researches if disclosure of being paid agent of company to do viral marketing influences effectiveness of such campaign. He finds that it does have some impact in lowering effectiveness, but only small one. As long as the perception was that agent provided honest opinion, viral marketing had nearly the same impact. *"For approximately 75% of the conversational partners (the people with whom the word-of-mouth marketing agents engaged in word-of-mouth communication) it did not matter that they were talking with someone affiliated with a marketing organization. Instead what mattered was that they trusted the agent was providing an honest opinion, felt the agent had their best interests at heart, and were providing relevant and valuable information. None of the key outcome metrics (credibility, inquiry, use, purchase, and pass-along/relay) were negatively affected by the agent disclosing their affiliation. In fact, the pass-along/relay rate (the number of people a person told after speaking with a word-of-mouth marketing agent) actually increased when the conversational partner was aware they were talking with a participant in an organized word-of-mouth marketing program"*

His findings are supported also by Doh and Hwang[61]. They discovered that limited amount of negative messages can actually help the campaign to be more credible and so create overall more positive effect. *"A few negative messages can be helpful in promoting positive attitude toward Web site and credibility of eWOM messages. This might be fairly reasonable, because some consumers may suspect the credibility of the Web site or the set of multiple eWOM messages if they find hardly any negative messages. A single negative message itself can be harmful for product evaluation; however, one negative message in a 10-message set is not much harmful and even can be*

beneficial in the eWOM context. The moderating roles of involvement and prior knowledge were also supported in some situations. [61]

Very interesting finding were done by Leskovec, Adamic and Huberman [62] on impact on purchase, if recommendations comes from single source. This experiment revealed that recommendations start soon to lose effect after more than three recommendations are passed between two people. Interestingly effectiveness of book recommendations decreases much more slowly than that of DVD recommendations, flattening out at around 20 recommendations compared to around 10 DVD exchanged recommendations as described in graph 6.4. The explanation can obviously be that people consistently pushing their recommendations becomes soon non-trustworthy. This also shows that people, who spread high volume messages (the sought after influencers) remain less credible than people providing few recommendations.

Graph 6.4 Impact on Purchase by Repeated Recommendation from One Source

(a) Books   (b) DVD
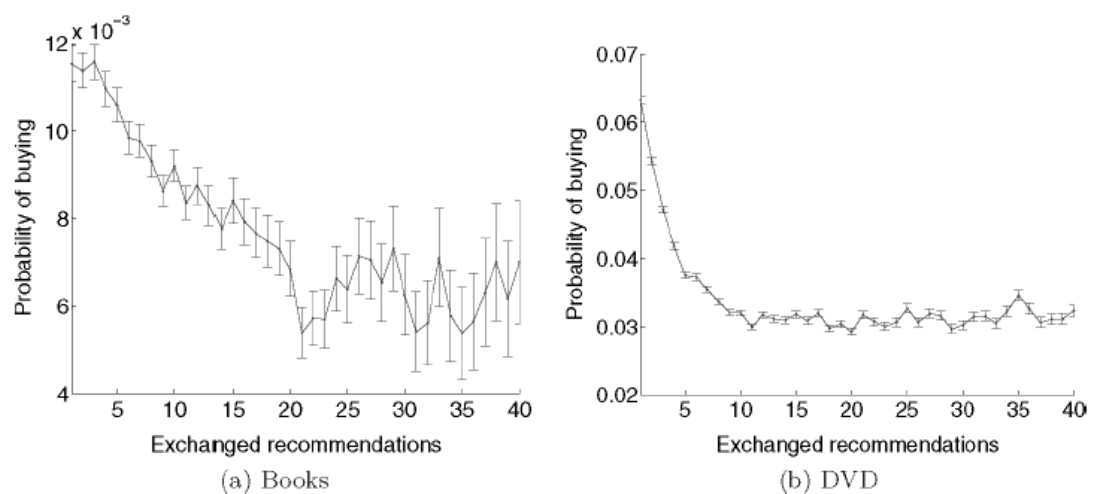
Source: Leskovec, Adamic and Huberman. The dynamics of viral marketing [7]

Based on all available research, this thesis concludes that viral marketing generally provides lower effect than WOM recommendations. However, if done right with appropriate messages, the effectiveness decreases only slightly versus WOM communication. Interestingly, full disclosure that viral marketing is conducted by paid agents doesn't have major negative impact. And while paid effectiveness of traditional advertising scores the lowest, the difference versus viral marketing and WOM is fairly small. Overall, relevant message matters more than way of delivery.

6.6   Potential Reach of Viral Marketing

Second critical question is the reach of viral marketing – how many people can be reached and touched by messages spread virally. This chapter will focus only on potential reach and how many people are truly reached and what parameters define influence the viral spreading will be analyzed in chapter 7.

Obviously viral marketing enjoys one huge advantage: worldwide reach and scale. Marketers can reach consumer in multiple countries and in very short time. This statement may be sound too strong considering that today more people in the world have NO access to Internet vs. those who do. Based on Internet World Stats [63] , only 22% of world population has access to Internet. Let just elaborate this point further and let this thesis define widespread internet as *"50% of people in the particular state connected to Internet"*. Few interesting facts base on the same source [63]

1. Altogether there are over 1 billion people in those 47 countries
2. Czech Republic just about makes the list (but the data-point is slightly old)

3. There is no BRIC country (Brazil, Russia, India and China) on this list

With all the above stated data, we have to ask the following: can we really say that we can reach customers through viral marketing world-wide? Countries with 1 billion people make this an impressive number on the list. However, the list doesn't include the major developing countries and thus makes it incomplete. Let me describe the economic development and resulting Internet dynamics of developing countries. In order to do so I am going to use "BRIC" countries (Brazil, Russia, India and China) as proxy for fast developing countries, but the findings can be easily applied to majority of all countries. Those countries are experiencing boom despite current crisis – with exception of Russia, all 3 others countries keep doing extraordinarily well. However, the fast growth is concentrated to only some people and resulting in inequality of income. See GINI index, which measures the degree of inequality in the distribution of family income in a country all BRIC countries:

Table 6.5 GINI Index

Country	GINI index
Brazil	56.7
China	41.5
Russia	42.3
India	36.8

Source: Central Intelligence Agency. The World Factbook[8]

Major income growth, along with dramatic increase of customer wealth has occurred in major cities. This concentration of purchase

power, together with technological and logistical simplicity, results in Internet penetration in major cities being much higher than the average in the country. In many of those emerging market cities we can experience Internet penetration that is higher than in developed markets.

Table 6.6 Internet Penetration in BRIC Countries

| Country	Internet Users	Penetration
Brazil	50,000,000	26.1%
China	253,000,000	19.0%
Russia	32,700,000	23.2%
India	60,000,000	5.2%

Source: Created by Author of the Thesis based on data from Internet World Stats[9]

For example: "In Moscow there were 5.7 million users (60% penetration) which put the capital two years ahead of the regions". On top of that some technologies even enable leapfrog those wealthy regions of emerging countries beyond mature ones. Moscow and San Petersburg enjoy Internet coverage through latest 4G technology WiMAX, while Western Europe has to rely on old ADSL or substantially slower 3G internet based on old UMTS technology. Internet thus effectively reaches worldwide population, which has high enough income and purchase power, which is worth for companies to market to. In that sense Internet thus become a proxy for marketing activity to be worth of doing. So despite of only 22% of worldwide population accessing the internet, we can assume that Internet provider worldwide medium to the consumer.

Last but not least, we can only expect dramatic growth of Internet thanks to mobile smart-phones with built-in mobile access to

Internet. While computer penetration keeps growing worldwide, mobile phone ownership grows even faster. Based on

Graph 6.7 Mobile Phone vs. PC Internet Users Forecast
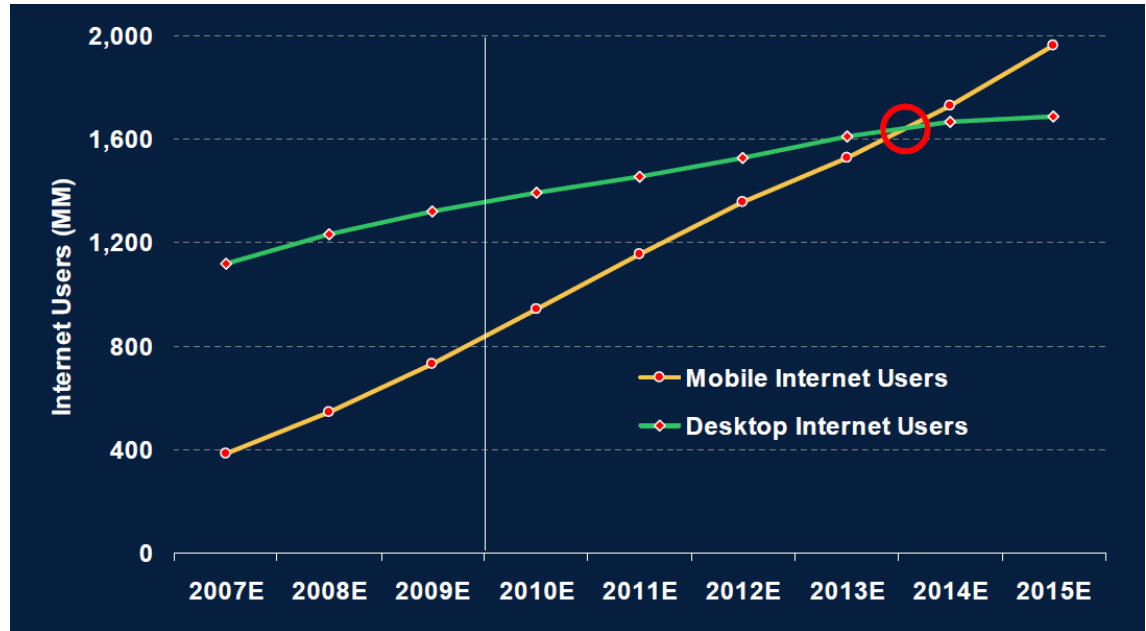
Source: Internet Trends, Morgan Stanley Research[10]

6.7 Viral Marketing Measurement

This thesis will purposely avoid analysis of viral marketing with specific financial incentive. To make this analysis right it would require all the financial data of such promotions. Second, majority of companies try to drive viral marketing today without specific financial incentives. Instead of paying people for promoting their products, they would love to convert the consumers to enthusiastic users, who are advocating the products to other consumers on their own. This thesis will cover that topic in chapter 8.

Obviously the reach represents fundamental data of viral marketing. There are several tools available to do it. For instance company Visible Measures provides their tool True Reach™[64], which measures volume of viral video sharing on Internet. For example their provide measurement of most succesful viral videos

on Internet every week in their "The TOP 10 Viral Video Ads Chart" as in chart 6.7

Chart 6.8 The TOP 10 Viral Video Ads Chart
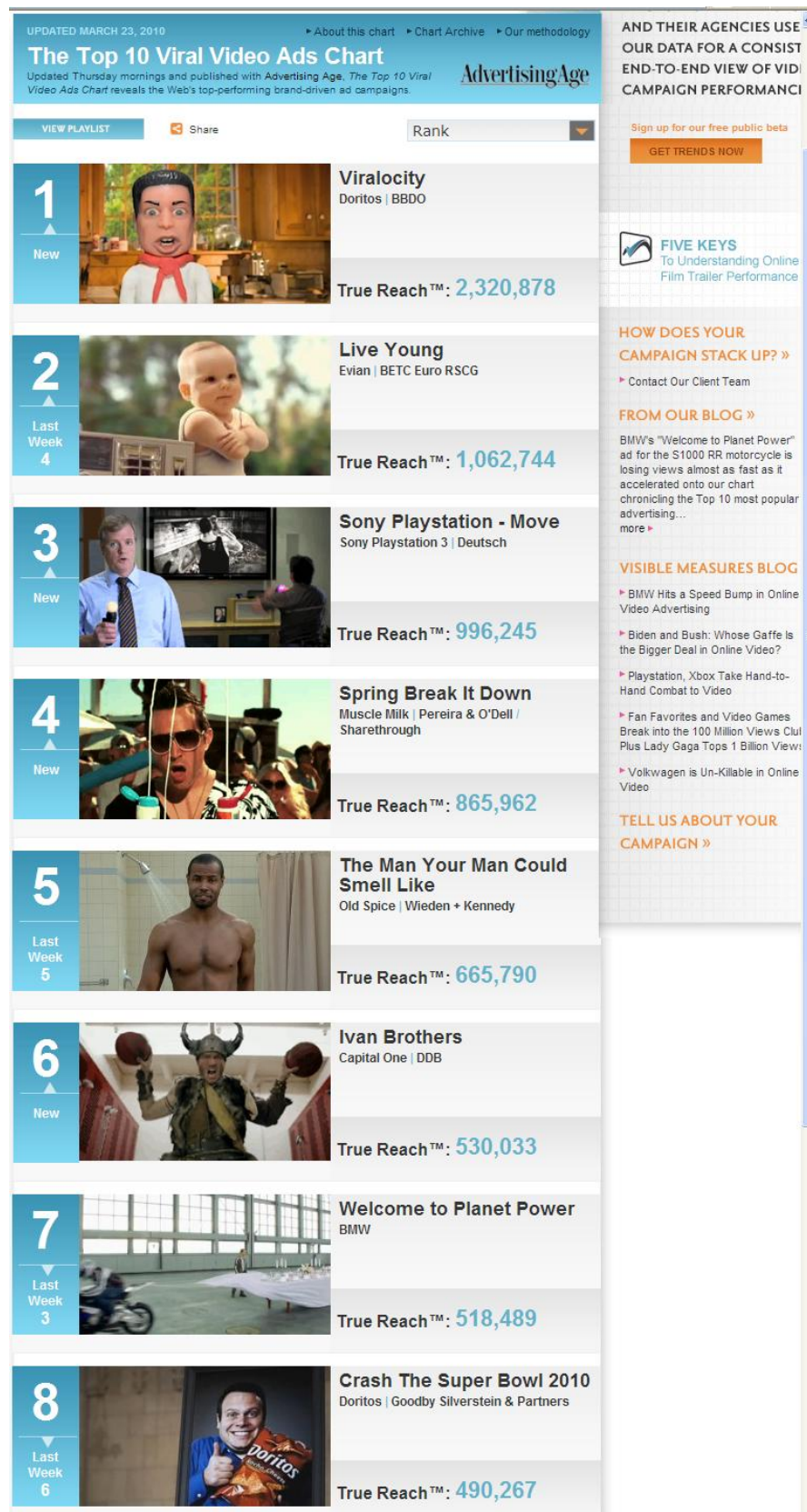
Source: Visible Measure s, Adage [111]

However, the reach itself is only rough measure. Companies say they try **to engage** the end-users rather than market to them. At the end, the measurement of such activity cannot be purely hitting the eyeballs or number of positive articles in the press. However, measuring engagement represents quite difficult task to any company. In my opinion, Forrester (major marketing consultancy company) defines probably the best possible measurement of engagement.

"We propose a new metric, engagement, that includes four components: involvement, interaction, intimacy, and influence. Each of these is built from data collected from online and offline data sources. Using engagement, you get a more holistic appreciation of your customers' actions, recognizing that value comes not just from transactions but also from actions people take to influence others. Once engagement takes hold of marketing, marketing messages will become conversations, and dollars will shift from media buying to customer understanding. [65]

Chart 6.9 Measurement of Engagement

INVOLVEMENT	INTERACTION	INTIMACY	INFLUENCE
What To Track			
• Site visits • Time spent • Pages viewed • Search keywords • Navigation paths • Site logins	• Contributed comments to blogs • Quantity/frequency of written reviews, blog comments, forum discussions, and UGC	• Sentiment tracking on third-party sites (blogs, reviews, forums, etc.) • Sentiment tracking of internal customer contributions • Opinions expressed in customer service calls	• Net Promoter (NP) score • Product/service satisfaction ratings • Brand affinity • Content forwarded to friends • Posts on high-profile blogs
How To Track			
• Web analytics	• eCommerce platforms • Social media platforms	• Brand monitoring • Customer service calls • Surveys	• Brand monitoring • Customer service calls • Surveys

Source: Forrester Research [12]

7   Mathematical Models of Viral Marketing

As the name suggests, Viral Marketing works on the similar principle as virus spreading. Consumers are exposed to marketing messages in the same way as healthy people to virus and they either become "infected" i.e. they start to spread the message further or they are "immune" to that marketing message and they don't spread it any further. Empirical studies of diffusion specifically on human social networks began to appear already 50 year ago, but formal mathematical models of diffusion were only introduced until decades later in work by Schelling[66] and Granovetter[67]. There are varieties of the mathematical models for network diffusion that have emerged from sociology and the economic theories in recent years. This thesis will start with a review of the most common mathematical models that have been examined in the medical, economical, sociology literature, including SIR models, personal influence models, threshold models, and cascade models, in addition to a family of models based on Markov random fields.

7.1   SIR Model

SIR model was design already in 1927 by W. O. Kermack and A. G. McKendrick[68], who developed the model to explain the rapid rise and fall in the number of infected patients in epidemics such as the plague (London 1665-1666, Bombay 1906) and cholera (London 1865). SIR model assumes that the population size is constant, incubation period of the infectious agent is instantaneous, and duration of infectivity is same as length of the disease. It also assumes a homogeneous population with no particular sociological structure.

"S" in SIR abbreviation stands for SUSCEPTIBLE – people who are susceptible to get infected, when in contact with INFECTED people. Once people recover from illness and they are healthy again they are considered RECOVERED, they will not spread the virus again and they will be immune to get sick by the same virus again. The change of people between categories in only one way: S→I→R, because immune people don't get susceptible or infected again. How does this model work for viral marketing? Consumers are exposed to viral messages in the same way as healthy people to virus. They either become "infected" i.e. they start to spread the message further or they are "immune" to that marketing message and they don't spread it. In comparison to real virus, this thesis postulates that the immunity to marketing message can be acquired in 2 different ways – both have the analogy in the medicine and its mathematical models.

1. Susceptible people receive relevant marketing message, which creates impact on their behavior; in analogy they become infected. So they start passing the message for certain period of time to their social contacts until they no longer see a need for passing. Thus they become recovered and no longer spreading the message. If they receive the same message again, they don' have any reason to pass it, because they already did it. If we compare it with epidemiology, this is the case of people having the illness and successfully recovering from it.

2. People receive the message, which has no relevance to their interest whatsoever. It did not change their behavior, it did not create any impact on them and so they did not start to pass the message at all. In comparison to epidemiological example, those people were immunized.

The SIR model consists of three coupled nonlinear ordinary differential equations:

$$\frac{dS}{dt} = -\propto SI$$

$$\frac{dI}{dt} = \propto SI - \beta I$$

$$\frac{dR}{dt} = \beta I$$

where t is time, $S(t)$ is the number of susceptible people, $I(t)$ is the number of people infected, $R(t)$ is the number of people who have recovered and developed immunity to the infection. α is the daily infection rate, and β is the daily recovery rate.

As number of people is constant (we can certainly omit the growth of population even easier for marketing purposes than in epidemiology) then the following equation must apply:

S(t) + I(t) + R(t) = N

where N is number of people in population.

The key value of the time evolution of these equations is the so-called epidemiological threshold, which defines, if the epidemics will outbreak or not. It is defined as the number of secondary infections caused by a single primary infection and it is called Basic Reproduction Number. It basically determines the number of people infected by contact with a single infected person before recovery.

$$N_R = \frac{\propto S(0)}{\beta}$$

In the case that all population is susceptible to virus, then Basic Reproduction Number equals to Contact Number, which is defined as:

$$C_R = \frac{\propto}{\beta}$$

So obviously when $N_R < 1$, each person who contracts the disease will infect less than one person before recovering, so the viral outbreak of will not happen. When $N_R > 1$ each individual who gets the disease will infect more than one person, so the epidemic has the potential (but no certainty!) to spread dramatically.

This system of equations is non-linear, and does not allow a generic analytic solution. However, results can be derived analytically with usage of mathematical modeling.

