

IDENTIFYING DISRUPTIVE TECHNOLOGIES IN IT INDUSTRY

Hossein Rouhani Zeidanloo – Miroslav Špaček

Abstract

Identifying potential disruptive technologies/innovations is a challenging task that many incumbents are facing nowadays. Over past decades, numerous examples of market leaders, who, due to the emergence of innovations, lost their position or were totally replaced, were observed. The paper aims at the recognition of the advent of disruptive innovation in IT branch that may consequently threaten company business. The goal of this paper is the development of theoretical framework which helps companies identify upcoming disruptive innovation/technology that pose a threat to existing company business. The framework was adapted to IT business sector since this sector is exceedingly prone to challenging disruptive technologies. The research was based on literature review that helped reveal and categorize existing prediction models based on selected characteristics of disruptive innovation. Furthermore, contextual interviews with IT experts and managers enabled to develop own theoretical framework which better suites the needs of IT business. Finally, the framework was verified and validated by a qualitative case study which, based on the feedback principle, brought the framework to fully applicable form. Eventually, the framework was tested on its ability to predict disruptive innovation in IT industrial sector.

Key words: Disruptive innovation, disruptive technology, disruption process, business model innovation

JEL Code: L25, O32, O33

Introduction

The initial concept of disruptive innovation was coined by Christensen in 1995 and since then this topic has been tackled by variety of the authors. Christensen, & Raynor (2015) described the “Disruption” as a process whereby a smaller company with less resources can successfully challenge incumbent businesses. Specifically, as incumbents are more focused on improving their existing products and services for their current customers (and usually most profitable), they exceed the needs of some segments and ignore the needs of others. Entrants are

targeting those overlooked segments, gaining a foothold by delivering more-suitable functionality - frequently at a lower price. Since established firms are focusing on higher profitability in more demanding products and services, they ignore to react appropriately to changing market situation. As a result, entrants recognize this opportunity and move upmarket by focusing on products and services which mainstream customers need and require. When mainstream customers start adopting the entrants' offerings in volume, disruption has occurred. It should be noted that identifying a disruptive innovation is a managerial problem, since managers usually do not have sufficient notion about the threat of disruptive innovation.

The original theory of disruptive innovation lacks sufficient consideration of customer needs, network effect and innovation in business model that could increase dramatically the speed of disruption especially in IT industry (Klenner & Hüsigg, 2009). This paper contributes mainly to identifying the disruptive innovation in IT industry by considering following characteristics into consideration as of importance:

- **Customer needs (market demand)** Customer needs could be perceived as “opportunities to deliver a value to a customer.”
- **Network effect:** Network effect occurs, when a value of a product increases with the number of the users of that product (Gröhn 1999). Typically, the higher the numbers of users, sellers, or buyers, the more intensive the network effect is and subsequently higher value is delivered to the customer. In IT sector, this problem is quite critical, as software products commonly grow faster by network effect (Gröhn 1999).
- **Business Model Innovation:** Business model innovation can be defined either as a process of creating a completely new business models in start-ups or transforming one business model to another within incumbent or after mergers and acquisitions (Geissdoerfer et al., 2016).

Besides our main goal, the supporting goal of this work is presenting and analysis/critical assessment of existing models of the identification of disruptive innovation/technologies with focus on IT industry. In line with the research objectives, the following research question was raised:

RQ1: How can incumbents assess and measure the severity of disruptive innovator's threat?

1 Literature review

1.1 Problem discussion

Christensen et al. (2005) pioneered the research of analyzing the market after the

disruptive innovation. The research explored in preference the products which have been already listed in the disruptive innovation list. They proposed a method for plotting the trajectories of the technology performance for the products/services, which have been already listed in the disruptive innovation category. This method is easy to be applied after the occurrence of the disruption but very hard to be applied beforehand. This controversial aspect has been the main critique against plotting trajectories for detection of the disruption. In addition, it is not quite clear how many aspects of disruptive innovations needed to be satisfied to call an innovation a disruptive (Tellis, 2006).

