

# [The hidden impact of word-of-mouth: A system dynamics approach](#)

## **The hidden impact of word-of-mouth: A system dynamics approach**

**The method of System Dynamics is applied to study the impact of word-of mouth on sales over time. Five simulations (or experiments) are run under different assumptions. The outcomes show a significant leverage effect of WOM: Depending on Customer Involvement, Product Life Cycle and Customer Satisfaction, the market development of a New-Product-Introduction varies between 11.0 and 59.3 percent, the contribution of Classical Advertising ranges from 18.0 to 75.0 percent, and the contribution of WOM from 25.0 to 82.0 percent at the end of the time series. Possible insights for practitioners as well as scholars are discussed. WOM can be the decisive factor for both business success or failure when introducing a product into a market which calls for more attention of WOM in the daily business agenda. Furthermore, the model highlights the importance of various influences of WOM under different conditions which may support decision makers in planning their communication investments and in allocating their communication budgets wisely under these varying conditions.**

### **1 Introduction**

One of the main functions of communication is to give both, the individual and the group, a low-risk opportunity to better understand their environment and to anticipate future alternatives for action, aka affective forecasting (e.g., Schwarz and Clore 1983, 2003) or mental simulation (e.g., Gilbert and Wilson 2007, Kraigher-Krainer 2014). In the buying context it is about better understanding decisions for or against products and services offered by companies. According to Hanna and Wozniak (2009) there are basically four sources of communication which customers may utilize in the information collection process: (1) personal experiences with companies and brands in the past by retrieval from memory - aka internal information; (2) company dominated information like advertising; (3) neutral sources like consumer reports and; (4) interpersonal communication and recommendations among customers, aka word-of-mouth (WOM). If consumer reports are not available and personal experiences do not exist or are outdated, customers depend on company information and experiences of others, the former being usually seen as more competent and more easily accessible yet less impartial than the latter (Childers and Rao 1992, Cialdini 2002, Gershoff, Broniarczyk and West 2001, Kraigher-Krainer 2014, Walker 1995, Wangenheim and Bayon 2004). For the purpose of the paper at hand we borrow the definition of WOM and eWOM from Rosario et al. (2016, p. 297):

“In marketing, word of mouth (WOM) is the act of consumers providing information about goods, services, brands, or companies to other consumers. Such information communicated through the Internet (through, e.g., reviews, tweets, blog posts, »likes,« »pins,« images, video testimonials) is called »electronic word of mouth« (eWOM) ...”

## 2 Word-of-mouth (wom, ewom)

The impact of Word-of-mouth (WOM) has long been underestimated if not neglected in the field of Business Communications by both, scholars and practitioners (Arndt 1967, Buttle 1997). Though silent in its nature and unspectacular compared to a national campaign, it always was and still is the foundation of many SMEs in their struggle to survive against big ad-spenders (Stokes and Lomax 2002). Bughin, Doogan, and Vetvik (2010, p. 113) estimate that word of mouth is the primary factor behind 20 to 50 percent of all purchase decisions. And Walker (1995, p. 39) reports that 46 percent of Americans rely on others' referrals in choosing a doctor, 44 percent in selecting a mechanic, and 42 percent for obtaining legal advice. Reichheld (2004) identifies the willingness to recommend a company or a product as a key indicator for customer satisfaction and the resulting "Net Promoter Score, NPS" has become a well-established indicator of customer satisfaction and company performance (Best 2009).

With the diffusion of the internet, notably social media, spreading the word about companies and brands literally around the globe has become a matter of a mouse click - thus introducing Word-of-Mouse (Hennig-Thurau 2004) or eWOM as the new complementary phenomenon reshaping the image of companies and their brands, sometimes overnight.

As early as 1999, when the web was in a quite nascent stage, CDNow, a web-based CD-shop and the world market leader at that time, found out, that they gained 45 percent of their customers by paid ads above-the-line (radio, TV, print ...) eating up 96 percent of their media budget whereas 55 percent of their clients were attracted by below-the-line-measures such as online networks, public relations, private links to their site and, most importantly, word of mouth, costing them altogether 4 percent of the media spending (Hoffmann and Novak 2000).