In the opinion of the author of this thesis, the power of SIR model lies in relative simplicity, while at the same time this model describes the real life very well. The weakness of these types of models is that they assume homogeneity of social network over which the diseases (product recommendations) are spreading, which is not certainly true. Also it uses only one parameter, which specifies the infectiousness of the viral marketing. In the world of viral marketing, this would mean that all people are equally susceptible to recommendations of a particular product.

7.2 Linear Threshold Model

Linear Threshold model was introduced by Granovetter[67] and he suggested the usage of this model for wide spectrum of problems: diffusion of innovation, spread of rumors and diseased, strikes, voting, education attainment, leaving social occasions, migration or even for experimental social psychology. Unlike SIR model, Linear Threshold Model describes population, which is not homogeneous. Each person (in literature we use word "**Node**" for person as this model applies also on models of electronic networks)

is influenced by other nearby nodes and their status. A social network is represented as a graph, with each person (customer or member)) as a node. Each node behavior status is either passive or active – i.e. in viral marketing situation we can say the "active person" spreads the information and so influencing the people in their social network, while "passive people" do not communicate actively any information. Node becomes active during any given time. A node v has predetermined random **threshold** θv, which obviously must have value between 0 and 1. This value can be chosen either randomly, or fixed at an arbitrary value such as 0.54. A node v is influenced by each neighbor w according to a weight b_{vw} such that:

$$\sum_{w \ neighbor \ of \ v} b(v,w) \leq 1$$

A node v becomes active when at least (weighted) θ_v fractions of its neighbors are active:

$$\sum_{w \ active \ neighbor \ of \ v} b(v,w) \geq \theta v$$

In the case of a arbitrary choice of thresholds, an opening set of active nodes (with all other nodes passive), will start the diffusion progression deterministically in distinct steps: in step t, all nodes that were active in step t-1 remain active, and we activate any node v for which the total weight of its active neighbors is at least θv. The model has monotonicity supposition: nodes can switch to active from inactive; however they do not switch in the other direction.

7.3   Cascade models

Cascade models of diffusion were first studied in the context of marketing (originally used in physics) by Goldenberg, Libai and Muller[69]. Each person or node gets influenced by other nearby nodes the same way as in linear threshold model and social network is represented as a directed graph, with each person (customer) as a node. However, in the cascade model, each node (individual) has a **single, probabilistic** chance to activate each inactive node for which he is a neighbor after becoming active himself. Simple example is the independent cascade model, in which the probability that an individual is activated by a newly active neighbor is independent of the set of neighbors who have attempted to activate him in the past. Starting with an initial active set of nodes, the process spreads out in a series of time steps like a cascade. At each time t, any node v who has just become active may attempt to activate each inactive node u. With probability $p_{u,v}$, u becomes active at the next time step. Whether or not it becomes active, v and u have no further contact throughout the remains of the process. It is also easy to generalize the independent cascade model. Instead of node v activating u with probability $p_{u,v}$, node v activates u with a probability that depends on the set of nodes who have tried to activate u previously. When node v first becomes active, he accomplishes to activate u with probability $pu,v(S)$, where S is the set of neighbors of u who have previously tried (and failed) to activate u. In order to ensure that the model is always well-defined, we may consider only sets of probabilities $pu,v(S)$, that are order-independent, so the probability that an individual u is active after a set Q of his neighbors have tried to activate him does not depend on the order in which the neighbors Q made their attempts; without this assets, it would not be clear what should

happen in the case that multiple neighbors of a node become active in the same step.

In the opinion of author of this thesis, this model works better than Linear Threshold model. We have already learnt that multiple recommendations from one person don't increase, but actually decrease probability of purchase, while is the case of Linear Threshold model. On the contrary,

7.4   Markov Random Fields

Markov chain was formulated by Russian mathematician Andrey Markov already at the beginning of 20th century and the mathematical apparatus was used for physics, chemistry, economics, and mathematical biology as well as gambling. It describes a discrete random process, which means that a system can be in various states, and which changes randomly in discrete steps. Local interaction games, general threshold models, and cascade models all assume a particular structure on the way in which each node chooses whether or not to adopt action *A* given the choices of his neighbors. Furthermore, these models are all vibrant in the way that they unambiguously model the progress of the events over time. A substitute to modeling the progression of actions in this way is to model only the final state of the network at convergence as one large global set of interdependent random variables. This can be achieved by modeling the actions of each node in the social network as a Markov random field. A Markov network, or Markov random field, is an undirected graphical model representing the joint distribution over a set of arbitrary variables. Each node of the Markov network represents a single variable. Each edge represents dependence between variables. Markov networks satisfy a diversity of properties that make them

useful for analysis about huge, structured fields. For example, they provide a straightforward method for determining whether two variables, *X* and *Y*, are conditionally independent given a set of variables *U*. In particular, it is sufficient to check the set of paths between *X* and *Y*. If each path passes through at least one node in *U*, then *X* and *Y* are conditionally independent; otherwise, they are not. Inference algorithms have been designed to take advantage of the independence properties and Markov networks graphical structure. The dissemination algorithm enables efficient inference when the underlying network structure resembles a tree. Abundant extensions exist for efficient approximate inference in general graphs. Let's evaluate a social network *G = (V,E)*. For each *v* ∈ V, we define a Boolean variable X*v* that corresponds to whether or not *v* implement new technology; it takes on the value 1 if *v* is active and 0 otherwise. These new variables obviously form a Markov network with the same border arrangement as the original social network. This illustration is powerful in that it allows the probability that a node *v* adopts action *A* to depend on whether or not his neighbors adopt *A* in an arbitrary way. In order to use this depiction to contemplate about marketing action and measures, additional customers can be added to the Markov network representing – for examples - the extent to which each player is targeted for marketing.

7.5   Conclusion about Suitability of Mathematical Models

Based on all research information, this thesis doesn't have to assume extreme importance of influencials in the WOM communication as well as in viral marketing. SIR model represents old and fairly simple model for mathematical modeling – as described, it assumes homogeneous population and no social links.

The mathematical models and studies don't prove the point sufficiently – most of the literature provides rather only anecdotal evidence. At the same time, author of this thesis could find empirical studies showing no major evidence for efficiency of influencials to in the dissemination of marketing information to the masses. On top of all mentioned examples, Duncan J. Watts experimental work on cascades. He doesn't dispute that they exist, but provides sober summary for those, who believe that they can plan viral marketing spreading – this time based on modeling of global cascades. *"Global cascades in social and economic systems, as well as cascading failures in engineered networks, display two striking qualitative features: they occur rarely, but by definition are large when they do. This general observation, however, presents an empirical mystery. Both power-law and bimodal distributions of cascades would satisfy the claim of infrequent, large events, but these distributions are otherwise quite different, and might require quite different explanations. Unfortunately a lack of empirical data detailing cascade size distributions prevents us from determining which distribution (if either) correctly describes which systems"*. [70]

This thesis will use SIR model to model, how messages spread through viral marketing not only because of lack of evidence for influential people disproportionate impact. On top of that this thesis will compare SIR models with real reach data from major marketing campaigns in Chapter 8. These comparisons will give clear evidence about similarities of theoretical and real-life data and so it will prove appropriate usage of SIR model for supporting or rejecting hypothesis of this thesis.

7.6 SIR Equations Modeling

7.6.1 Modeling Tools

As already mentioned, SIR system of equations is non-linear, and does not allow a generic analytic solution. However, significant results can be derived analytically especially with usage of modeling. The author of this thesis used tool Mathematica Player from Wolfram Research Company [71] . Specifically for modeling of all graphs representing the infection spreading through the time, this thesis uses "SIR Epidemic Dynamics" [72] from Wolfram Demonstrations Projects, which was contributed by Dr. Steve Strain from Department of Biology, Slippery Rock University of Pennsylvania. [73]

7.6.2 Parameters

As described in chapter 7.1 SIR stands for SUSCEPTIBLE – people who are susceptible to get infected, when in contact with INFECTED people. Once people recover from illness and they get healthy again they are considered RECOVERED. The model assumes several parameters, which have impact on final outcome of mathematical modeling. The same way as for epidemiological studies, the parameters in SIR mathematical model can be potentially divided into 4 groups from marketing promotion perspective. The particular group defines the suitability of particular parameter on marketing promotion.

1. Parameter can be influenced by marketing decision and the change of initial parameter in SIR model causes substantial difference in final outcome

2. Parameter can be influenced by marketing decision, however the change of initial parameter in SIR model causes no or very limited difference in final outcome

3. Parameter cannot be influenced by marketing decision, marketing decision only has to consider it as given, but it has substantial impact on final reach

4. Parameter cannot be influenced by marketing decision, but they have no impact on final outcome

Graphically we can describe the whole situation in Table 7.1. There are actually 4 quadrants, where one of them is not applicable, resulting in above described 3 groups. The desired parameters for viral marketing lay in quadrant 1.

Table 7.1 Impact of based on Parameters of Viral Marketing

		Impact on result	
		YES	NO
Possibility of influencing by marketing decision	YES	1. Desired	2. Useless for marketer
	NO	3. Useless for marketer	4. Useless for marketer

Source: Created by Author of the Thesis

The following chapters will research, where SIR model parameters belong. In summary SIR model equations solution requires 5 parameters.

1. **S(0)** - number of susceptible people the beginning of infection

2. **I(0)** - number of people initially infected

3. **R(0)** - the number of immunized people

4. **C**R – contact number (given by $CR = \dfrac{\propto}{\beta}$)

5. **T** – duration of viral infection

7.6.3   The Number of Immunized People

Let's start fist with group of recovered (immune) people R(t) in time t=0 - R(0) – in the model is given by population characteristics. Many models assume that the number is 0, which means that in population all people are fully susceptible to be infected by virus or by marketing message. However, this is not true in real life. In the epidemiological language, those people were immunized and so they cannot get the virus even if exposed to them. In marketing world, such people receive the message, which they are not interested, has no relevance to them whatsoever for any possible reason. This obviously creates fundamental limits to final impact viral marketing. No matter how large this number remains, it is fixed number for particular disease or group of products – however the size has large impact on final outcome.

7.6.4   Initial Data-points for Models

To model the solution, we need to assume initial parameters and model how change of other parameters changes the whole spread. This thesis will use previously described MML-TGI database, which characterizes attitude of the people/population of Czech Republic to specific consumer marketing group, as well as following data from viral marketing in Chapter 7.7.

Let's first assume initial levels of immune people for different type of goods and let's focus on boundary examples. Table 5.4 shows high level of Non-recommendation – from 18% in food to 39% in financial services. Can we say that these people are immune to marketing messages? Certainly yes – they did not talk to anybody about particular topic in the last 12 months! Personal recommendation happens, even if these people were not exposed to marketing messages at all because of their personal experience. It is possible that these people did not really experience anything meaningful regarding financial service. However, it is completely impossible that people would not have any experience with regards to food. The group of people, who do not recommend and share, might be even bigger as the timeline reaches 12 months, which is by far too long timeframe for any viral marketing campaign. But to be on the safe side, this thesis will only use people, who expressed no information spreading whatsoever.

So for further modeling this thesis will consider let 2 boundary situations for model from MML-TGI database as described in previous chapter: R_0 = 18% (clothing) and R_0 = 39% (financial services) for initially immune percentage of population.

NOTE: Bear in mind that in some literature R_0 is used for description of Basic reproduction number.

Initially Infected Population

Now let's first assume the very levels of initially infected population – that means people infected at t=0. Viral marketing campaign needs to start with the initialization of epidemics – in marketing terminology it is called "seeding". To make it effective it is better to start with just a small amount of people – using more connected and influential people certainly makes more sense.

However, to make sure that the viral marketing really starts, the logical assumption certainly is that the larger the number the best. For initial modeling, let's use value of $I_0 = 0.001$ – this means that one in thousand people will be initially infected. This number is actually very high – this thesis uses initially number on highest levels of potentially to show examples of succesful viral spreading. Specifically or Czech Republic it would mean that there is initially is reached by "seeding" 10,000 people, which is a large number on top range of possible viral campaign. But this number should ensure that viral marketing will start successfully and it doesn't stop spreading simply because of initially low "infection".

Contact Number and Basic Reproduction Number

Based on previous definitions, we have a clear understanding what those numbers mean for the spreading of a virus. What do these parameters mean for viral marketing? The **contact number represents purely the strength of the viral idea and not how many people on average will forward the marketing message further**. If only a fraction S_0 of the population is susceptible to viral epidemics, then basic reproduction number must be:

$$N_R = C_R \cdot S_0$$

and an epidemic can occur only if this number exceeds 1.

Suppose a fraction R_0 of the population is vaccinated against the virus i.e. they don't spread any marketing information on particular topic or category of products. In this case, $S_0 = 1 - R_0$ and no epidemic can occur if:

$$R_0 > 1 - 1/N_R$$

To graphically describe this situation see below the graph 7.2. For example: if 60% of population is immunized, then the epidemics cannot occur, if contact number is below 2.5 – regardless of any

other parameters. If it exceeds it, then it is still only a possibility –
because other parameters may cause no epidemics.

Graph 7.2 Immunized Population vs. Basic Reproduction Number
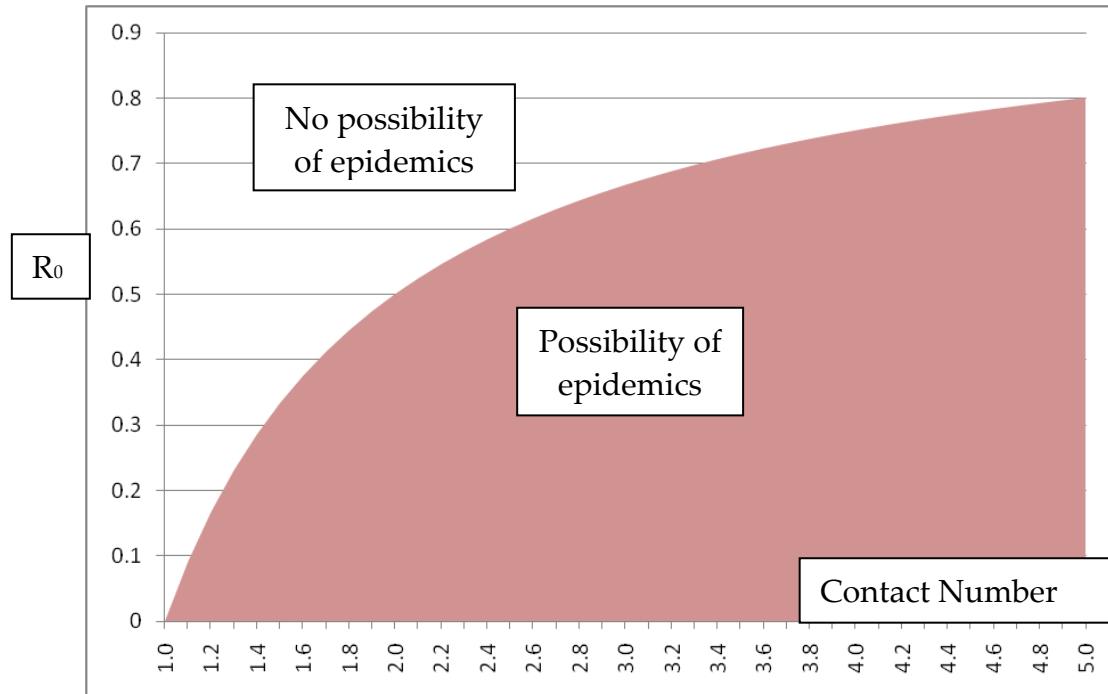
Source: Created by Author of the Thesis

As described above, a contact number describes ratio between the
daily infection rate and daily recovery rate. Let me approximate
the number for analysis from MML-TGI database. We know how
big groups are and we need to quantify their volume of spreading.
On purpose this thesis uses number, which is rather high: 25
people in the case of "with many people" and 12 in the case of
"few friends and family"– so the number on the safe side to create
viral marketing spread. Last but not least, the numbers of
spreading are for the whole year – usually the whole viral
campaign doesn't last that long. In chapter 8 we will see that viral
campaigns rapidly lose their spreading in much less than 90 day.
So using numbers for 3 months represents a safe assumption. The
number will be confirmed by modeling and viral marketing data.

Table 7.3 Assumption of Contact Number (Clothing)

Clothing	Percentage of population	Total number of people influenced in 12 month	Number of people influenced 3 month
With many people	16.4%	25	1.03
With few friends and family	39.2%	12	1.18
1 or 2 people	25.0%	1.5	0.09
Nobody	17.8%	0	0.00
Not stated	1.6%	1	0.00
Contact Number			**2.30**

Source: Created by Author of the Thesis

Table 7.4 Assumption of Contact Number (Food)

Food	Percentage of population	Total number of people influenced in 12 month	Number of people influenced 3 month
With many people	12.0%	25	0.75
With few friends and family	43.4%	12	1.30
1 or 2 people	27.3%	1.5	0.10
Nobody	15.8%	0	0.00
Not stated	1.4%	1	0.00
Contact Number			**2.16**

Source: Created by Author of the Thesis

Table 7.5 Assumption of Contact Number (Mobile Phones)

Mobile Phones	Percentage of population	Total number of people influenced in 12 month	Number of people influenced 3 month
With many people	14.0%	25	0.87
With few friends and family	30.6%	12	0.92
1 or 2 people	24.6%	1.5	0.09
Nobody	28.9%	0	0.00
Not stated	1.9%	1	0.00
Contact Number			**1.89**

Source: Created by Author of the Thesis

Table 7.6 Assumption of Contact Number (Cars)

Cars	Percentage of population	Total number of people influenced in 12 month	Number of people influenced 3 month
With many people	12.6%	25	0.79
With few friends and family	24.6%	12	0.74
1 or 2 people	21.8%	1.5	0.08
Nobody	38.9%	0	0.00
Not stated	2.2%	1	0.01
Contact Number			**1.61**

Source: Created by Author of the Thesis

Table 7.7 Assumption of Contact Number (Pharmaceuticals)

Pharmaceuticals	Percentage of population	Total number of people influenced in 12 month by	Number of people influenced 3 month
With many people	7.5%	25	0.47
With few friends and family	25.4%	12	0.76
1 or 2 people	29.5%	1.5	0.11
Nobody	35.6%	0	0.00
Not stated	2.1%	1	0.01
Contact Number			**1.34**

Source: Created by Author of the Thesis

Table 7.8 Assumption of Contact Number (Financial Services)

Financial Services	Percentage of population	Total number of people influenced in 12 month by	Number of people influenced 3 month
With many people	6.4%	25	0.40
With few friends and family	25.5%	12	0.76
1 or 2 people	26.6%	1.5	0.10
Nobody	39.3%	0	0.00
Not stated	2.2%	1	0.01
Contact Number			**1.27**

Source: Created by Author of the Thesis

Duration of infection

The duration of infection is yet another very important factor. As described before, we can observe the difference between WOM communication and viral marketing. WOM marketing only enables people to share their experience with products with others. That means that after they receive messages, they need to do an action – experience product. For viral marketing this in between step doesn't exist and it enables the rapid and fast spread of viral messages. Let's start the analysis with 7 days. In the world of viral marketing 7 days old news may be old news. Many people simply forward viral marketing once for all in one day – only few stay active longer. The numbers of chapter 8 will confirm the validity of this assumption.

7.6.5 Initial Amount of Infected

Let's now find out what happens, when we model the infection reach in time with different initial amount of infected people. In the terminology of viral marketing, we will model impact of the initial seeding of result of reach. To make sure the model shows successful viral campaign, I will use category of clothing, which is most prone to WOM or viral sharing. It enjoys high contact number and low amount of immunized people. From previous assumptions done in chapter 7.6.3, the resulting parameters for initial modeling are following:

- Contact number: 2.3
- Immunized: 17.8%

The graphs 7.7 will compare I_0 levels from practically impossible number of 0.1 up to meaningful seeding number of 0.000001. **Red line** represents *infected population percentage* and **blue line** corresponds to *susceptible population percentage*.