There are quite lots of works that have been published in the field of predicting a disruptive innovation (Sainio, & Puumalainen, 2007; Nagy et. al, 2016; Rafii & Kampas, 2002). On the other hand, some additional research is necessary to be completed until a comprehensive methodology and framework aimed at the identification of disruptive innovation come into effect. This methodology/framework must be adjustable to the needs of various market players like startups, incumbents, or consulting companies. Therefore, managers should pay a great deal of attention not only to current company performance but also to the preparation of companies to potential disruption which may threaten their businesses. To accomplish this task, they must be proficient at identifying these disruptions and capable to execute appropriate measures to successfully defy to these disruptive changes.

1.2 Existing prediction models

Several approaches could be found in the literatures for identifying the possible disruptive innovation. Existing approaches for identification of the disruptive innovation could be categorized into the following categories:

- **Scoring models:** It mainly analyze the potential of disruptive innovation based on giving a score to some sort of contributing factors which considered for different stages as specified based on the research. (Rafii & Kampas, 2002; Christensen et al., 2004; Sainio & Puumalainen, 2007; Klenner & Hüsigg, 2009).
- **Economic models:** focuses on an economic perspective like the effect of disruption on prices, market shares and economical related factors such as social welfare (Adner, 2002).
- **Patent analysis models:** It focuses on the identification of possible disruptive innovation based on patent analysis and the novel and unique technologies (Lee et al., 2014).

- **Literature-based discovery models:** It takes advantages of the text mining literature for identifying the technical disciplines that are likely candidates for disruptive technological products (Kostoff et al., 2004).
- **Situational models:** They focus on other aspects such as continuous monitoring of the technology landscape in one's own industry to identify technologies that are better performance drivers is a necessity (Paap & Katz, 2004).
- **Keyword network analysis models:** it has been used to focusing on clustering and distribution of keywords to identify and predict the research trends, often together with visualization to understand the advances of emerging technologies (Dotsika & Watkins, 2017).

The work of Rafii & Kampas, 2002, has not been specifically designed for IT sector, but it is more a general one which can be used for different scenarios, however the effect of business model innovation, network effect and customer demand has not been considered in their work. On the other hand, Klenner & Hüsigg (2009) proposed a scoring model framework for predicting and identifying the disruptive innovation based on the studies of (Rafii & Kampas 2002).

2 Methodology

This paper focuses on identifying disruptive innovation in IT industry. At the first step, a theoretical framework based on intensive literature reviews was proposed. At the next step, a qualitative method and Case-study approach for analysis and decision-making was used as it turned out that it is quite hard to come up with a measurable numbers and data, which can directly contribute, to disruptive innovation aspects.

2.1 Structure of the Interview Guideline

The structure of the interview guideline divided into a German and English approach. Both are based on previously extracted theoretical findings and the elaborated derivations of the first step, which are then, used to interview decision-makers and IT experts. In total, we have done eight interviews with the managers in different IT companies, project managers and engineers to have feedback of people with different backgrounds on our framework.

2.2 Conducting the Historical Case-study

The adjusted framework after the interview stage has been applied on the case study between MySpace and Facebook. MySpace was once considered one of the top social networking sites, and between 2005 and 2008, it was the most popular one. If the proposed

framework is applied by managers between 2009 and 2011 – every year at least one time – it could correctly identify the fact that Facebook will disrupt MySpace business with high probability. Facebook has managed to meet the needs of customers by adding much better and more user-friendly services and in addition to taking great advantage of network effects.

2.3 Conducting the current Case-study

The focus of the current case study is on IT service companies, which compared Atos SE with two other main players in the market such as Accenture & Infosys. Our evaluation based on the data, which is publicly available from 2021, predicated that with relative high probability the Atos SE would be disrupted in long terms by its competitors such as Accenture and Infosys if the current trends continue without any major changes in the company.