The huge potential of eWOM for both sales success and cost saving spread rapidly and today hardly any company does not attempt to participate in this gold rush of accessing new and young customers with comparably low advertising budgets. Correspondingly, the field of eWOM-related marketing research has lately literally exploded (Rosario et al. 2016, Ya You, Vadakkepatt and Joshi 2015) and cannot be squeezed into a fair state-of-the-art review for the purpose at hand.

## 3 Methodology

We choose System Dynamics as the method for better understanding the influence of interpersonal communication on business success, as WOM is a phenomenon that happens over time (Bruce, Foutz and Kolsarici 2012) and System Dynamics (SD) is designed to look at effects over time (Sterman 2009). As such, it can simulate reinforcement effects as well as balancing effects and compute the bottom-line of these mutual influences and interactions over a given period. Our research question is: Which are the most important predictors and criterions of WOM and how do the predictors influence the criterions over time in a global SD-model?

## 4 Conceptualizing wom

In order to answer the research question, we first review the literature in an attempt to identify the most important drivers and consequences of WOM. WOM and eWOM have been related to many aspects which can, of course, not be modelled sufficiently. Among the discussed antecedents are product- and industry characteristics (Ya You, Vadakkepatt and Joshi 2015), exclusivity of product innovations, locked-in customers, and their price sensitivity (Peres and van den Bulte 2014), the need to belong and the individual's level of self-disclosure (Sicilia, Delgado-Ballester, and Palazon 2016); or self-enhancement (Chawdhary and Dall'Olmo Riley 2015).

But the most frequently discussed criterions of WOM are Customer Satisfaction (e.g., Buttle 1997, Derbaix and Vanhamme 2003, Matos and Rossi 2008, Nyer and Gopinath 2005, Stephens and Gwinner 1998) and Involvement (e.g., (Berger and Schwartz 2011, Sicilia, Delgado-Ballester, and Palazon 2016, Turnbull and Meenaghan 1980, Walker 1995).

That customer satisfaction drives WOM is quite straightforward and not very surprising: Practically each textbook on customer satisfaction states somewhere that satisfied customers speak positively about the company whereas dissatisfied customers spread negative word. Customer satisfaction is, in turn, usually conceptualized as expectation disconfirmation based on schema-theory (Kraigher-Krainer 2007, 2014, Oliver 1980, Parasuraman, Zeithaml, and Berry 1985).

Furthermore, scholars hypothesize an influence of the mix of volume vs. variability of valence on the impact of WOM (Rosario et al. 2016). Usually it is also postulated that negative WOM is more likely than positive WOM and that the negative impact of negative WOM is stronger than the positive impact of positive WOM (Arndt 1967, Chawdhary and Dall'Olmo Riley 2015, Walker 1995).

Significantly less attention is put on the phenomenon that customers frequently remain silent about their positive or negative experiences and why this is. And that is where involvement comes into play with its two dimensions, perceived risk and motivation (Kraigher-Krainer 2007, 2012). Again, it is quite straightforward that WOM, sometimes also grasped as a form of herd behavior, serves the reduction of perceived risk in the purchase situation (Arndt 1967, Bauer 1960, Katona 1953), and may refer to many things such as the product itself, the company, possible shipping problems, or even loss of privacy and credit card misuse (Garbarino and Strahilevitz 2004). However, as influential as the perceived-risk dimension in understanding WOM seems to be the motivational component of involvement, as the ECID-model (Kraigher-Krainer 2007, 2012) illustrates. According to this model vivid and impactful sharing of experience with others needs a balanced mix of opinion leaders and opinion seekers. In other words: There are products which are simply too unimportant to share experiences about them in a community regardless of whether they were positive or negative. And there are products where the motivation to gain personal experience is low, the perceived risk however is high. This constitutes an opinion seeker, which is someone seeking a shortcut to a proper decision by finding competent others, usually called opinion leaders.