Graphs 7.9 Impact of Initial Seeding on Viral Reach
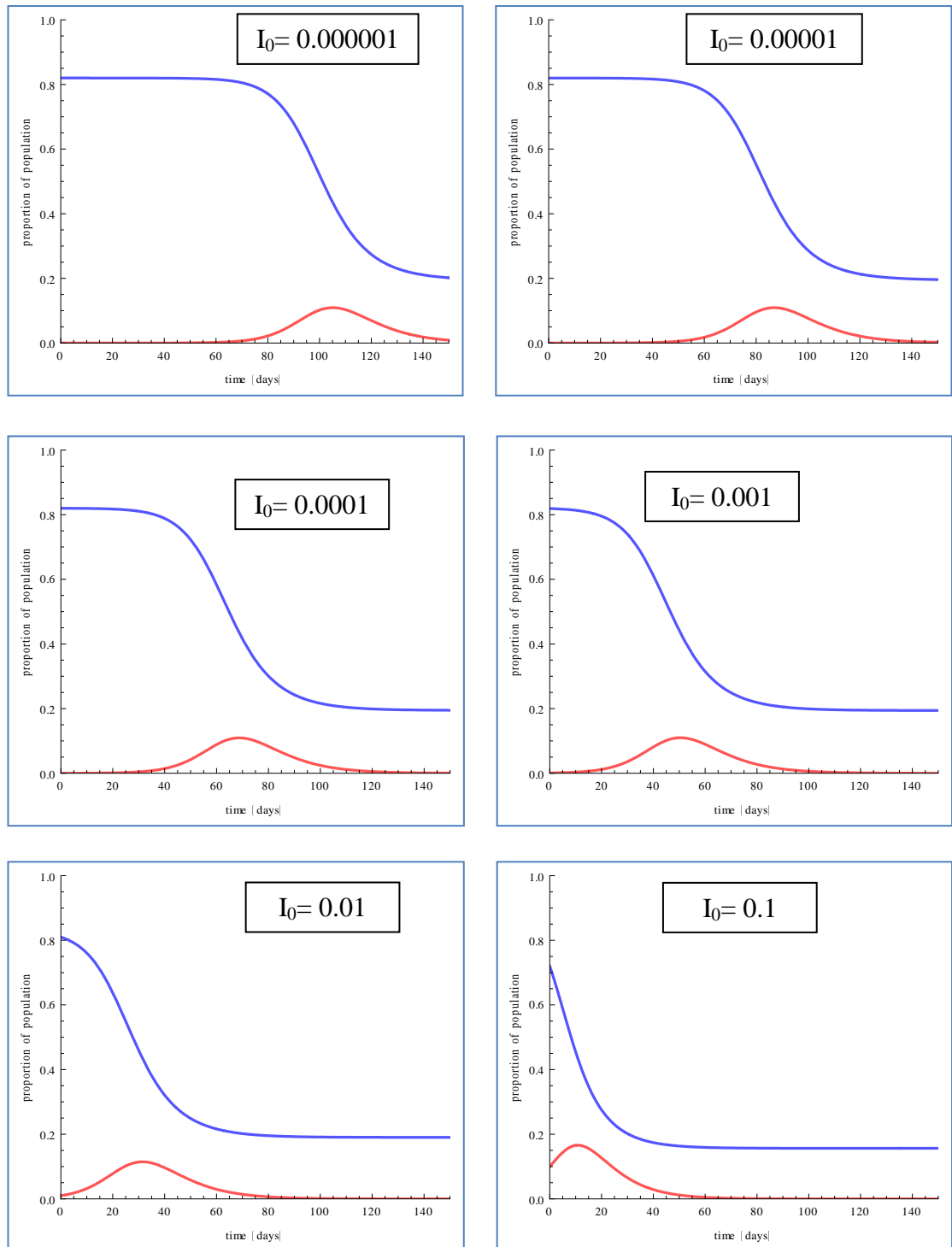
Source: Created by Author of the Thesis by Mathematica Player

The outcome of this modeling seems to be very interesting – there is no change in the level of infected population with change of six magnitudes for I_0! The only difference, what different levels of initially infected people bring, is the time when number of infected

people reaches the peak; however, the peak level stays nearly the same.

What does it mean for viral marketing? The amount of people receiving seeding has very little impact on the final outcome. So in real life the seeding cost can be minimized – just reaching few people initially. Obviously focusing the seeding on highly connected people and opinion leaders makes lot of sense, but the amount of people doesn't really make large difference. The results also provide other insight. Certainly reaching initially 10% of population requires not just viral seeding, but a proper heavy-duty traditional TV and print advertising. However, this will still have little impact for additional viral impact for a campaign.

7.6.6 Duration of Infection

The initial assumption done in previous the chapter for purpose of following analysis was 7 days. Certainly in real life, the duration of infection – so the time when particular individual keeps spreading marketing message – may vary. It sounds solid to assume that the longer people spread the message, the better for final result of viral spreading of campaign.

Let's model what the relationship is between duration of infection on viral spreading outcome. To make sure the model shows successful viral campaign, the author will again use the category of clothing. From previous assumptions done in chapter 7.6.3, the resulting parameters for initial modeling are following:

- Contact number: 2.3
- Immunized: 17.8%

The graphs 7.8 will compare T duration of viral spreading from low number of 2 days to very high number of 20 day. Bear in mind,

this is a duration of spreading done on average by one person – not the length of the whole campaign.

Red line represents *infected population percentage* and **blue line** corresponds to *susceptible population percentage*.

Graphs 7.10 Impact of Duration of Infection on Viral Reach
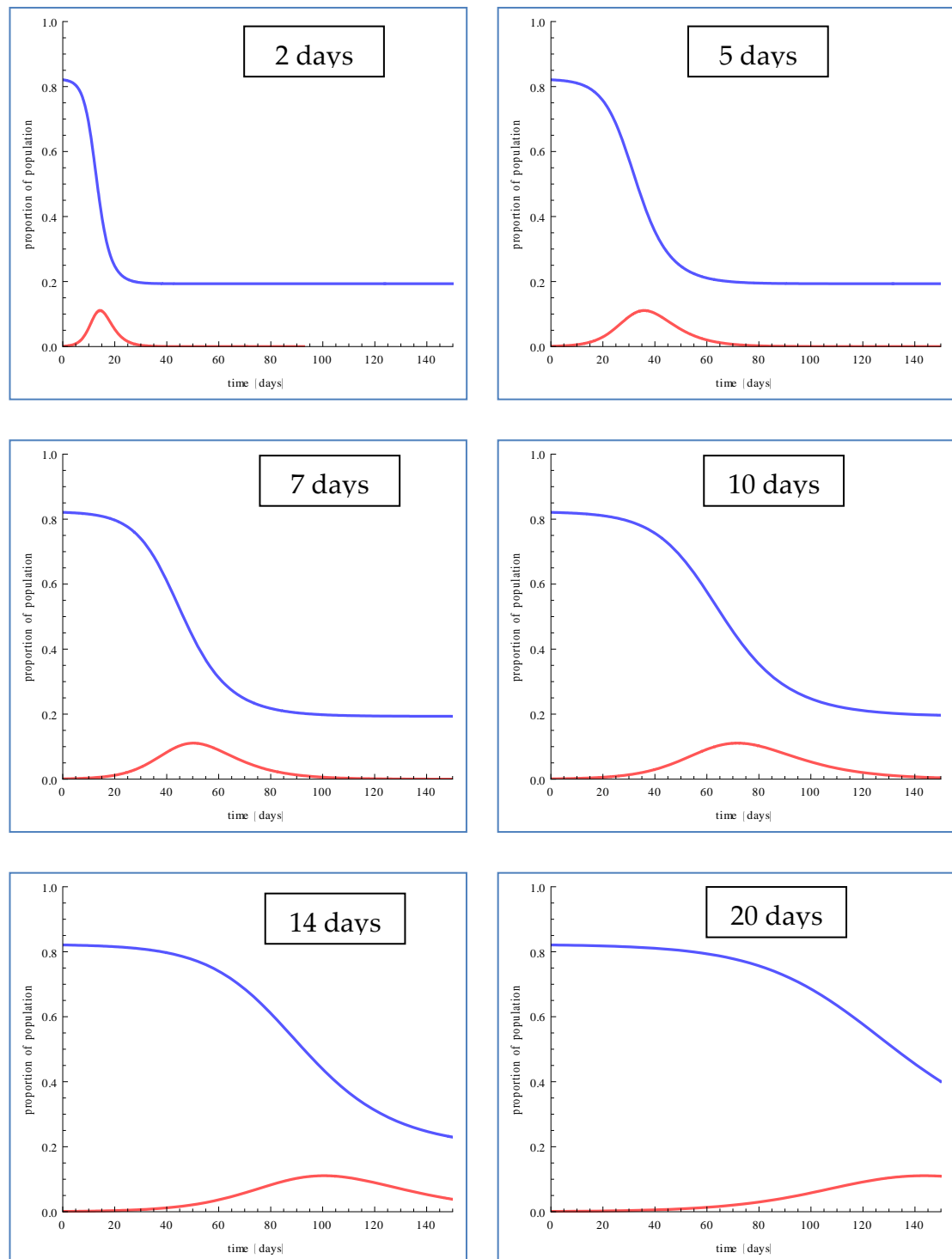
Source: Created by Author of the Thesis by Mathematica Player

The outcome of this modeling is very similar to modeling of initial infected population. There is no change in the level of infected population with huge change of length of infection. The only difference is again the time length, when number of infected people culminates; nonetheless, the peak level stays nearly the same.

What does it mean for viral marketing? It doesn't really matter how long people keep spreading the message – whether they send all messages in one day or keep on spreading them over a longer period of time. Actually, from a viral marketing point of view, the shorter the time, the better the results can actually be. As we've already discussed previously, receiving the same message from the same contact actually decreases the probability of a purchase – doing short, but broad bursts of message spreading with no further impact rather eliminates possibility of duplicate massages to the same contact.

7.6.7 The Number of Susceptible People

We've already defined that population size can be assumed constant and thus for population size must apply:

$$S_{(t)} + I_{(t)} + R_{(t)} = N$$

Obviously for t=0

$$S_{(0)} = N - I_{(0)} + R_{(0)}$$

The thesis has already defined that $R_{(0)}$ is given by population characteristics and N is constant. Considering that in real marketing scenario $I_{(0)}$ seeding represent very low percentage of population, we can omit the low number. As a result, the number

of susceptible people is give by population characteristics, the same way as number of initially immune people.

7.6.8 Contact Number

The modeling will focus on categories, which exhibit 2 different extremes. Clothing, food and mobile phones represent categories mostly prone to sharing with high potential contact numbers. While financial services and pharmaceutical show the examples of products of least shareable topics. All other parameters remain the same and those are set up on safe-side to show viral spreading scenarios.

- **Duration of infection: 7 days**
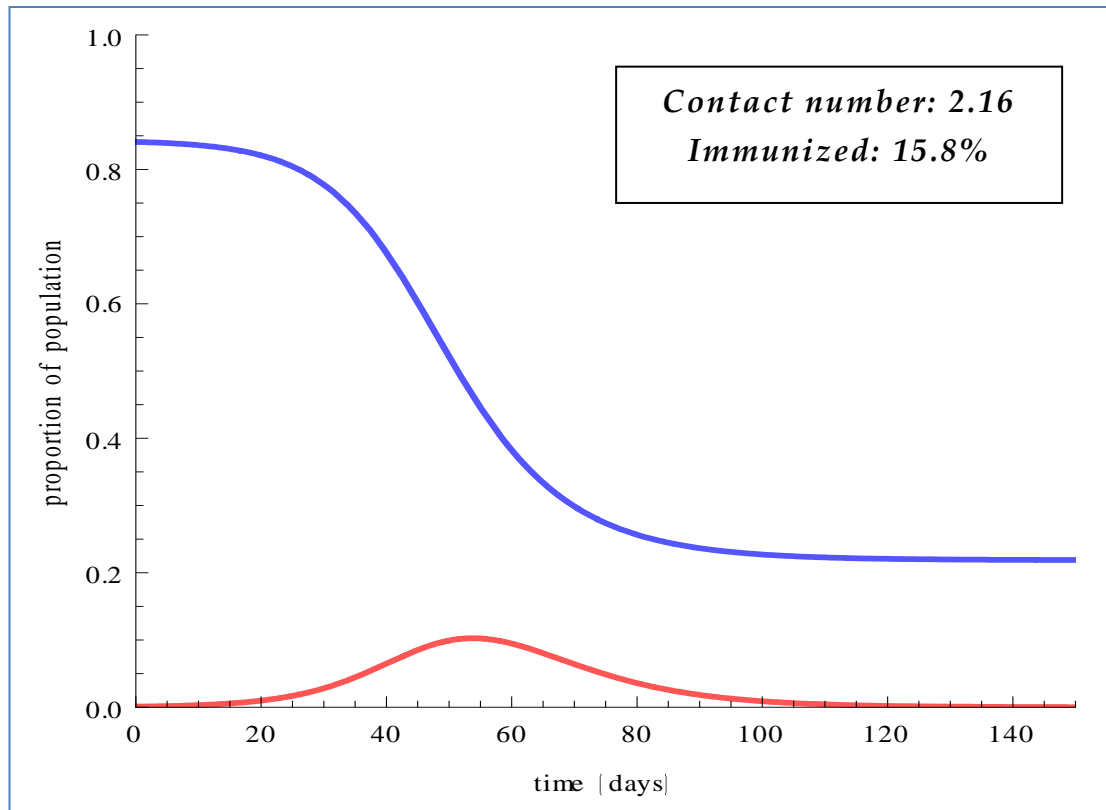- **Initially Infected Population: 0.001**

Graphs 7.11 Viral Sharing Progression Model for Clothing
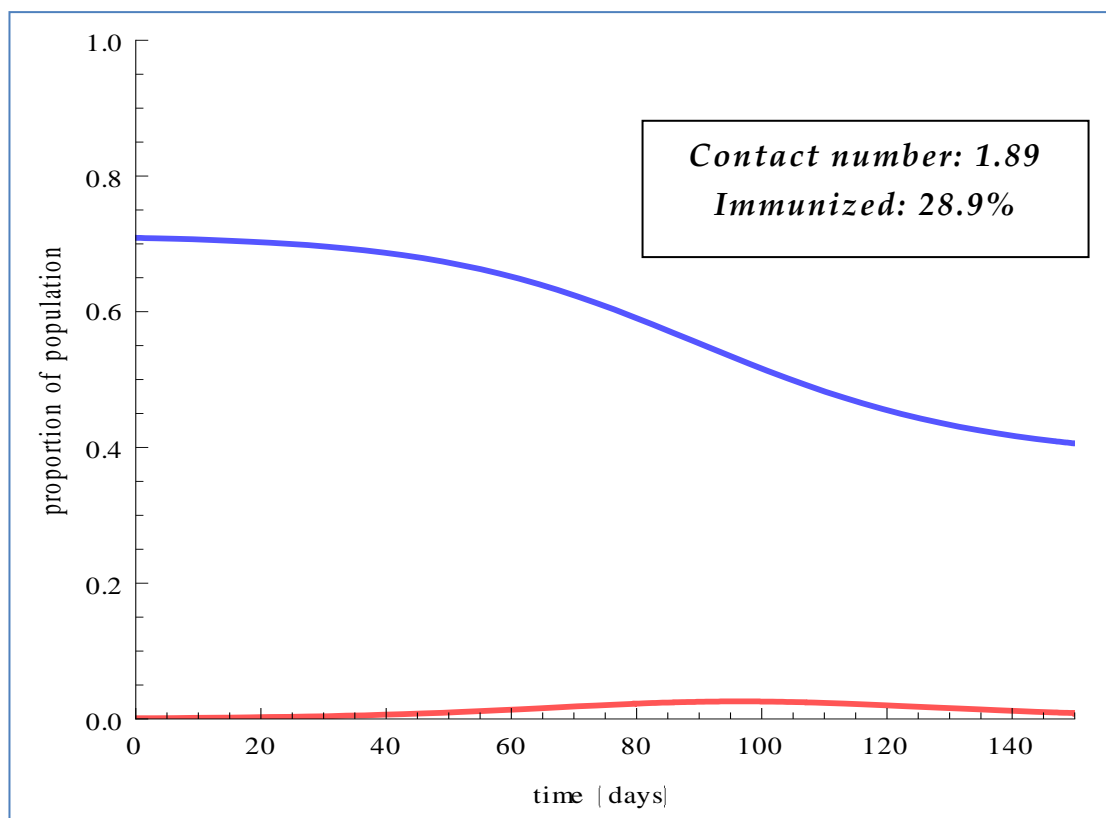*Contact number: 2.3   Immunized: 17.8%*
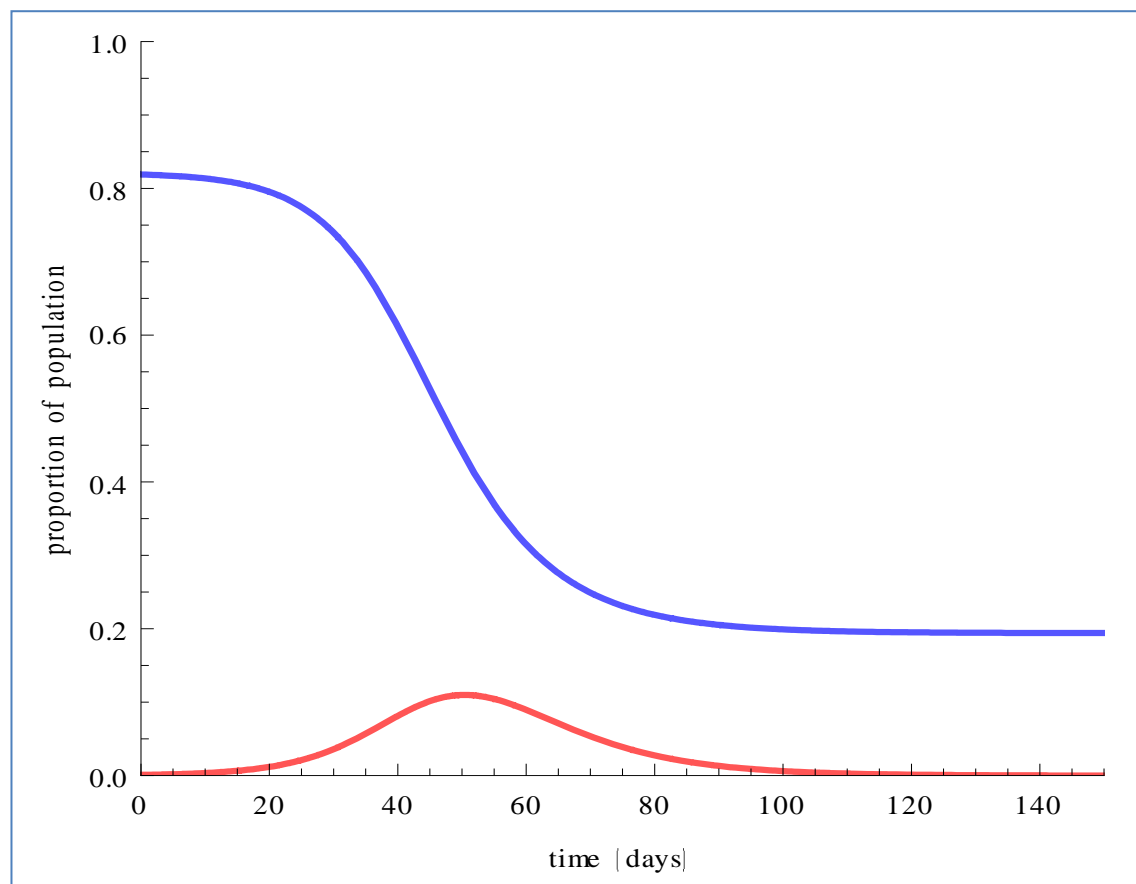
Source: Created by Author of the Thesis by Mathematica Player