3 Results and Discussion of Findings

3.1 Concluded framework

In this work, we based our method on previous studies of Rafii & Kampas, 2002, Christensen et al., 2005; Christensen et al., 2015, Klenner et al., 2013 and Paap et al., 2004. All these approaches tried to identify the potential disruptive innovation by measuring it against propositions and criteria (scoring-based model) which is based on Christensen's original theory. Besides that, each approach offers a useful addition to the overall methodology that we are trying to build here. To complete the list of criteria (contributing factor), we performed an extensive literature review to extract the most important factors which influence IT sectors. Two phases were taken into consideration for the elaboration of the framework, which included a library of contributing factors (criteria/proposition) for each phase:

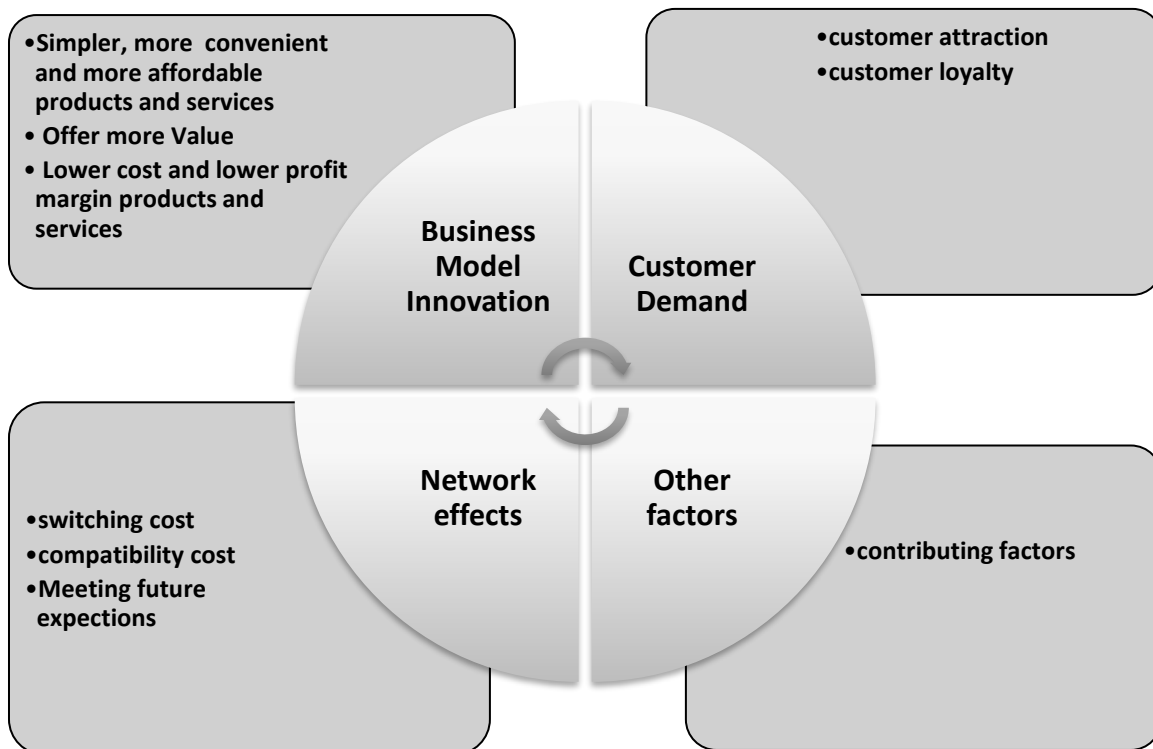
- Foothold (Niche) Market
- Main Market

To further enhance validity of contributing factors be suitable for IT industry, following factors were taken into consideration in the framework:

- Customer Needs (market demand)
- Network effect
- Business Model Innovation

These factors were incorporated into framework in parallel with other relevant factors as pointed out in Fig. 1.

Fig. 1: Contributing categories in the framework



Source: own elaboration

3.2 Contribution factor (criteria) development

For designing our contributing factors (propositions), we reviewed a number of critiques and improvement of the original Christensen's theory and analysed other similar framework and approaches, which focused on identifying the disruptive innovation ex-ante. The outcome of the literature reviews, interviews and two case-studies lead to following contributing factors (criteria) that needs to be alternatively considered for either foothold market or main market. These contributing factors are categorized as per their weights (some, substantial and very high influence). Tab. 1 shows the categorization of contributing factors for foothold market.