Correspondingly, the literature identifies moderators of WOM such as the degree of participation of opinion leaders (Peres and van den Bulte 2014), pioneers and early adopters (Arndt 1967) or, market mavens (Feick and Price 1987) in the interpersonal communication process. Furthermore, source credibility, source competence, similarity between source and receiver (Childers and Rao 1992, Cialdini 2002, Kraigher-Krainer 2014, Wangenheim and Bayon 2004, Wangenheim, Bayon, and Weber 2002) as well as social ties between sender and receiver (Baker, Donthu, and Kumar 2016) are discussed as possible moderators.

The most prominent consequences comprise attitudes to and perceptions of the brand (Buttle 1997), loyalty to the brand (Reichheld 1997, 2001, 2004), purchase intentions (Baker, Donthu, and Kumar 2016, Matos and Rossi 2008) and behaviors such as demand, purchases and purchase rates (Arndt 1967, Bruce, Foutz, and Kolsarici 2012, Bughin, Doogan, and Vetvik 2010, Buttle 1997, Rosario et al. 2016).

This pattern of behaviors, in turn, promotes the willingness to share experience and that closes the loop to the predictors of WOM. Strictly speaking, the superiority of System Dynamics over deterministic approaches like the S-O-R-model is that, in fact, many phenomena cannot be separated and assigned to predictors, mediators, moderators, or criterions, because the consequences may serve as predictors of the predictors. In other words: In loops, there are no starting points and end points. And that is why we prefer this method of investigation over a deterministic method for the research question at hand.

## 5 Setting up the model

The conclusions of our literature review are: Firstly, there is a significant body of literature conceptualizing (dis)satisfaction based on schema-theory and expectation disconfirmation. Secondly, there is sufficient support for the assumption that (dis)satisfaction along with involvement create (or not) WOM (for an overview see Matos and Rossi (2008), for a respective model see Derbaix and Vanhamme (2003). Hence, the components of our model for integrating WOM into the “classical” communications concept are:

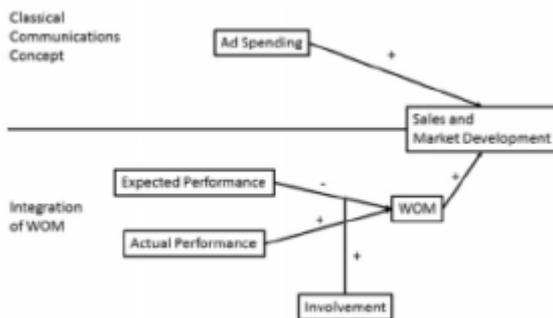


Figure 1: Conceptualizing the influence of satisfaction-triggered WOM on sales and market development

Source: Authors

1. (Dis)satisfaction as the predictor of future sales which is in turn the result of
  - a. expected performance of a product/service (expressed in numbers of periods the product is expected to work) minus;
  - b. actual performance of the product/service (expressed in numbers of periods the product actually works);
  - c. conceptualized this way we can also integrate possible effects of product lifetime on WOM discussed among scholars (e.g., (Berger and Schwartz 2011, Ya You, Vadakkepatt, and Joshi 2015);
2. Involvement as a moderating factor reinforcing or diminishing WOM;
3. Future sales and respective market development as the criterion.

## 6 Translating the model into mathematical relations

Although SD is just a set of mathematical formulas about (non)linear relations of components, SD software provides a simple way of letting the computer do these computations in discretionary granulation. We use Anylogic for this purpose. The applied assumptions and hypothesized mathematical relations between the variables are:

1. Market research has revealed 10,000 potential customers, the market potential, for a new product launch sensu “New to the World” (Trott 2013, Fig. 12.6.), that is to be introduced into the market.
2. Depending on the ratio Product Lifetime (PLT) to expected Product Lifetime (ELT) subjects are in one of four states:
  - a. Noncustomers (NC);
  - b. Satisfied Customers, (as long as the product works); it is assumed that customers recommend the product throughout their state as customers adjusted by their involvement;
  - c. Dissatisfied Customers (DC), if the product was expected to work longer than it did. It is assumed that disappointed customers engage in negative WOM, meaning that their negative WOM is

subtracted from the positive WOM of the other customers, again adjusted by their involvement;  
d. Delighted customers (if the lifetime exceeds the expected lifetime); correspondingly it is assumed that delighted customers positively contribute to WOM (thus their positive WOM add to the positive WOM of all customers), adjusted by their involvement;  
e. For the sake of simplicity positive and negative WOM have the same weight and the total WOM is computed as positive WOM minus negative WOM even though literature indicates that negative WOM has a higher weight and is more likely as positive WOM, as discussed before, which would significantly amplify the results below. However, we wanted to keep the model conservative and not exaggerate the hypothesized relations;

### 3. Adoption from Ads:

- The market entry starts with zero customers as we are introducing a product “new to the world”;
- the contact rate with ads (i.e., the probability to have contact with the ads) is set to 0.5 whereby the rate is set to smooth (otherwise we would have sudden customers);
- the conversion rate from ads is set to 0.1 meaning that one out of ten contacted Non-customers will adopt the product;
- Example: If there are 7,000 Non-Customers, the contact rate is 0.5 and the conversion rate from Ads is 0.1 then the adoption from Ads per time unit will be  $7,000 * 0.5 * 0.1 = 350$  per period;

### 4. Adoption from WOM:

- Depending on the product involvement, each customer shares his product experience with 1 vs. 3 market members per period: No. of talks = No. of customers \* Involvement;
- the probability that the recipient will be a Non-customer is Non-Customers/Market size;
- adoption from WOM is therefore:  $NC/Market\ Potential * Involvement * ((CU-DC)*0.1)$ ;
- Example: If the conversion rate (the recipient can be convinced of the opinion) is again 0.1, the involvement is high (3 contacts) and we have 3,000 customers and 1,000 dissatisfied customers, then the adoption from WOM per time unit will be  $6,000/10,000 * 3 * ((3,000-1,000)*0.1) = 360$ ;

### 5. Product Life Time: As mentioned earlier, this variable serves two functions:

- After the product life time (PLT) customers are going back into the Non-Customer base and have to be acquired again; this is operationalized by a delay (=PLT) in the outflow valve;
- Together with the expected life time (ELT) this variable simulates customer satisfaction, e.g.:
  - PLT = 3 and ELT = 3 → satisfaction → Customer speaks positively for 3 time units and then becomes Non-customer;
  - PLT = 2 and ELT = 2 → satisfaction → Customer speaks positively for 2 time units and then becomes Non-customer;
  - PLT = 2 and ELT = 3 → dissatisfaction → Customer becomes a DC and speaks negatively about the product for 1 time unit then moves to NC.

6. The Market Development Index (MDI) is the ratio of current market demand to market potential (Best 2009, p. 75). In the case of a quasi-monopolistic situation of a company introducing a product new to the world it equates the ratio of sales to market potential. It is important to recall the above mentioned study of Peres and van den Bulte (2014), which reveals that exclusivity of product innovations may have a negative effect on WOM.

The modelling of these assumptions in Anylogic is depicted in Figure 2.

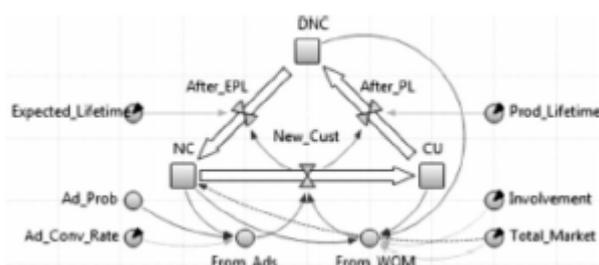


Figure 2: Modelling of the previously mentioned variables and relations in Anylogic

Source: Authors

## 7 Results

Five simulations (or experiments) are run under varying assumptions. Table 1 shows both, the assumptions (Involvement, PLT, ELT) and the outcomes (MDI and from where it comes):