Graphs 7.12 Viral Sharing Progression Model for Food Category

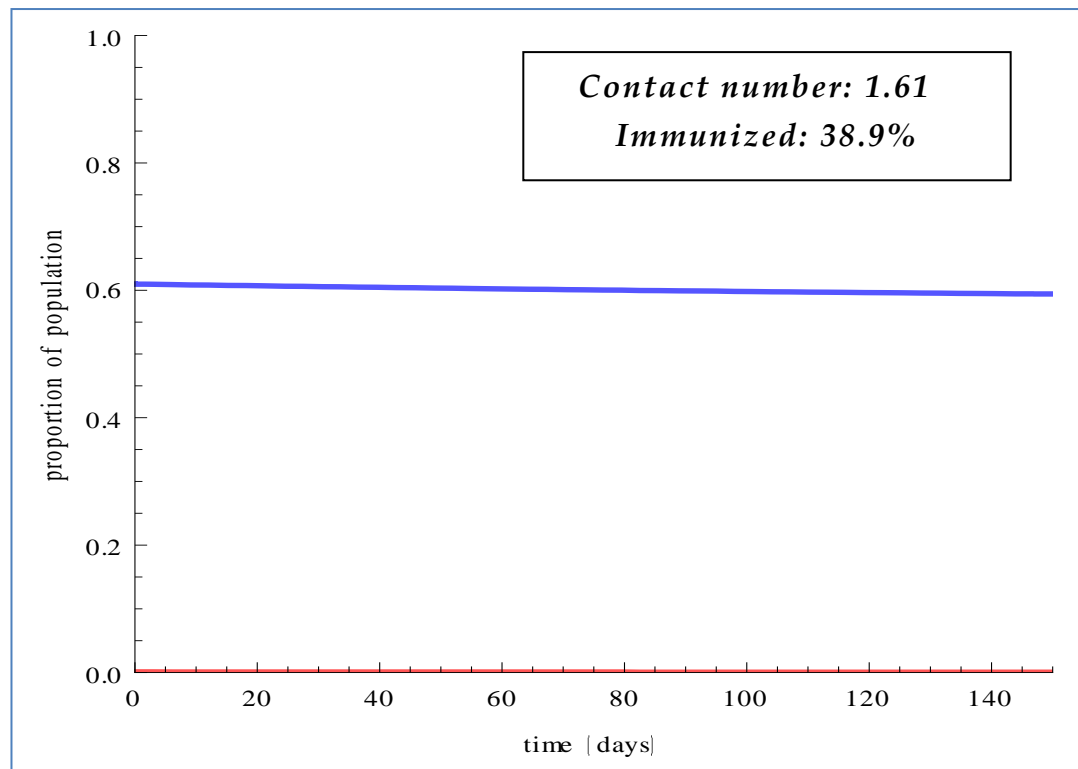Source: Created by Author of the Thesis by Mathematica Player

Graphs 7.13 Viral Sharing Progression Model for Mobile Phones

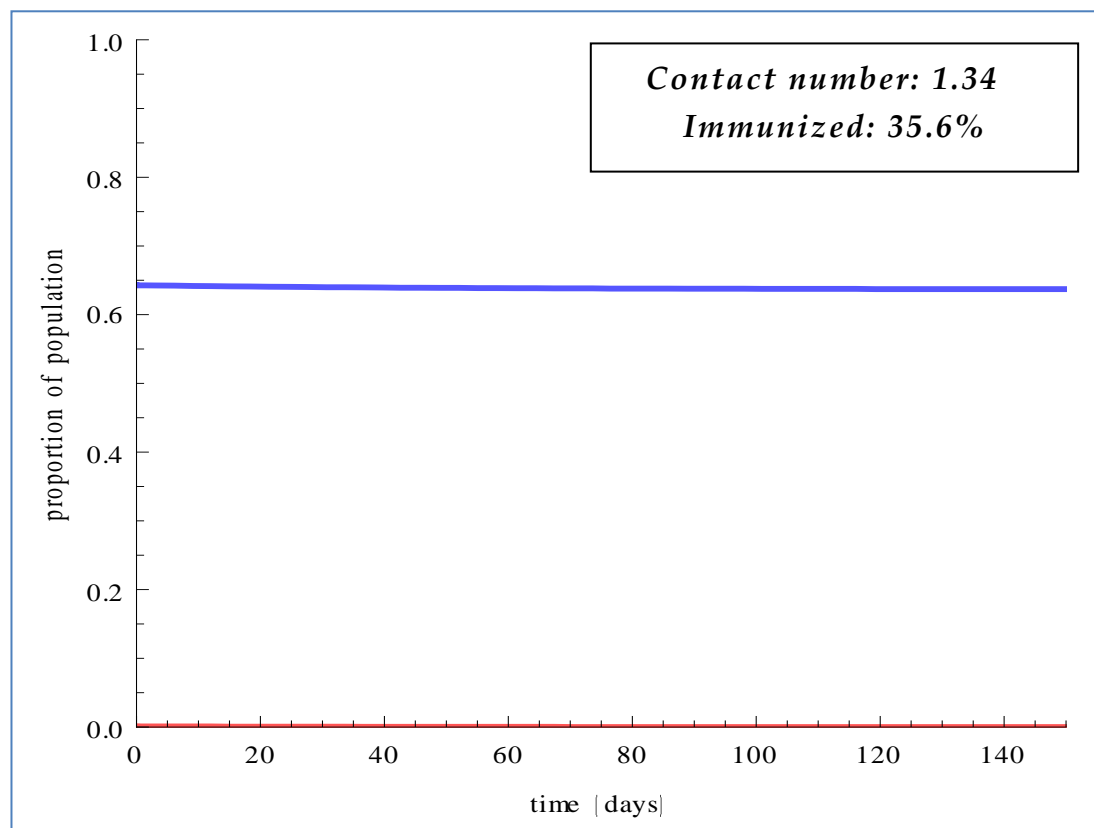Source: Created by Author of the Thesis by Mathematica Player

Graphs 7.14 Viral Sharing Progression Model Cars Category

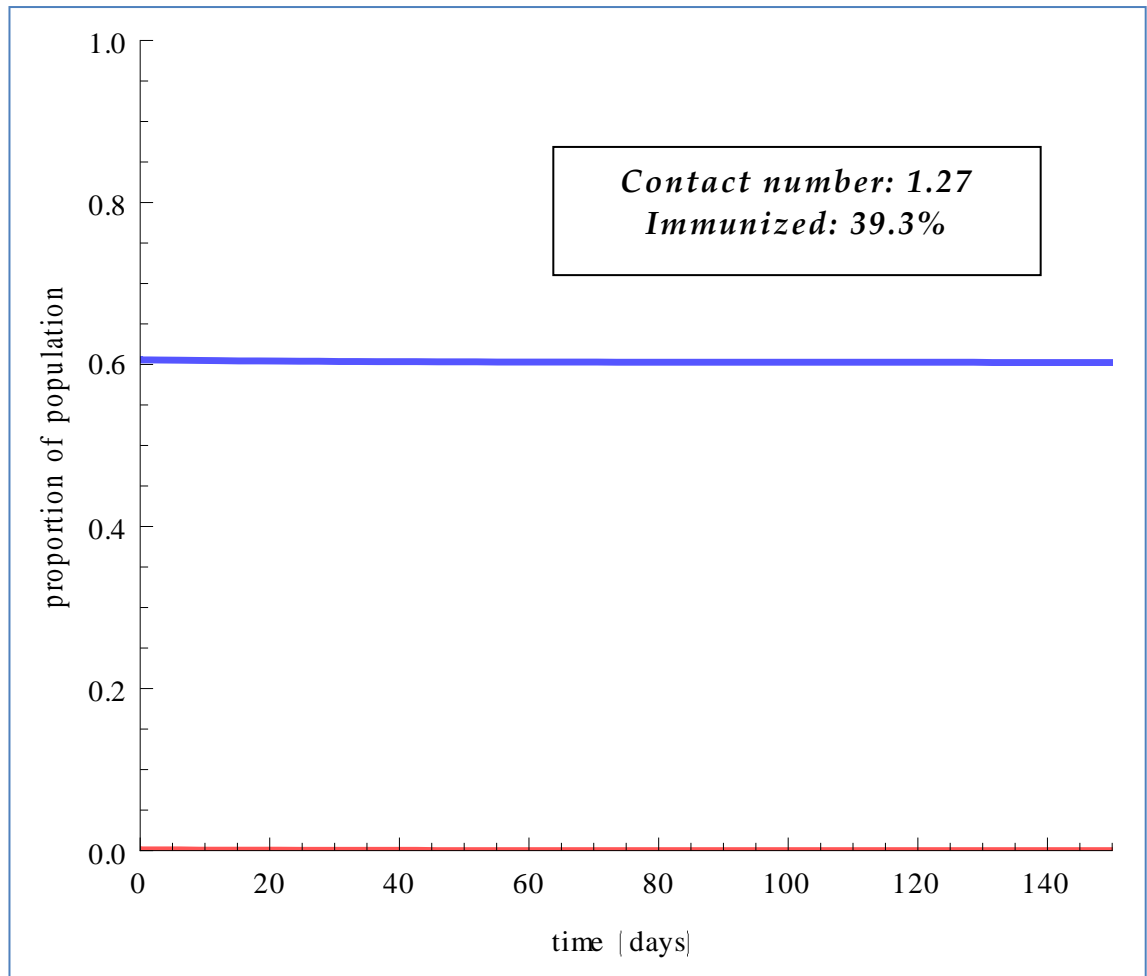Source: Created by Author of the Thesis by Mathematica Player

Graphs 7.15 Viral Sharing Progression Model for Pharmaceuticals

Source: Created by Author of the Thesis by Mathematica Player

Graphs 7.16 Viral Sharing Progression Model for Fin. Services

Source: Created by Author of the Thesis by Mathematica Player

Those 6 graphs represent a spectrum of examples of viral marketing reach. For clothing and food, we can see **solid potential** for viral marketing reach. People do like to talk about those types of products - marketers just have to give them good reason to talk about it. However, already in mobile phones category is this potential dramatically decreased. On the other hand, cars do have a solid potential, but only when it comes to men. For financial services and pharmaceutical products, the viral marketing represents very difficult task as those categories have a very low propensity WOM sharing.

Let's now go back to the original table based on previous modeling and let's assign individual parameters to the table.

Table 7.17 Impact of Based on Parameters of Viral Marketing

		Impact on result	
		YES	NO
Possibility of influencing by marketing decision	YES	C_R	I(0)
	NO	S(0), R(0)	T

Source: Created by Author of the Thesis

Parameters are following:

- **S(0)** - number of susceptible people the beginning of infection
- **I(0)** - number of people initially infected
- **R(0)** - the number of immunized people
- C_R – contact number (given by $C_R = \frac{\alpha}{\beta}$)
- **T** – duration of viral infection

Despite the fact that viral marketing spreading is defined by 5 different parameters, only one of them is relevant to a marketing action. Contact number can be influenced by marketing decision and the change of initial, which means that this parameter in SIR model causes substantial difference in final outcome. The initial amount of seeded people can be influenced, but has a little impact on final reach of the campaign. All remaining parameters cannot be influenced at all.

7.6.9   Impact of Contact Number

Once we've identified that contact number is possible to influence and it that has the on the final outcome, we need to investigate the relationship between ream and contact number. For modeling following parameters are used:

- Immunized: 40%
- Duration: 0.55 days
- Initially Infected: 0.00001

The choice of the parameters will be explained and supported by real data in chapter 8.3.1. **Red line** represents *infected population percentage* and **blue line** corresponds to *susceptible population percentage*.

Graphs 7.18 Impact of Contact Number on Viral Reach
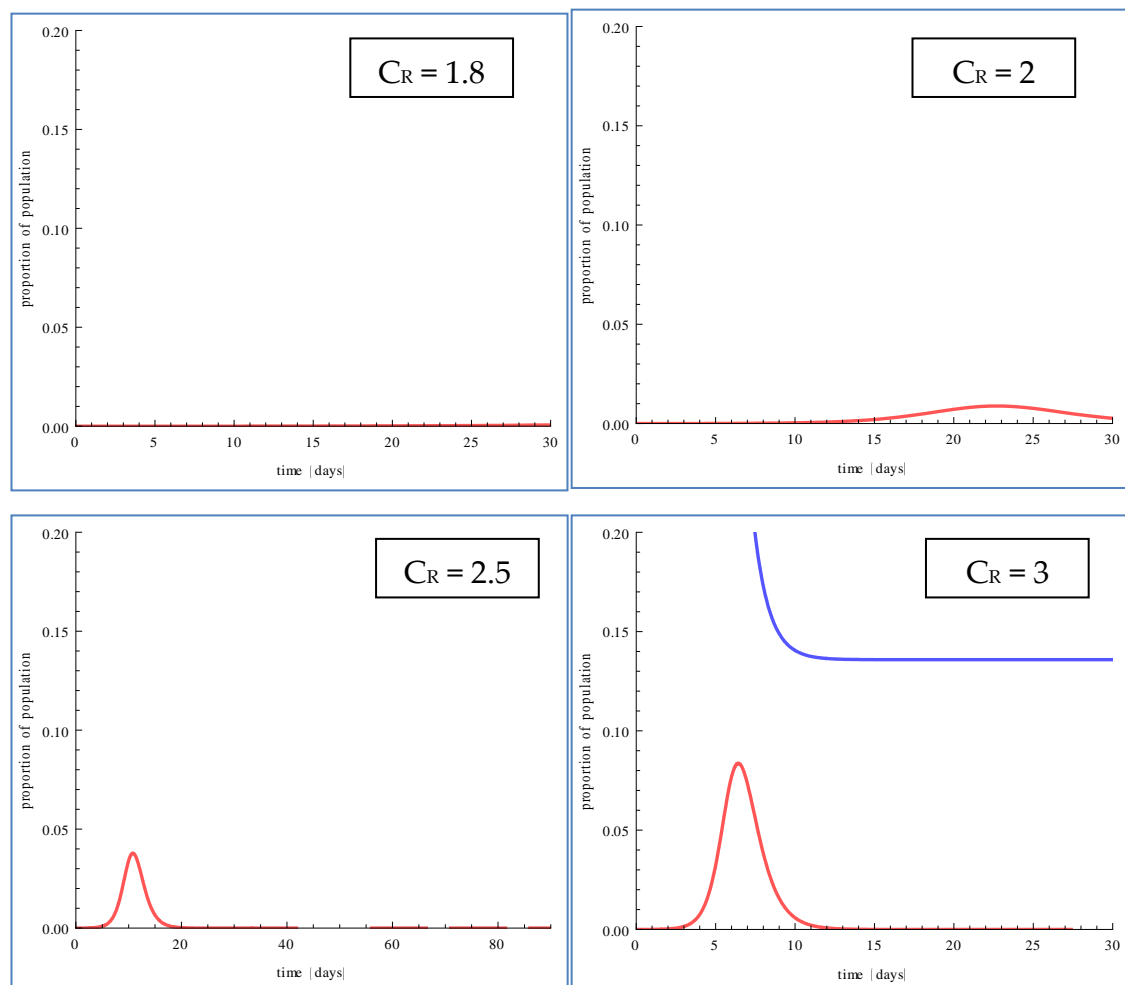
Source: Created by Author of the Thesis by Mathematica Player

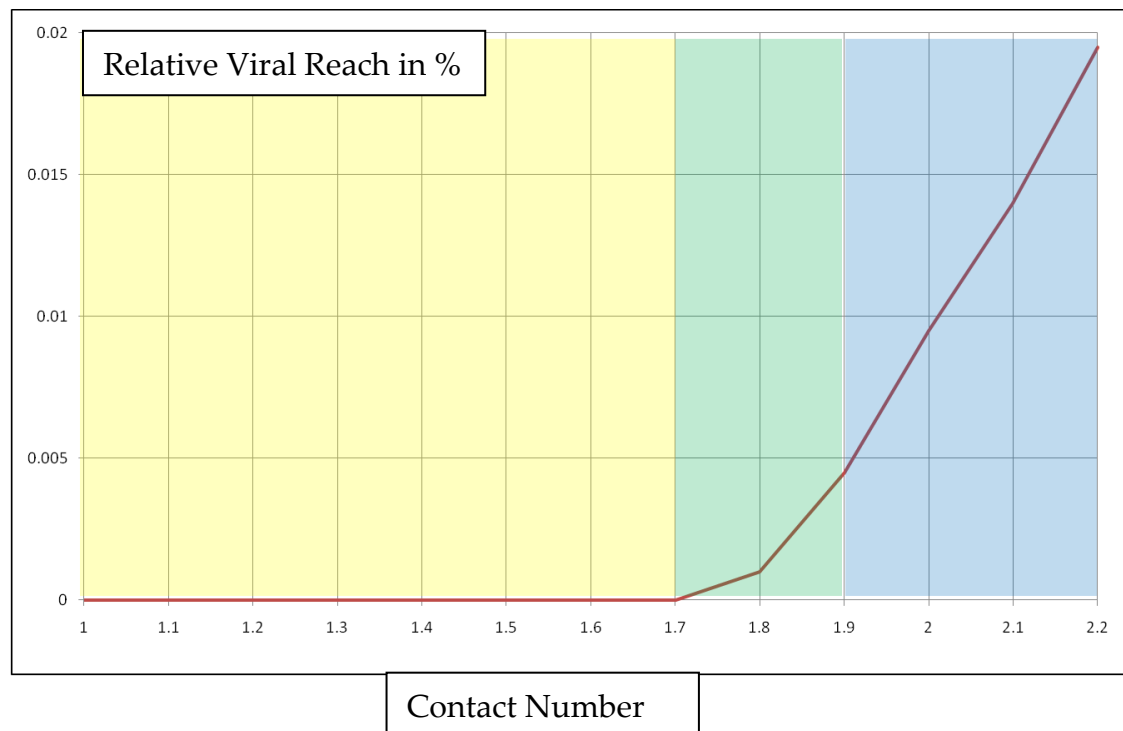The set of graphs shows the following: until contact number reaches close to 2, reach of viral spreading will be non-existent. Once it is reached the viral seeding will deliver results. Let's plot the specific graph (graph 7.17) around contact number 2

Graph 7.19 Relationships of Contact Number and Viral Reach

Source: Created by Author of the Thesis by Mathematica Player

The graph shows a non-linear impact of contact number to viral reach. Contact number up to 1.7 delivers no reach (yellow area). When contact the number changes from to 1.7 to 1.9 (green area), the reach grows in exponentially. When the contact number reaches over 2 (blue area), the relationship becomes linear. This relationship explains why it is so difficult to predict the outcome of viral marketing. A small shift in contact numbers from 1.7-1.9 makes the difference between success and failure.

The phenomenon was best described by David Meerman Scott[75]: *"It is virtually impossible to create a Web marketing program that is*

guaranteed to go viral; it requires a huge amount of luck and timing. That's an important point to remember as you work on viral marketing ideas, because it's unlike the old-rules, numbers-based marketing techniques you're probably used to. Consider a direct mail campaign: You could always count on a direct mail piece to generate a known number of responses, say 2 percent. So if you needed to have 100 people respond, you sent out 5,000 mailers. Easy, right? Viral marketing is much different. You just can't count on numbers in the same way. Many efforts fail miserably and there are countless Web sites, e-books, and videos that only their creators' mothers and bosses have seen". [74]

The author of this thesis agrees with unpredictability – the thesis will analyze the real data in the next chapter.

In the same document, David Meerman Scott also compares viral marketing to venture capitalist activity (Picture 7.18). One invests in many companies – in several one loses all investments, in many one barely gets one's money back and few star successes will get a person all the profit. In the next chapter, this thesis will show that the bell curve relationship doesn't represent the real viral marketing campaigns distribution.

Picture 7.20 Viral Marketing Bell Curve

Source: David Meerman Scott [13]

8 Viral Marketing Campaign Data Analysis

Theoretical data help dramatically to understand how viral marketing works. However, only a comparison to real data provides the real insights. In chapter 5 this thesis has analyzed WOM behavior – in this chapter viral marketing data will be analyzed.