Tab. 1: Contributing factors (criteria) for foothold market categorized by its weight

Weight	Contributing factor
Some influence	<ul style="list-style-type: none"> • Small/Big market for possible disruptive products • Many new companies are entering the Market by offering so called disruptive products/services
Substantial influence	<ul style="list-style-type: none"> • Business model targets over-satisfied or non-satisfied customers • Simpler, more convenient, and more affordable products and services. • More Value offered by products and services
Very high influence	<ul style="list-style-type: none"> • Product/service is cheaper and simpler or advanced with higher price • Product/service create new demands/needs or address non-consumers • Over-satisfied or non-satisfied customer exist • Disruptor products is not currently appreciated by main customer segment

Source: own elaboration

Similar approach was chosen for the categorization of contributing factors for the main market. The outcomes are summarized in Tab. 2.

Tab. 2: Contributing factors (criteria) for main market categorized by its weight

Weight	Contributing factor
Some influence	<ul style="list-style-type: none"> • Further improvement of products is not appreciated by customer like paying more • Incumbents dominate the market for quite long time. • Low customer loyalty
Substantial influence	<ul style="list-style-type: none"> • Products/services are based on standard components and features • Business model is different. • Switching cost are low or High • Compatibility cost (for example old technologies) • Meeting future expectation of the customer in terms of the size considering efficiency • Lack of product/service matching what disruptor already offering • Increase of the current product and decrease in sales
Very high influence	<ul style="list-style-type: none"> • Lack of any serious barriers to enter like patent, license, or capital (good) • The possible disruptive innovation is compatible with existing network • Shift of the market shares toward low-end or high-end by offering different products/services

Weight	Contributing factor
	<ul style="list-style-type: none"> • Shift in customer needs which leads to change in performance or attributes • Is there a change in value chain? • Radical sustaining innovation

Source: own elaboration

3.3 Measurement development

For each phase, foothold, or main market, we have a library of factors which makes the disruption more or less likely to be successful. It helps the groups of skilled managers think systematically about any possible threats to the core business, and how to take possible actions to hinder or co-opt those threats. In the evaluation process, manager's engagement in using the framework will reveal the individual assumption about the threat. The measurement is designed around a seven-point scale, roughly similar to Rafii et al. (2002) instrument, which rates each criterion (contributing factors) disruptiveness from (+3) highly positive effect to (-3) highly negative effect.

Since some criteria are more important than others are, and has higher positive effects toward the disruption or fewer effects, we also created a weighting factor which weight each criterion from one to three:

Weighting the Disruption

1 = Some influence

2 = Substantial influence

3 = Very high influence

Then in the next step, we need to calculate the weighted score for each criterion by multiplying the raw rating by the weight. In order to be able to normalize the score for each stage – foothold and main market – we calculate the average weight to fall within -3 to +3 range.

Conclusion

Based on extensive literature review, eight categories of models which are efficient at the identification of incoming disruptive innovation have been presented and critically evaluated. In addition, the paper proposes new framework that has been purposefully developed to reveal the advent of disruptive innovation that could threaten company performance. The

research was confined to IT sector which is exceedingly receptive to disruptive innovation. Afterwards, the framework was validated by means contextual interviews conducted with IT experts and managers. Moreover, the framework was verified by testing on a real case. The research conducted in this respect enabled the authors to respond research question (RQ1) in the way that scoring models composing of relevant contributing factors that are weighed according to their influence can provide reliable picture about the severity of the threat of being disrupted by a new technology/innovation.

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Contact

Hossein Rouhani Zeidanloo
Prague University of Economics and Business
Faculty of Business Administration
Churchillovo nám. 4, 137 00 Praha 3
rouh02@vse.cz

Miroslav Špaček
Prague University of Economics and Business
Faculty of Business Administration
Churchillovo nám. 4, 137 00 Praha 3
miroslav.spacek@vse.cz