	INV	PLT	ELT	MDI	from ads	from WOM
Simulation 1:	1	3	3	16.5%	75.0%	25.0%
Simulation 2:	3	3	3	28.9%	36.0%	64.0%
Simulation 3:	3	2	2	16.5%	50.0%	50.0%
Simulation 4:	3	2	3	11.0%	75.0%	25.0%
Simulation 5:	3	4	3	59.3%	18.0%	82.0%

Table 1: Assumptions and outcomes of the five simulations

Source: Authors

The outcomes show a high leverage effect of WOM: Depending on Customer Involvement, Product Life Cycle and Customer Perceived Quality, the degree of market development of a New-Product-Introduction varies between 11.0 and 59.3 percent, the contribution of Classical Advertising varies between 18.0 and 75.0 percent, and the contribution of WOM varies between 25.0 and 82.0 percent at the end of the time series.

## 8 Conclusions

The presented business simulation provides some possible insights for practitioners as well as for scholars: (1) WOM can be the decisive effect for both, business success and flop when introducing a product into a market which calls for more attention to WOM in the daily business agenda. (2) The model highlights the importance of different influences of WOM under different conditions which may support decision makers in planning their communication investments and in allocating their communication budgets wisely under these varying conditions. (3) WOM is of particular importance when it comes to introducing a new product into the market (Reingen and Kernan 1986), thus emphasizing the necessity to manage WOM (Wirtz and Chew 2002) instead of just letting it happen.

## 9 Limitations and future research directions

SD is theoretical in nature. It does not depict real WOM; instead does it help simulate WOM in the laboratory over time. As such, all outcomes are bound to the goodness of the underlying model. Future studies may stress or extend the model that we used. Or they may break down the model to certain industries or even individual companies where, for example, life cycles are longer, customer perceived quality is more diffuse, customer involvement is very low or, WOM is inhibited or biased by considerations such as the protection of competitive advantages, which may be in place in some B2B purchase contexts.

Furthermore, an extended model could emphasize the relationship and interdependence between ads and WOM. Buttle (1997), for instance, identifies varying support through advertisement in terms of content and frequency at different stages of product introduction and Bruce, Foutz, and Kolsarici (2012, p. 469) hypothesize that "... ad spending is more effective at an earlier stage due to repetition wear-in and synergy with WOM, increased WOM activities at a later stage could become more powerful in driving demand."

Furthermore, it might be insightful to validate and triangulate the model at hand through an agent-based model.

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## Klíčové slová/Key Words

system dynamics approach, word-of mouth, customer involvement, product life cycle, customer satisfaction

prístup dynamiky systému, ústne podanie, zapojenie zákazníka, životný cyklus produktu, spokojnosť zákazníka

## JEL klasifikácia/JEL Classification

M31

## Résumé

### Skrytý vplyv ústneho podania: Prístup systémovej dynamiky

Metóda systémovej dynamiky sa používa na štúdium vplyvu ústneho podania na predaj v priebehu času. Päť simulácií (alebo experimentov) sa vykonáva pod rôznymi predpokladmi. Výsledky ukazujú významný pákový efekt ústneho podania: v závislosti od angažovanosti zákazníkov, životného cyklu produktu a spokojnosti zákazníkov rozvoj trhu nového produktu predstavuje od 11,0 do 59,3%, príspevok klasickej reklamy sa pohybuje od 18,0 do 75,0% , a príspevok ústneho podania z 25,0 na 82,0% na konci časového radu. Rozoberané sú možné poznatky pre praktikov ako aj vedcov. Ústne podanie môže byť rozhodujúcim faktorom pre podnikateľský úspech alebo neúspech pri zavádzaní produktu na trh, ktorý si vyžaduje väčšiu pozornosť ústneho podania v každodennej obchodnej agende. Model ďalej vyzdvihuje dôležitosť rôznych vplyvov ústneho podania za rôznych podmienok, ktoré môžu podporiť rozhodujúce osoby pri plánovaní ich komunikačných investícií a pri rozumnom rozdeľovaní svojich komunikačných rozpočtov v týchto rozdielnych podmienkach.

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