8.1 Data Source

As in WOM communication analysis, this thesis uses secondary data with many features of primary data. The source of data doesn't represent subjective interpretation of data, but truly raw data. The original source has been provided by a company called Visible Measures through their tool device called True Reach™[64]. The data has been collected as following: *"this system is a hybrid semantic search engine that collects video performance data from hundreds of video-sharing sites. The resulting video data is stored in a constantly growing video repository that contains real-time and historic performance data on over 200 million unique videos. Our Video Metrics Engine captures in-stream audience behavior moment-by-moment viewing results. After a lightweight, one-time integration with your site's video player, our Video Metrics Engine tracks every viewer interaction that occurs within the video player. This tracking spans across every video everywhere the player travels online. By directly measuring every time viewers hit play, rewind, fast-forward, forward-to-a-friend, and other player-based behaviors, our Video Metrics Engine calculates precise audience engagement metrics, providing you with unprecedented visibility into content consumption, traffic drivers, viewer demographics, and more* [75].

The data series provides weekly reach of top viral ads starting from July 17, 2009 till March 21, 2010. The source data include 143

viral videos, which represents major viral campaigns of leading companies. It obviously doesn't cover all viral marketing activity during above described timeframe; it represents only succesful campaigns and a whole range of unsuccessful viral campaigns will not be cover in this data source.

8.2   Data Analysis Decisions

The source data contain continuum of data of existing campaigns at the beginning date of July 17, 2009 as well as newly added campaigns until March 21, 2010. To be able to show progression of reach data, the analysis removed all campaigns, which had already existed at the start of data-series without a known initial beginning of the campaign. Second, all remaining campaigns shorter than 14 weeks have also been removed to make sure that enough time was allocated to show successful viral growth; in doing so, the analysis ensures that potentially successful viral campaign was not omitted because of slow start. The final data-set of viral video qualified as based on the above mentioned criteria, and consists of 56 viral campaigns with fully documented course of viral reach week-by-week.

8.3   Data Analysis Outcomes

8.3.1   Real Data vs. SIR model

Let's start the analysis of real data with course of the viral reach over 14 weeks. The initial data will look at cumulative average of all 56 campaigns depicted in graph 8.1. The fist important outcome is that in aggregate the campaigns reach peak of their reach already **in the first week**. Measurement in week represents unfortunately too large a unit of time for more detailed analysis – days alone would be more of an appropriate measure (unfortunately this data has not been available). Before moving to

further analysis, let's compare the real campaign with a modeled campaign with SIR algorithm.

Graph 8.1 Average Reach of All Viral Marketing Campaigns
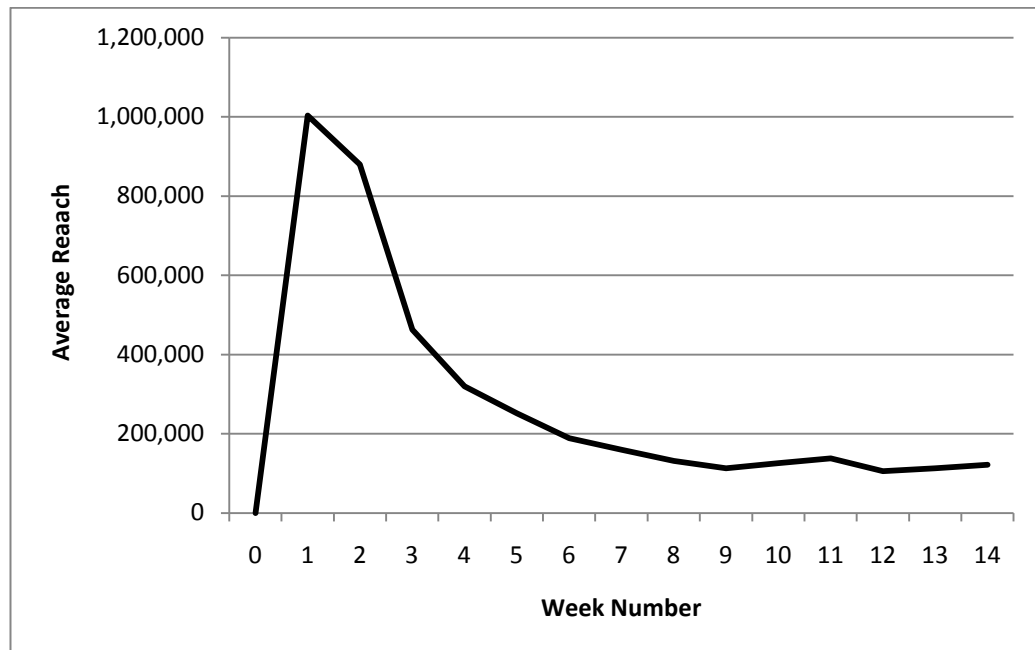
Source: Created by Author of the Thesis from TrueReach data

Graph 8.2 SIR Model

Parameters:
Contact number: 3
Immunized: 40%
Duration: 0.55 days
Initially Infected: 0.00001

Source: Created by Author of the Thesis by Mathematica Player

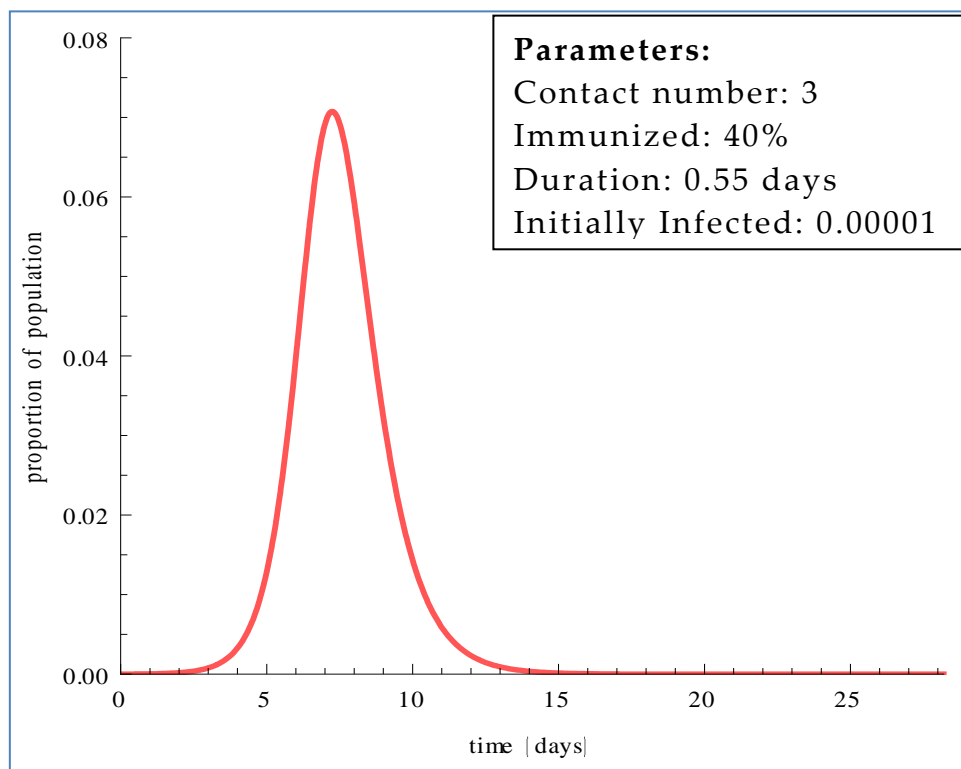The model has been created to represent an extremely fast rise of all viral marketing campaigns. To be able to achieve the peak of viral reach in first week, the duration of infection had to be chosen below one day! In reality this time represents quite well the behavior of people, who spread the viral marketing. Experience tells us that people don't go on spread viral marketing for a long period of time. Interestingly enough this modeling shows us that typical behavior of viral marketing spreading should be done in one short blast and no more viral spreading after that.

As previously described, the real data don't have necessary granularity and so exact modeling would not be useful. However, shape of real vs. modeled reach comparison serves our purpose well. The rising part of the graph shape shows a very solid approximation of model vs. real data through the rapid increase within one week. After reaching the peak, model and real data show difference. The decay of viral reach is slower than the model shows. The explanation hypothesis is as simple as follows: while the length of infection of specific disease is constant, the duration of viral infection differs. If nothing else, after sending the viral message, people do receive it immediately. However, they don't have to necessarily read it immediately and especially act on it – there is always some delay, which is neither measurable nor predictable. So for modeling we can use only average duration of infection, which omits the effect of delayed viral spreading.

8.3.2 Reach of Campaigns

This analysis looks at all 56 campaigns and their cumulative reach in 14 weeks. First let's simply plot the graph of reach of all 56 campaigns in Graph 8.3. It reveals one large and hugely successful campaign and then a quick drop of reach for the rest.

Graph 8.3 Reach of Individual Campaigns in 14 Weeks
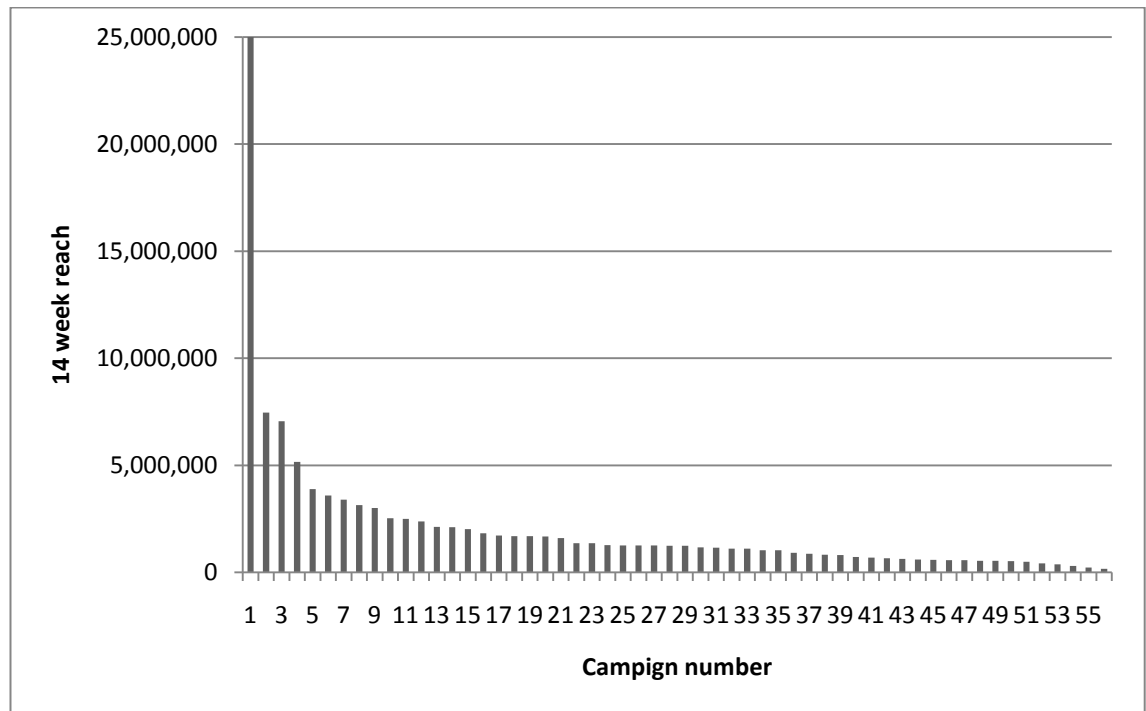
Source: Created by Author of the Thesis from TrueReach data

Rather than a simple graph, let's use frequency analysis, which demonstrates it even better.

Graph 8.4 Frequency Graph of Campaign Reach
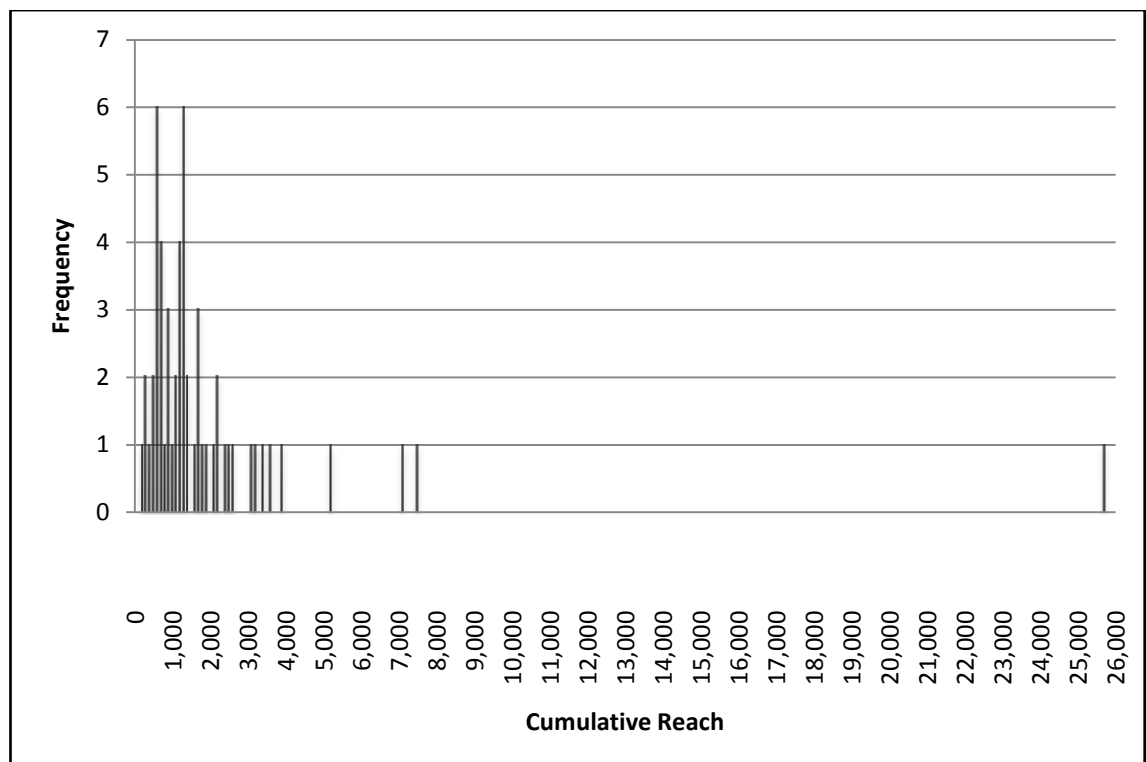
Source: Created by Author of the Thesis from TrueReach data

The frequency graph shows that the frequency of majority of campaigns looks really similar to standard distribution as described by David Meerman Scott – 52 out of 56 campaigns demonstrate bell curve like shape of frequency. However, there are 4 outliers – 3 relatively small and one huge. The top viral campaign – Evian water presenting roller-skating babies [76] – represent higher reach than bottom 32 campaigns combined. While initially used only as viral campaign, Evian has recently decided to build on major success of this viral video and will start to use it for TV advertising. [77]

8.3.3 Peak of Campaign Analysis

The analysis in graph 8.1 focused on averages of individual campaigns and shows that a campaign on average reaches peak in its first week. Let's examine the time when campaigns reached the peak.

Graph 8.5 Number of Campaign Reaching Peak in Week Number
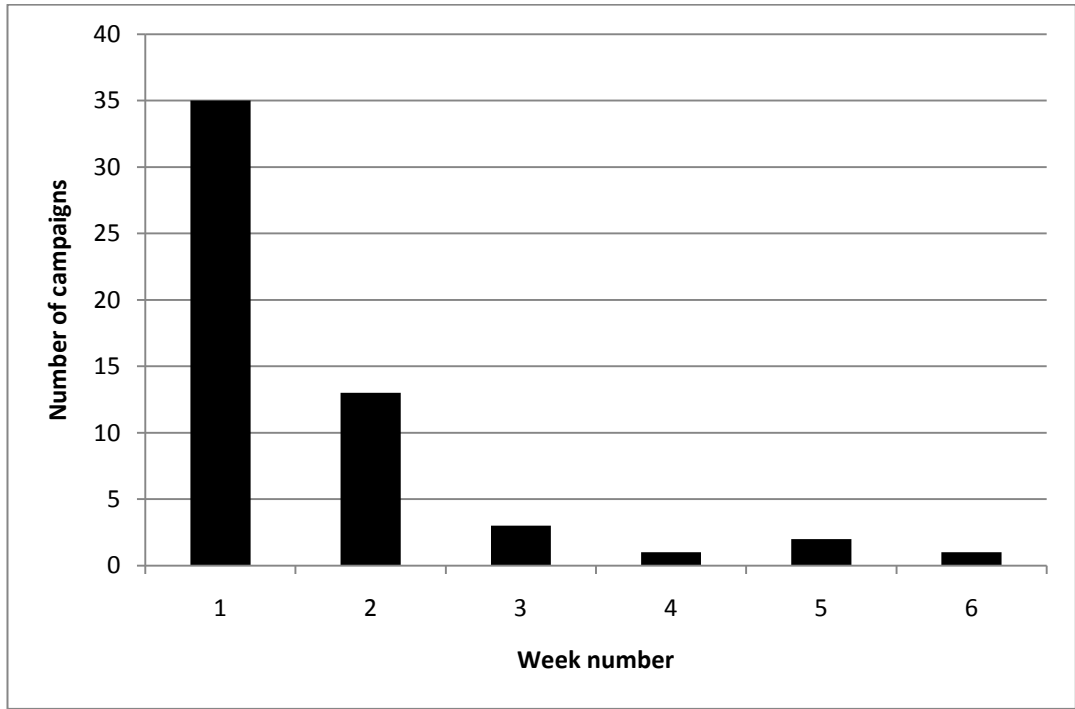
Source: Created by Author of the Thesis from TrueReach data

The majority, 35 out of 56 campaigns, reached their peak within a week, while 13 more reached it in a second week. There is one complete outlier (not represented in graph 8.5 for easier readability), which peaked in its last week. Nonetheless, we cannot avoid some specific circumstances such as advertising or specific event, which caused extra spike late in the campaign. The more probable cause is a simple mistake of data, because the next week, 15, the campaign showed typical decay as if there had been no previous spike.

Let's also compare the peak of campaign of Top 28 Campaigns vs. Bottom 28 Campaign. Graphs 8.6 shows that more successful campaign kept viral growth until week number 2 and only then they started to fade away. Less successful campaigns don't have the strength to spread for more than one week and after the initial burst decline dramatically. Still, those viral campaigns belong to successful ones – the failures are not recorded at all.

Graph 8.6 Average Reach of All Viral Marketing Campaigns
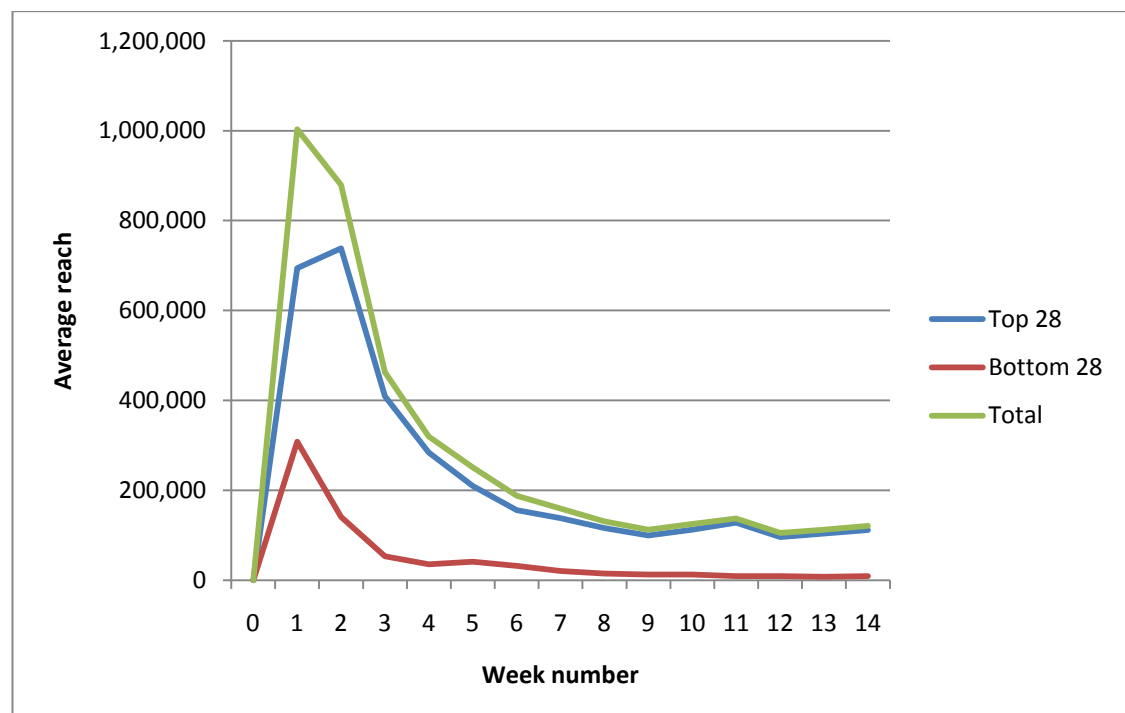
Source: Created by Author of the Thesis from TrueReach™ data

8.3.4   Shape of Reach of Individual Campaigns

Graphs 8.7 and 8.8 are normalized to their individual peaks representing 100%. They show that the majority of individual campaigns do behave as based do SIR model - after a quick peak they fade away. Only 4 out of 16 top ones don't have the abrupt decline after reaching their peak – but still, the campaign shape doesn't look completely different. There will obviously be more campaigns not exactly following perfect theoretical graph – however this doesn't mean that they defy the theory.

All other campaigns can be seen in addendum 12.4.

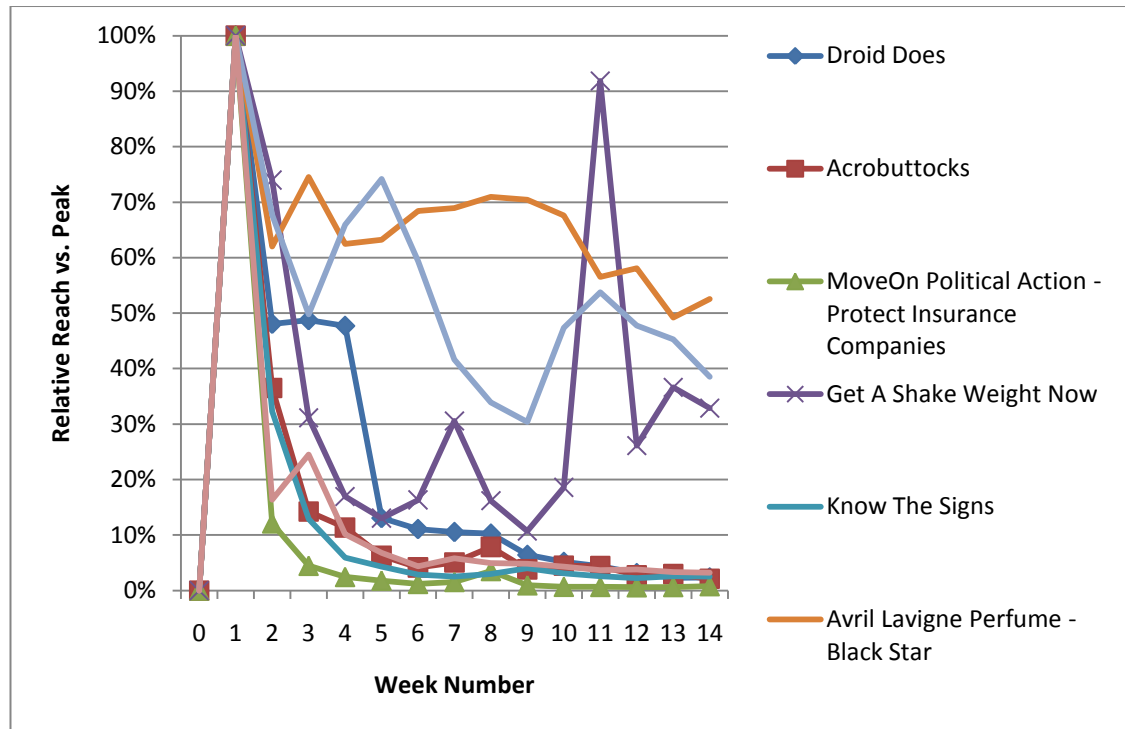*Graph 8.7 Shape of Reach Top 8 Viral Marketing Campaigns*
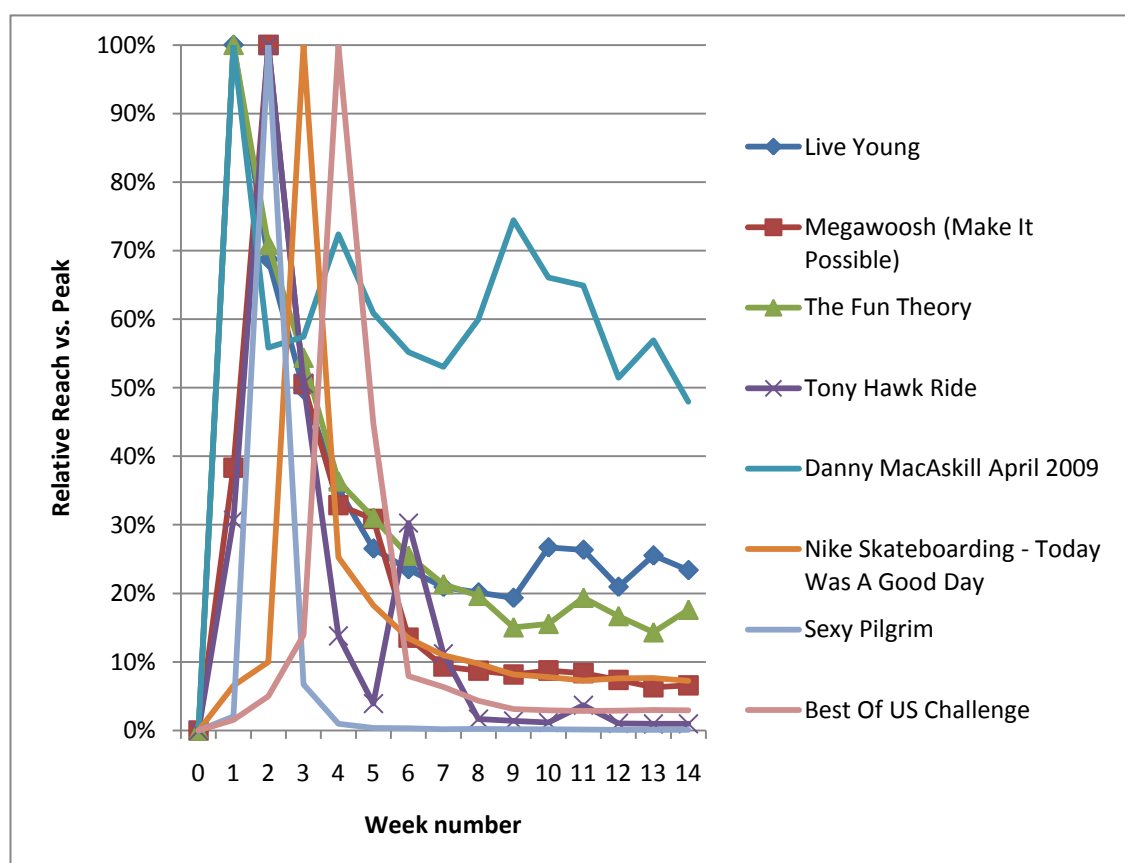
Source: Created by Author of the Thesis from TrueReach data

Graph 8.8 Shape of Reach of Top 9-16 Viral Marketing Campaigns

Source: Created by Author of the Thesis from TrueReach™ data

9 Why Messages Spread Virally

Once we answered what the mechanism of messages spreading is, we need to answer the following fundamental question: Why do people spread messages? This thesis found a lot of material on this topic; however, the findings were not always supported by proper research studies. Nevertheless, based on other research and data analysis, this thesis can support the hypothesis strongly enough.

9.1 WOM Communication

At the beginning, let's separate WOM communication from viral marketing. Nearly all studies about WOM communication support the very obvious statement that people communicate positively about products because of their great experience with these products. And at the same way they communicate negatively because of poor experience. Among all the studies, this thesis just wants to mention couple. Brown, Barry, Dacin, & Gunst [78] suggest that commitment both mediates and moderates the effect of satisfaction on positive WOM. *"Existing research demonstrates that higher satisfaction leads to greater levels of commitment and WOM intentions and that commitment leads to increased WOM behavior, but this research goes further. Our research provides further insight into the possible nature of the relationship between satisfaction and commitment in the prediction of both positive WOM intentions and actual WOM behavior. The results suggest that consumer commitment to the retailer partially mediates the effect of satisfaction on positive WOM"*

Chung and Darke[79] focused on 2 interesting aspects products, which are subject of WOM communication. They compared the volume of WOM for self-relevant products and utilitarian products, where these product-types were initially rated as equally good. Products that are "self-relevant" offer consumers an

opportunity to communicate something important about themselves to others by providing WOM. Products that are purely utilitarian in nature to the consumers don't provide opportunity to talk about themselves. Not surprisingly people are biased towards self-relevant products. In addition,, the difference between volume (they use world valence) between those 2 types of product were huge, showing clearly that people share their experience because of themselves and not others. *"Overall, the findings in this initial study were consistent with the prediction that consumers would be more motivated to engage in WOM for self-relevant products than for utilitarian products. Importantly, this finding could not be explained by differences in attitudes or product knowledge."* [79]

Table 8.1 Means for Self-relevant versus Utilitarian products

Measure	Self-relevant ($n = 36$)	Utilitarian ($n = 32$)
Positive WOM	3.42	1.56
Negative WOM	1.33	0.47

Chung M. Y. Cindy, Darke R.Peter (2006). The consumer as advocate: Self-relevance, culture, and word-of-mouth [14]

9.2   Viral Marketing

Let's now look at viral marketing. As discussed previously, viral spreading of messages doesn't require experience or purchase of the product and so motivation must be different than satisfaction with products – although it doesn't preclude that particular viral marketing message reaches a person, who has already had a positive experience with products.

Lindgreen and Vanhamme [80] argue that emotions work in viral marketing - social sharing of emotions phenomenon. They also add that more disruptive the events are faster and more frequently they are shared with other people. They summarize all different mechanisms of emotions in table 8.2 – but they don't provide measurements about which emotions trigger viral spreading more than others.

Table 8.2 Emotion behind Viral Marketing

Mechanism(s)	Source and explanation	Mechanism(s)	Source and explanation
Entertainment, amusement, irritation	*Splash of Paint*: People are directed to the company's Internet site by entertaining, amusing, and/or irritating them.	Coolness, fun; unique offer	*Virgin Atlantic*: Customers pass on the message when they think it is cool or fun, or if the offer is second to none.
Fun, quirk, amusement; specific and relevant to the person	*Claritas*: Viral marketing campaigns should be funny, quirky, or amusing, or something that is very specific and relevant to the individual customer.	Violence, pornography, irreverent humor	*Clark McKay and Walpole Interactive*: The messages drawing highest response rates are those that have elements of violence, pornography, or irreverent humor.
Fun, humor, excitement (jokes, games)	*Fabulous Bakin' Boys*: Its website supports the muffin products with flash animation sites, fun, jokes, as well as games that people can download and forward to their friends.	Comic strips, video clips	Comic strips and video clips grab the attention of people, who then forward the content to their friends.
Emotional elements	Internet strategies must have high levels of emotional content including interactivity, the ability to involve other people, chat rooms, and the creation of online community.	Contests and humor; important advice	Contests and humor are important elements in successful campaigns, which can also be successful if they have important advice for customers.
Nature of the industry; online tenure of the audience; topic	*Sage Marketing and Consulting Inc.*: The success of viral marketing is dependent upon (1) the nature of the industry that the company is in; (2) the online tenure of the audience; and (3) the topic. People are more likely to pass on information about products like entertainment, music, Internet, and software.	Controversy	A company gains publicity when the media writes about controversy on its website, and competitors will have to deal with the company. But such word-of-mouth marketing can be dangerous because dissatisfied customers are more likely to share their negative experiences than satisfied customers.
False, deliberately deceptive information; popularly believed narrative, typically false; anecdotal claims; junk	So-called 'urban legends and folklore' can be organized as (1) false, deliberately deceptive information; (2) popularly believed narrative, typically false; (3) anecdotal claims, which may be true, false, or in between; and (4) junk. Such stories are frequently forwarded to friends, family, and colleagues.	Fun, intrigue, value; offer of financial incentives; need to create network externalities	People pass on messages if they find the product benefits to be fun, intriguing, or valuable for others; if they are given financial incentives for doing so; or if they feel a need to create network externalities.

Source: Lindgreen.Vanhamme The use of surprise [15]

Several other authors state clearly that viral marketing doesn't spread because of brand, but because of everyday conversations done by ordinary people. For instance Dunsdon[81] states that viral conversations because of brands is the exception rather than

the rule. *"There are billions of brands out there and it seems perverse to assume that people care enough to have a dialogue with the vast majority of them. Do people really want an active relationship with Sure deodorant, MFI, or Always sanitary towels?"* [81] Although he admits that there are few exceptions of brands, which give a "permission to have conversations." Because they are integrally connected with people passions (football clubs Chelsea or Bayern Munich or photography equipment Canon), promote good cause (like Greenpeace) or brands that have an extreme point of view on life (Vice Magazine). Walter J. Carl reaches the same conclusion. *"The take-home point from the current study is that, as predicted by recent discussions of everyday communication in the communication literature, effective WOM and buzz marketing is not rooted in the marketing of a particular brand, product, or service but rather is based in the everyday relationships and conversations of people discussing other matters"* [58].

Dobele, Lindgreen, Beverland, Vanhamme and van Wijk[82] studied, which emotions cause that messages get shared with other people. They consider the impact of the six primary emotions on message forwarding in nine chosen viral marketing campaigns. They focused on 6 basic emotions: Surprise, Joy, Sadness, Anger, Disgust and Fear. They conclude that all successful viral campaigns must include element of surprise and plus one additional basic emotion. *"Our analysis of the nine viral marketing campaigns leads to the important managerial implication that marketers must achieve fit between a key emotion and their brand or viral marketing campaign because this will ensure increased chance of forwarding. Keeping in mind that all campaigns must achieve an element of surprise"* [82]

Table 8.3 Emotion Elicited in Different Marketing Campaigns

Viral marketing campaign	Surprise	Joy	Sadness	Anger	Disgust	Fear
Weapons of Mass Destruction	✔		✔	✔		
Christmas Cards	✔	✔				
Raging Cow	✔	✔	✔			
Honda Accord	✔	✔				
Motorola V70	✔	✔				
Red Cross	✔		✔			✔
Organization of Women's Freedom	✔				✔	
Save BNN	✔		✔	✔		
Rock the Vote	✔	✔				

Source: Dobele, Lindgreen, Beverland, Vanhamme and van Wijk. Why pass on viral messages? [16]

Donavan, Mowen and Chakraborty[83] investigated factors influencing the spreading of negative viral communication of so called "urban legends". They conducted experiment in three aspects of a recent urban legend: the central character (altruistic vs negative), the outcome of the story (positive vs negative), and the presence or absence of a brand name. *"Results indicate that intent to communicate an urban legend is lowest when the central character is altruistic and the outcome of the story is positive. These results are consistent with previous suggestions that consumers circulate urban legends in order to communicate negative information involving moralistic stories possessing an ironic twist."* [83]

Phelps, Lewis, Mobilio, Perry and Raman [44] studied personality characteristics and social motivations do email receivers. What emotional reactions does receipt of pass-along email messages elicit and under what conditions they are deleted. What types of messages tend to get forwarded? Why do people forward pass-along emails? What interpersonal communication motives cause consumers to pass-along email messages that they have received? Based on their research they come to a conclusion that the main reason for forwarding that is that it is fun and they enjoy it, and or that it will need to help others. Not necessarily does the message itself have to be funny – the act of doing it must be.

Table 8.4 Motives for Sending Pass-Along Email

Item	M	SD
Because it's fun	3.91	1.12
Because I enjoy it	3.61	1.34
Because it's entertaining	3.48	1.12
To help others	3.48	0.85
To have a good time	3.39	1.31
To let others know I care about their feelings	3.39	1.03
To thank them	3.09	1.24
To get away from what I'm doing	2.74	1.39
Because it peps me up	2.74	1.14
To show others encouragement	2.70	1.22
Because it allows me to unwind	2.70	1.26
Because it's exciting	2.65	1.11
Because it relaxes me	2.48	1.24
Because it's stimulating	2.48	1.08
To get something I don't have	2.48	2.35
To get away from pressures	2.48	1.24
Because it's a pleasant rest	2.43	1.08
Because I'm concerned about them	2.43	1.16
Because it makes me feel less tense	2.35	1.15
To put off something I should be doing	2.35	1.30
Because I have nothing better to do	2.26	1.25
Because it's reassuring to know someone's there	2.13	1.32
Because I want someone to do something for me	2.00	1.17
Because it's thrilling	2.00	1.13
To tell others what to do	1.83	1.19
Because I just need to talk	1.83	1.07
Because I need someone to talk to	1.65	0.83
Because it makes me feel less lonely	1.48	0.79

Source: Phelps, Lewis, Mobilio, Perry, and Raman [17]

Chiu, Hsieh, Kao and Lee [84] studied how people forward e-mails. They conclude that people who receive a marketing message with a higher degree of utilitarian value or hedonic value are more willing to forward it to others. This outcome looks obvious and doesn't seem to be very surprising; however, the facts supported by research provide better insights.

In this thesis' opinion, most insightful reason about why we spread messages comes from Steve Knox [85]. He reckons that the reasons why consumers choose to talk about things are deeply rooted in the cognitive psychological sciences. Our brains are designed to reserve their processing power for critical talks and the mechanism for that is using 'schemas': mental models that we use to make the world work. They enable us to assume many things and use the schema to fill in the missing details. Other literature uses expression 'heuristics' instead of schema- rules of thumb for quick decision making. Our brains simply make the assumption how the world works. In Knox's opinion, disrupting a schema turns out to be the key reason, why people talk. Their mindset has been disrupted and the way to get over it is to talk about it. Among others, he uses the example of highly discussed news about successful landing a US Airways plane on the Hudson River by Captain Chesley Sullenberger. People schema is that planes don't land successfully on water – when engines fail, a plane crashes. But we don't talk about crashed airplanes more than necessary because paradoxically our "schema" has not been disrupted. Viral marketing should use the same cognitive principles: consumers will talk about brands when a schema is disrupted. They talk when they are given a piece of surprise that does not fit inside their mental model.

9.3   Why Messages Spread Virally Summary

Based on all this research, this thesis concludes that the most important reason for viral marketing is to be **surprising, unexpected or disruptive in messages offered to peoples' minds**. Humor itself cannot deliver or ensure that messages are shared – although combination of surprise and humor delivers very good results.

To illustrate this point even further, let's compare top viral marketing videos with overall most viewed videos. The same source of Visible Measures provides this data in "The 100 Million Views Club" [86]. Based on data from April 11, 2010 there are 65 videos, which were viewed on Internet more than 100 million times with number 1 video (music video *Soulja Boy: Crank Dat*) reaching over 720M viewings. The whole list comprises from types of vides summarized in table 8.4.

Table 8.5 Types of Top Shared Video on Internet
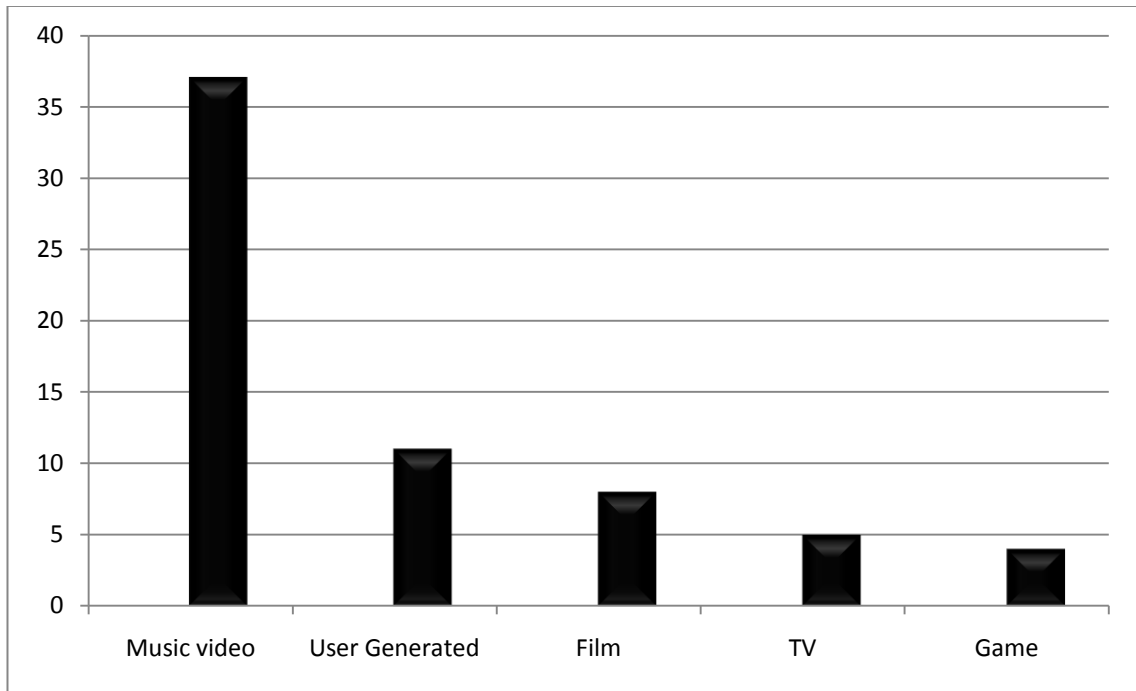
Source: Created by Author of the Thesis based on Visible Measures Data "The 100 Million Views Club" [18]

In the whole list we cannot find a single viral video created by companies advertising their products beyond movies, TV programs, films and video games, which in summary represent media themselves. Humor played also only limited role in spreading the media videos virally. This thesis did not find any correlation between humorous media clips vs. other media clips. Beyond media, we can see 12 user-generated videos, where humor plays a role. However, the most virally spread video beyond movies, films and video game is a video of Susan Boyle's story from the "Britain's Got Talent" TV show. Not really a TV show advertising a trailer, but a real life video of a totally surprising, unexpected and emotional story. An older, not really a good looking woman starts her speech with an audacious statement about wanting to become a famous singer. To the shock of the audience and the panel, she sings in a surprisingly beautiful voice a song, which brings tears into people's eyes. The reaction of the commentator: *"You did not expect that, did you? Did you? No!"* [87] Followed by a statement from a member of the jury: *"Without a doubt that was the BIGGEST surprise I ever have had in three years on this show. When you stood there with that cheeky grin and said I want to be like Elaine Paige, everyone was laughing at you. No one is laughing now. That was stunning and incredible performance"* [87]

9.4   Implications on Viral Marketing

To spread messages in a virally successful manner and thus to achieve a desired broad reach, we need to include elements of disruption or surprise.   Furthermore, brand building and marketing effectiveness require continuity, long-term brand value and foundational truth about the specific brand! If people get surprised, the viral video succeeds in great reach – but, it will

obviously fail completely on marketing effectiveness. In better case, people barely remember the brand or the marketing message – or sometimes they don't remember at all, which brand was the whole video about. Actually in the worst case scenario, people get confused or alienated, because they had certain perceptions about particular brand in their mind and this perception has been altered. In this case, viral marketing can be very useful in "re-branding", where we change value proposition; however, it is very difficult, if we want to keep brand consistency. Mathematical models showed, how difficult viral marketing reach becomes, because marketer can control only one parameter (Contact Number); this insight shows that high Contact Number clashes with effectiveness of viral marketing, which makes succesful viral marketing even more difficult. The afore mentioned Steve Knox [85] describes the situation as following: *"Effective word-of-mouth disrupts schemas that are tied to the core of your category and brand. We call this the foundational truth. Disruption can never stray too far from the foundational truth or the consumer rejects it. A classic example was the attempt to reposition Las Vegas as a "family friendly place." This change was wildly disruptive but strayed too far from the core schema of Las Vegas as an adult playground. It was rejected in the consumers' mind. Effective word-of-mouth that drives consumer advocacy disrupts mildly, not wildly, from the consumers' foundational truth."* [85]

In summary, succesful viral marketing needs to balance the fine line between consistency of brand (to drive proper effectiveness of marketing) and the element of surprise and/or an element of disruption (to drive broad reach of viral marketing). The disruption cannot be artificial, and it is hard to tie it directly to the product with exception of the media itself (music, film, TV). The

disruption cannot be too deep – otherwise consumers reject it and such viral marketing causes more of damage to the brand than improvement of its value. From epistemological principal, it is impossible to predict how shareable any viral marketing is – because the only way how to test it is to execute it. Once we let viral messages spread, there is no way stopping them, no matter whether they have a positive or sometimes unfortunately negative effect.

If the effect is negative, viral marketing can cause serious damage to the company's image and brand. The reason is very simple: a proper marketing campaign requires planning and proper budgets, which are only available through company's marketing departments. On the contrary, viral marketing can be created with extremely limited budgets, which can be found in other parts of a company: product development, R&D, sales team, distribution etc. Marketing departments cannot control all the activities. Individual initiatives within a company can expose the consumers to messages, which are not aligned with corporate directions and which are completely off-brand. As described above, messages tend to spread virally better when they represent surprise of disruption. Viral marketing campaign created by one junior product marketing person with a new surprising and disruptive value in contrary to desired brand value proposition has a higher chance of broad viral reach than a properly designed viral campaign. And as already stated previously, once a successful viral campaign starts, it is impossible to stop it. Thus one ill-thought-through viral camping can destroy a brand's goodwill for a long time, confuse consumers and potentially might require a major marketing budget to mitigate the damage.

10 Summary

10.1 Thesis Outcome Summary

The thesis confirmed that WOM communication is necessary for success of discontinuous technological innovation. Marketers need to overcome existing chasm between Early Adopters and Early Majority - WOM marketing needs to be designed with this fact in mind. On top of that, traditional marketing influences positively WOM communication. Marketers should never discuss traditional TV advertising versus WOM marketing - the combination of both delivers the best results.

There are 2 schools of thoughts regarding viral marketing and its definition: The first one sees viral marketing more or less the same as WOM marketing - WOM communication of experience with products simply happens through electronic means, mostly through Internet; The other one sees large difference, because WOM means that consumers share this opinion with other people, based on their own experience with company's products" (NOT based on recommendation of recommendation) regardless of means of communication. Viral marketing on the other hand doesn't actually require experience with the product. This thesis agrees with the latter opinion and so it insists that viral marketing can be characterized as a very specific form of WOM marketing with electronic referrals and without the need for either of the experiences with company's products, nor new product purchase. One of the main implications of this fact is that the reach of viral marketing is much broader and its speed of sharing is much faster than WOM – no matter if WOM communication is shared personally in face-to-face communication or through electronic means.

In summary, this thesis delivered enough evidence to prove or reject all 5 hypotheses.

Hypothesis H1: *"Consumer goods categories differ substantially in its propensity to and efficiency of WOM and viral marketing"* was **PROVED**. Food and Clothing categories demonstrated up to 3x differences between propensity to WOM sharing than financial services or pharmaceutical products. Propensity of categories to WOM sharing is given both by volume of WOM sharing as well as by perceived persuasiveness. These two factors show positive correlation and so they reinforce each other, delivering positive as well as negative extremes. Marketers in Food and Clothing categories should benefit more from viral marketing effort and so they should make WOM and viral marketing an integral part of every campaign. At the same time, viral marketing can be still successful for financial services and pharmaceutical products. The messages and/or executions could be designed so robustly that they overcome the initial handicap of these categories.

Hypothesis H2: *"WOM marketing of technological products in the stage of continuous innovation is more efficient than WOM marketing of other groups of consumer goods"* was **REJECTED.** To the contrary of popular belief, WOM sharing about Cars, TV/video/audio and Mobile phones don't show any above the average propensity to WOM sharing. At the same time, they don't demonstrate below the average propensity either. At last, if the level of discontinuity rises in a particular category (like transition from normal mobile phones to smart-phones), importance of WOM and viral marketing grows.

Hypothesis H3: *"Successful viral marketing represent very difficult and complicated discipline, because ingrained constrains and resulting little ability to influence the final outcome"* was **PROVED**. The research gave enough evidence about an only limited influence of opinion leaders to the success of viral marketing. For that specific reason, SIR model can be applied to viral marketing and theoretical data correlate nicely with real viral marketing campaigns data. SIR model reveals that viral marketing spreading is defined by 5 different parameters; however, only one of them (Contact number) is relevant to a marketing action. This parameter can be furthermore influenced by a marketing decision and the change of initial this parameter in SIR model causes substantial difference in the final outcome. The initial number of "seeded" people can be influenced, but has a little impact on a campaign's final reach. All remaining parameters cannot be influenced at all. Contact number represents purely the strength of the viral idea- as to how many people on average will forward the marketing message further. On top of that the relationship between the contact number and the final reach of a viral campaign is very non-linear, which is a fundamental challenge for a marketer. Getting a contact number over 2 is the only thing what matters. Average viral marketing delivers limited or no impact at all. There is no doubt that there are successes stories of viral marketing – those are, however, rare exceptions from the rule. Finally, the main reasons for spreading messages contradict brand consistency, marketing messages and companies' interests (more details to come in description of hypothesis 5). Off-brand messages tend to spread virally much better than on-brand ones and thus represent a potentially huge negative impact for companies. Last but not least, the final impact of viral marketing (both effectiveness and reach)

campaigns cannot be planned, because of no possibility of testing – the only way to measure viral strength of message/ idea or of a whole campaign is to let it run, without any possibility to stop it.

Hypothesis H4: *"Viral marketing spreads extremely fast; successful viral campaign reaches its peak within 1 month from launch"* was **PROVED**. Viral marketing spreading can be fast, because unlike WOM marketing, it doesn't require any purchase or previous experience with particular products. This thesis actually proves that it MUST be fast to be successful. Successful viral campaigns on average peaked in the first week, while the most successful of them on average in a second week. Only one out of all campaigns (less successful one) peaked later. Nonetheless, we can assume that other impact than that of a viral strength caused that spike – advertising or more probably a simple data mistake, because after than the campaign lost again. Clear implication for any viral campaign is the following: if the viral marketing campaign doesn't spread within the first 2-3 weeks, the campaign will hardly be succesful. To the contrary, WOM marketing spread can take time, because of the basic need for experience or purchase.

Hypothesis H5: *"Humorous messages do spread virally better than other types of messages"* was **REJECTED.** This thesis concludes that the most important factor for success of viral marketing is to act surprisingly, unexpectedly or disruptively to peoples' minds. Humor itself cannot deliver or ensure that messages are shared – although the combination of surprise and humor delivers very good results. The best viral reach results were delivered, when products and viral video is the same – music clips. Also TV programs, films and video games trailers, which in summary

represent media themselves, scored much better than any other viral video campaign. Humor played also only a limited role in spreading the media videos virally. This thesis did not find any correlation between humorous media clips vs. other media clips.
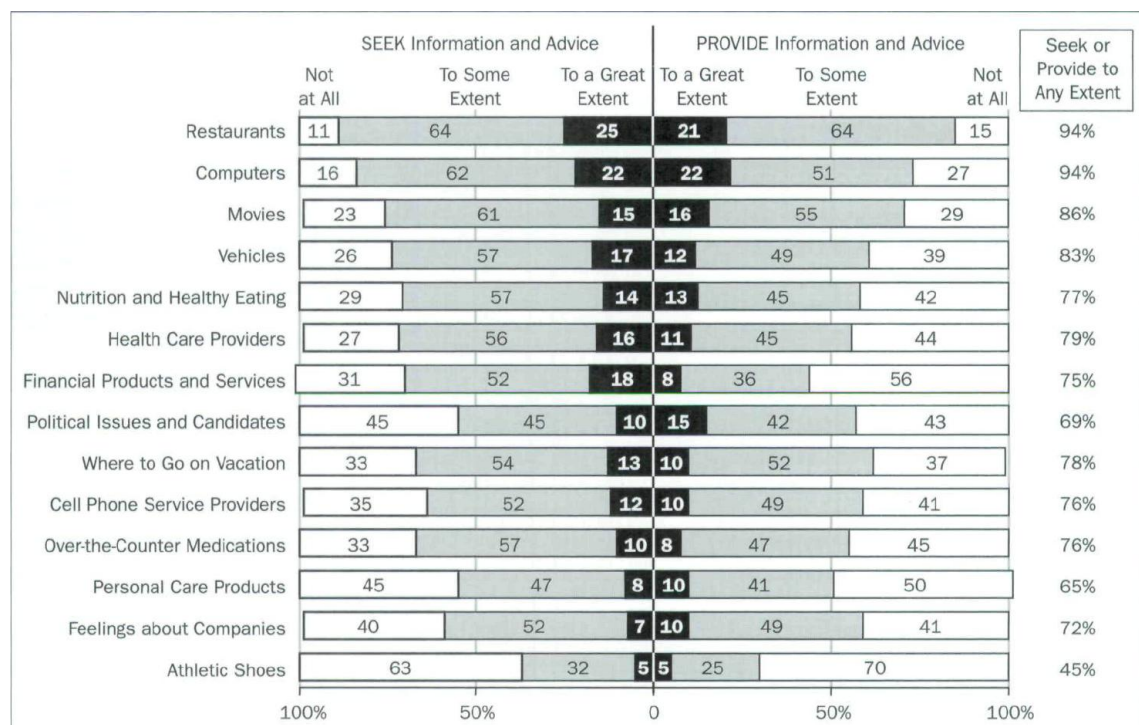
10.2 Thesis Limitations

The data-points for categories susceptibility for WOM and viral marketing come from the Czech Republic and are based on available facts; it is not possible to generalize the quantified propensity of WOM sharing in Czech Republic to world-wide population. However, we can find enough evidence that different products have different level of susceptibility to WOM recommendation across the globe. For instance Lescovec's empirical studies based on large networks of recommendation come to conclusion that *"Some products are easier to recommend than others"* [88] based on the study comparing music, books, DVDs and vides.

Allsop, Basset and Hoskins [59] show different levels of WOM recommendation for different products. This thesis doesn't aspire to do analytical comparison of the results, because this study of population of USA was not done through representation sample of population. People were randomly chosen and so the results are skewed toward heavy online users. However, interesting similarities as well as discrepancies can be found. Food remains top category for providing advice as well as searching for advice. Cars score in similar range as population of the Czech Republic represented by this thesis. On the contrary, financial services and health-care products do NOT stay in the bottom of WOM communication. Probable explanation (without any aspiration to prove this by research) is following: This research was done in

2006, well before the financial crisis. At that US consumers made huge amount of money on many financial investments and so financial services played a major role in consumer interests. Situation regarding health care products in USA market differs dramatically from Czech or actually whole European Union market. Healthcare companies as well pharmaceutical companies in USA spend huge amount of money for advertising, including prescription drugs. However, this practice is not allowed in EU countries. As already mentioned traditional advertising and WOM complement and reinforce each other rather than compete against each other. For that particular reason WOM recommendation for health care and pharmaceutical products should be higher in the USA than in the Czech Republic.

Table 10.1 Interest in Advice Giving and Seeking for Different Type of Products in US Market

	SEEK Information and Advice			PROVIDE Information and Advice			Seek or Provide to Any Extent
	Not at All	To Some Extent	To a Great Extent	To a Great Extent	To Some Extent	Not at All	
Restaurants	11	64	25	21	64	15	94%
Computers	16	62	22	22	51	27	94%
Movies	23	61	15	16	55	29	86%
Vehicles	26	57	17	12	49	39	83%
Nutrition and Healthy Eating	29	57	14	13	45	42	77%
Health Care Providers	27	56	16	11	45	44	79%
Financial Products and Services	31	52	18	8	36	56	75%
Political Issues and Candidates	45	45	10	15	42	43	69%
Where to Go on Vacation	33	54	13	10	52	37	78%
Cell Phone Service Providers	35	52	12	10	49	41	76%
Over-the-Counter Medications	33	57	10	8	47	45	76%
Personal Care Products	45	47	8	10	41	50	65%
Feelings about Companies	40	52	7	10	49	41	72%
Athletic Shoes	63	32	5	5	25	70	45%

Source: Harris Interactive Online survey [19]

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12 Addendum

12.1 Internet Penetration Tables and Graphs

Source: http://www.internetworldstats.com/top25.htm as of November 12, 2009

#	Country or Region	TOP 47 COUNTRIES WITH THE HIGHEST INTERNET PENETRATION RATE			
		Penetration (% Population)	Internet Users Latest Data	Population (2008 Est.)	Source and Date of Latest Data
1	Greenland	92.30%	52,000	56,326	ITU - Mar/08
2	Netherlands	90.10%	15,000,000	16,645,313	ITU - Mar/08
3	Norway	87.70%	4,074,100	4,644,457	ITU - Aug/07
4	Antigua & Barbuda	85.90%	60,000	69,842	ITU - Mar/08
5	Iceland	84.80%	258,000	304,367	ITU - Sept/06
6	Canada	84.30%	28,000,000	33,212,696	ITU - Mar/08
7	New Zealand	80.50%	3,360,000	4,173,460	ITU - Mar/08
8	Australia	79.40%	16,355,388	20,600,856	Nielsen//NR - Mar/08
9	Sweden	77.40%	7,000,000	9,045,389	ITU - Mar/08
10	Falkland Islands	76.50%	1,900	2,483	CIA - Dec/02
11	Japan	73.80%	94,000,000	127,288,419	ITU - Mar/08
12	Portugal	72.90%	7,782,760	10,676,910	IWS - Mar/08
13	United States	72.30%	220,141,969	303,824,646	Nielsen//NR - June/08
14	Bermuda	72.10%	48,000	66,536	ITU - Mar/08
15	Luxembourg	71.00%	345,000	486,006	ITU - Mar/08
16	Korea, South	70.70%	34,820,000	49,232,844	ITU - Mar/08
17	Faroe Islands	69.90%	34,000	48,668	ITU - Aug/07
18	Hong Kong	69.50%	4,878,713	7,018,636	N//NR -

				Feb/05
19	Switzerland	69.00%	5,230,351	7,581,520	Nielsen//NR - May/08
20	Denmark	68.60%	3,762,500	5,484,723	ITU - Sept/05
21	Finland	68.60%	3,600,000	5,244,749	ITU - Mar/08
22	United Kingdom	68.60%	41,817,847	60,943,912	Nielsen//NR - May/08
23	Taiwan	67.20%	15,400,000	22,920,946	TWNIC - Jun/07
24	Liechtenstein	66.70%	23,000	34,498	ITU - Mar/08
25	Slovenia	64.80%	1,300,000	2,007,711	ITU - Mar/08
26	Germany	63.80%	52,533,914	82,369,548	Nielsen//NR - Mar/08
27	Barbados	63.80%	180,000	281,968	ITU - Mar/08
28	Saint Lucia	63.60%	110,000	172,884	ITU - Mar/08
29	Spain	63.30%	25,623,329	40,491,051	Nielsen//NR - May/08
30	Belarus	61.90%	6,000,000	9,685,768	ITU - Mar/08
31	Monaco	61.00%	20,000	32,796	ITU - Aug/07
32	Italy	59.70%	34,708,144	58,145,321	Nielsen//NR - May/08
33	Estonia	59.70%	780,000	1,307,605	ITU - Mar/08
34	Malaysia	59.00%	14,904,000	25,274,133	MCMC - Jun/07
35	Singapore	58.60%	2,700,000	4,608,167	ITU - Mar/08
36	France	58.10%	36,153,327	62,177,676	Nielsen//NR - Mar/08
37	Austria	56.70%	4,650,000	8,205,533	C.I.Almanac - Mar/05
38	Niue	55.70%	900	1,617	RockET - Sept/05
39	Bulgaria	55.10%	4,000,000	7,262,675	ITU - Mar/08
40	Guernsey & Alderney	54.80%	36,000	65,726	ITU - Oct/05

41	Romania	53.90%	12,000,000	22,246,862	ITU - Mar/08
42	Jamaica	53.50%	1,500,000	2,804,332	ITU - Mar/08
43	Belgium	52.80%	5,490,000	10,403,951	ITU - Dec/07
44	Israel	52.00%	3,700,000	7,112,359	TIM - Jul/06
45	San Marino	52.00%	15,600	29,973	ITU - Mar/08
46	Macao (China)	51.60%	238,000	460,823	ITU - Mar/08
47	Czech Republic	50.00%	5,100,000	10,220,911	ITU - Dec/05
	TOP 47 in Penetration	68.70%	717,788,781	1,044,977,592	IWS - June/08
	Rest of the World	13.20%	745,843,580	5,631,142,696	IWS - June/08
	World Total Users	21.90%	1,463,632,361	6,676,120,288	IWS - June/08

12.2 Car WOM Recommendation - Gender Based

	Male	Female
With many people	20.0%	5.4%
With few friends and family	30.4%	18.9%
1 or 2 people	23.2%	20.4%
Nobody	24.1%	53.1%
Not stated	2.3%	2.2%

12.3 MML-TGI Data – Additional Details

Source: Citation from Market & Media & Lifestyle, MEDIAN, 2007 3rd stage and 2007 4th stage. *(Including typos and misspelling)*

Work with "Introduction for data 07.4

In most cases the questionnaires are questioned identity in the 3rd quarter 2007 and 4th quarter 2007. This introduction is made in standard form and refer to the all MML-TGI ČR07.4 data. At the end of introduction there are the most important changes between the both quarters.

Data processing

Data processing was performed in a standard way as described below: At the receipt of a new bunch, the individual questionnaires were assigned numbers and checked with respect to completeness. The next step was coding of open questions followed by computer data entering. The computer data entering was performed twice ensuring thus 100% verification. As the subsequent phase, logical checks and final cleaning of electronic data was performed. In the next step the data was checked with respect to their representativeness, and the weighting process (see below) was carried out. The processed data was analysed by means of mathematical statistical methods.

Weighting and outlet optimization from researches MML-TGI to Mediaprojekt and Radioprojekt

The following paragraphs describe briefly the process of the weighting method. This process is used for treating the data in order to match the sample structure with the population structure as best as possible. Despite the fact that the respondents are

selected on the basis of correct statistical principles and methods, owing to various random influences, small discrepancies between the sample structure and the real population structure always occur. In order to get rid of such discrepancies, the so-called weights are used. The weights represent values assigned to individual respondents on the basis of a statistical algorithm. As a result, a given group of persons (e.g. an age category) with the respective percentage in the sample lower or higher than the frequency of this category in the real population (i.e. theoretical frequency) would reach after the weighting a frequency which is a better match (best case equal) to the frequency of the given category in the population. Therefore, the results calculated from the weighted data file can be considered as representative with respect to the entire population. The weighting is one of the most important aspects of the research and for a correct interpretation of the results one has to know the weighting method as well. By employing a poor weighting the results may get distorted, making thus the entire research study rather inaccurate.

For comparing desired (usually called theoretical in mathematical statistics) frequencies with the real (empirical, selective) frequencies, good correspondence methods are used. One of the best-known ones is the chi-square method enabling you to determine the discrepancies between theoretical and empirical frequencies. Using correct statistical procedures one can determine whether such discrepancies are still within the tolerance range, or whether they are in contradiction with the hypothesis of correspondence between theoretical and empirical samples (see e.g. Anděl J. Matematická statistika, SNTL 1978, str. 191-208).

Our weighting algorithm is based on the chi-square method. We tried to optimise the weights in order to minimise the chi-square test values for selected population characters (marks). The following characters were considered as fundamental and chosen as weighting variables (the number of categories is in parentesis): SEX (2), AGE (7), , EDUCATION (4), REGION (8), DISTRICT (14), SIZE OF RESIDENCE SITE (5), NUMBER OF MEMBERS OF THE HOUSEHOLD (5) and DAY OF THE WEEK (7). Since the frequency correspondence pertaining to these individual (marginal) classes does not necessarily guarantee correspondence between selective and real frequencies of combinations of these classes, the weighting algorithm included the following combinations of the basic characters (marks) as well:

SEX x AGE

SEX x REGION

REGION x AGE

AGE x EDUCATION

NUMBER OF MEMBERS OF THE HOUSEHOLD x AGE

REGION x SIZE OF RESIDENCE SITE

REGION x EDUCATION

REGION x NUMBER OF MEMBERS OF THE HOUSEHOLD

DAY OF THE WEEK x SIZE OF RESIDENCE SITE

DISTRICT x AGE (3 categories)

Regarding to agreement about outlet optimization from researches MML-TGI, Mediaprojekt and Radioprojekt, the last issue from Mediaprojekt popularity and daily reache of electronic media in Radioprojekt according the agreed methodology are also entered to weighting. The limits for filling the medias to weighting variables

according the last issue popularity, i.e. daily reach (in relevant quarter) in target group of all respondents, were defined this way: Media above 3,5 % are weighted in combination with 3 age categories (12–29, 30–49, 50–79 years old), media above 2,5 % are (next) weighted in combination with sex and media between 1,5–2,5 % are weighted only to target group - all. The other media do not enter to the weighting. The weights can be theoretically obtained the arbitrarily non-negative values. However it brings about the risk of considerable enlargement of statistical errors of the answers and will be considerably problematic also from sociological stand-point. Therefore it is necessary to confine the weight values within certain limits. Regarding the multiplicity of weighting variables and their combination, limits of the weights of individual respondents were kept within the interval 0,2 - 5,0.

For the own calculation a modified Deming-Stephan method was used (see Jan Neudstadt: Problematika vah ve výběrových šetřeních, Thesis, MFF UK Prague 1997)

For no above-mentioned weighting sets, the hypothesis on theoretical and weighted empirical frequencies could not be rejected.

Statistical deviation

In this paragraph we briefly describe the statistical deviation and value significance basics. Statistical deviation is defined by the formula of standard deviation of measurements. In the scope of the Market & Media & Lifestyle Project, two main standard deviations can be measured. The first one determines the error in estimation of successful reach frequencies while the second one gives the error in estimation of relative frequency (per cent) of successful

reaches. Both standard deviations are proportional. For their relationship see the following formulas:

standard deviation of frequencies:

$$s_1 = \sqrt{n * (1 - \frac{n}{N})}$$

standard deviation of relative frequencies:

$$s_2 = \sqrt{\frac{1}{N} * \frac{n}{N} * (1 - \frac{n}{N})},$$

where

N denotes the selection range from a given population, and

n is the number of successful reaches.

On the basis of these formulas, the width of the confidence interval pertaining to frequencies of successful reaches and/or confidence interval of relative frequencies can be determined. These intervals are calculated in order to cover the real desired value with a 95% probability. Owing to the asymptotic behaviour of confidence intervals, their width equals approximately four times the standard deviation. The real confidence interval can be calculated using the following formula:

confidence interval of frequencies:

$$n \pm 2*s1$$

confidence interval of relative frequencies:

$$n/N \pm 2*s2$$

Word of mouth

Word of Mouth is becoming part of many companies' marketing thinking. It is becoming a medium in its own right and brand owners and agencies are now considering it as a channel alongside traditional media.

Everyone appreciates the power of personal recommendations but the question is understanding the behavior across different categories, relating it to other media consumption and being able to target the influencers! We have an opportunity here to put TGI ahead of the rest in measuring this EXTREMELY IMPORTANT medium on an international basis.

The potential of the data from the new w.o.m. questions combined with all the other category and media information on TGI is IMMENSE.

Questions of Word of Mouth are very important and atractive upgrade of TGI and is becoming part of many marketing companies.

We have acted on this by developing a set of questions for TGI – to help target individuals who create 'buzz' and extend the reach of a media campaign. This will give us a new feature on our surveys to talk about that is very much 'of the moment'. We can be able to work with different groups of respondents which are key (influence the people around them) for buy/ use etc.
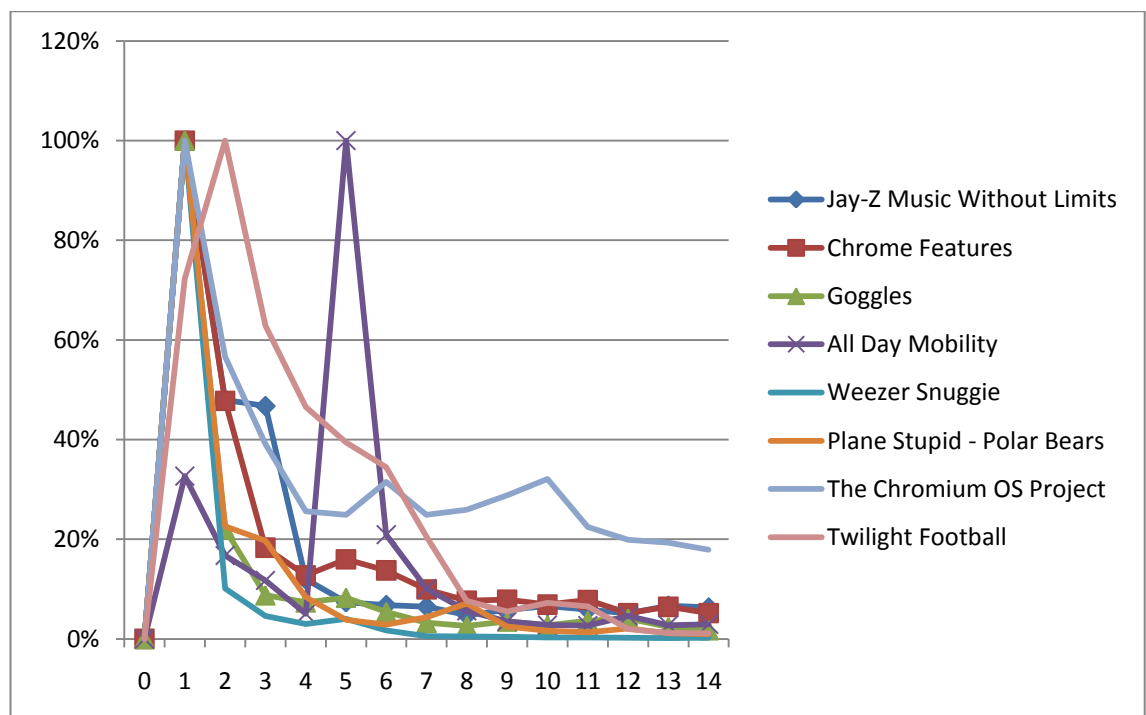
12.4 Viral Marketing Campaigns – Additional Details

All following Graphs were created by the author of the thesis based on data from Visible Measures data from True Reach™[64]

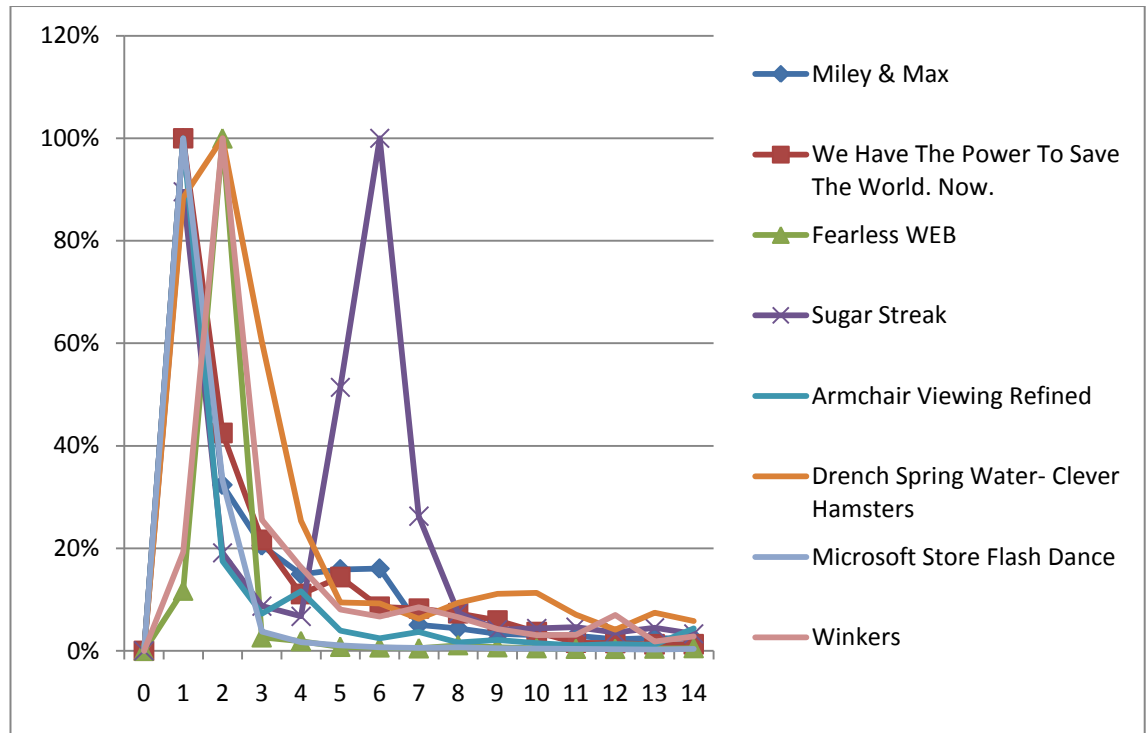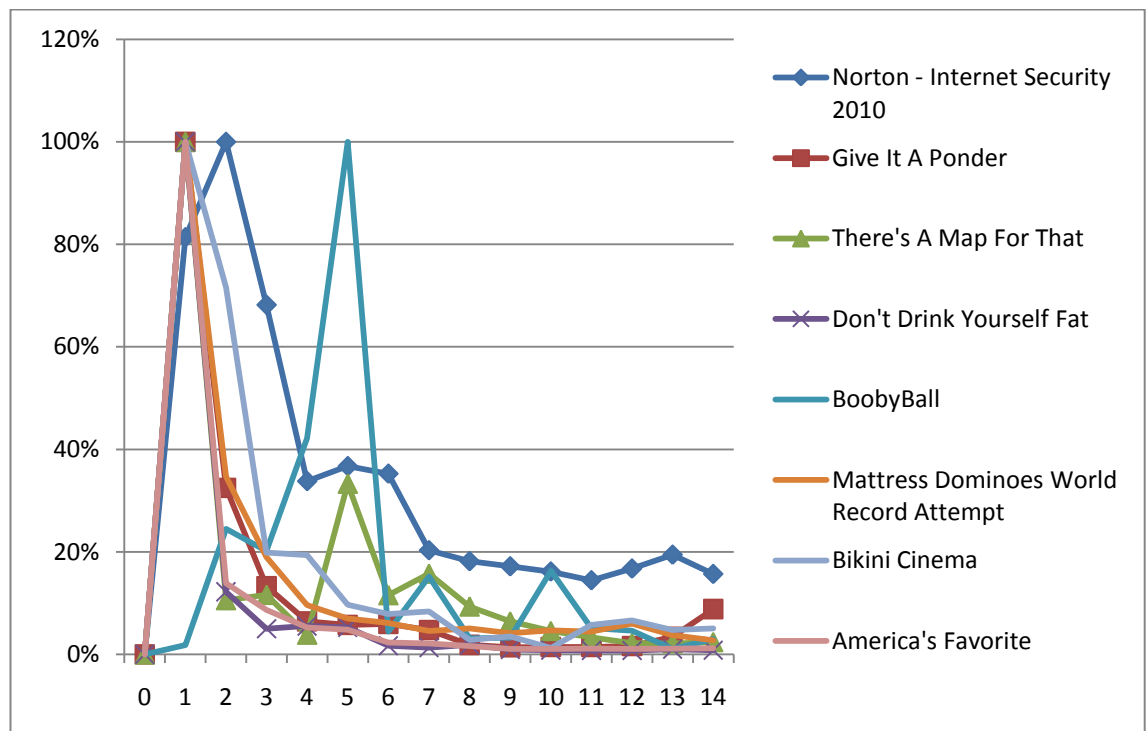*Graph 11.1 Shape of Reach of Viral Marketing Campaigns 17-24*
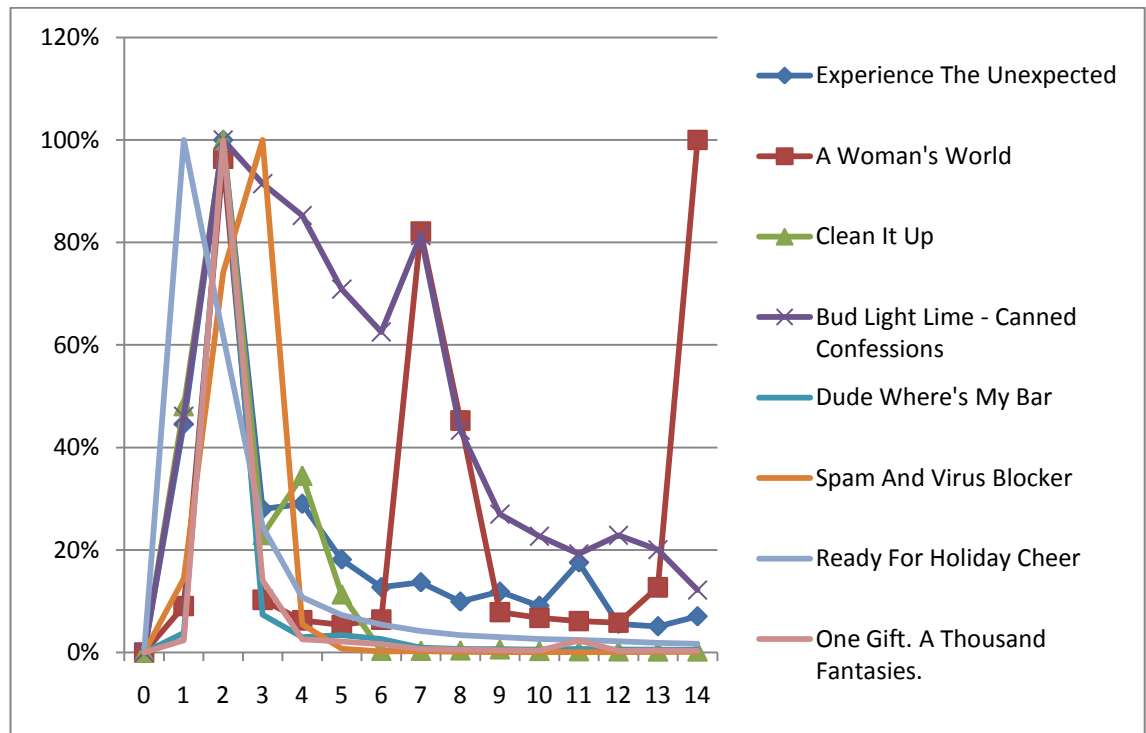
Graph 11.2 Shape of Reach of Viral Marketing Campaigns 25-32

Graph 11.3 Shape of Reach of Viral Marketing Campaigns 33-40

Graph 11.4 Shape of Reach of Viral Marketing Campaigns 41-48

Graph 11.5 Shape of Reach of Viral Marketing Campaigns 49-56