



A Business Model to Detect Disease Outbreaks

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Abstract

Introduction: Every year several disease outbreaks, such as influenza-like illnesses (ILI) and other contagious illnesses, impose various costs to public and non-government agencies. Most of these expenses are due to not being ready to handle such disease outbreaks. An appropriate preparation will reduce the expenses. A system that is able to recognize these outbreaks can earn income in two ways: first, selling the predictions to government agencies to equip and make preparations in order to reduce the imposed costs and second, selling predictions to pharmaceutical companies to guide them in producing the required drugs when a disease spreads. This production can specify probable markets to these companies.

Methods: Both earning methods would be considered in this modeling and costs and incomes will be discussed according to basic business models (especially in the health field). To execute this model, the internet is used as a recipient of information from the doctors and the service providers for prediction.

To ensure collaboration of doctors in the data collection process, the amount of money that is paid is proportional to the rate of sending the patients' information. On the other hand, customers can access outbreak prediction information about a specific illness after payment or subscription of system for monthly periods. All the money transferred in this system would be via online credit systems.

Results: This business model has three main values: recognizing disease outbreaks at the right time, identifying factors and estimating the spreading rate of the disease and, the categorization of customers in this model is based on the value provided including pharmaceutical companies and importers of drugs, the government, insurance companies, universities and research centers. By considering various markets, this model has the ROI of 0.5 which means the investment in it reverses in 6 months.

Conclusion: According to the results, the business model developed in this study, has fair value and is feasible and suitable for the web. This model develops medical information network and proper marketing, earns good profits and the most critical resource of it is the algorithm that detects the disease outbreak which must be properly constructed and used.

Keywords: Disease Outbreak, Business Coalition Healthcare, Internet, Health Services Availability

Article History: Received: 20 May 2014 Revised: 25 Jul 2014 Accepted: 10 Aug 2014

Cite this article as: Lajevardiy SA, Kargari M, Teimourpour B, Kargar S. Business model to detect disease outbreaks. Int J Travel Med Glob Health. 2014;2(4):121-5.

1. Introduction

Nowadays the early detection of diseases, either influenza, or biological terror attacks such as smallpox is very vital [1], with the incubation period of the disease, in order to maximize the effectiveness of control measures [2].

Most disease outbreaks must be quickly identified and locally controlled. Most widespread disease outbreaks are identified and locally controlled, however some local breakouts spread slowly and may not be even detected [3,4].

In the future, many people will be affected by various kinds of diseases especially respiratory-related ones that demand special care by specialists and specific equipment [5].

This may happen in various places, near or far from the responsible organizations and it is a vital need to organize the expertise and equipment which are needed to deal with the accuracy of such events.

In addition, considering wide ranges of pathogens in the detection of threats is essential.

By increasing the threats posed by bioterrorism, early detection through experimental data and the use of physician-based reporting systems is required.

In the past 10 years, increasing computing power has led to

the development of mathematical algorithms for the detection of disease outbreaks.

The data of national laboratories are collected in a network named health care system.

This system is usually run by the government and if a business model is prepared for that, it can be handled by private companies.

This study presents a business model for detecting disease outbreaks and uses new models to perform that.

2. Methods

The Business Model Canvas is a strategic management template for developing new business models or documenting existing ones [6]. It is a visual chart with elements describing a firm's value proposition, infrastructure, customers, and finances [7]. It assists firms in aligning their activities by illustrating potential trade-offs. The Business Model Canvas was initially proposed by Alexander Osterwalder [7] based on his earlier work on Business Model Ontology. Since the release of Osterwalder's work in 2008, new canvases for specific niches have appeared, such as the Lean Canvas.

2.1. The Business Model Canvas

Many different business conceptualizations exist; Osterwalder's work and thesis [7, 8] proposes a single reference model based on the similarities of a wide range of business model conceptualizations. With his business model design template, an enterprise can easily describe its business model which includes:

Key Activities: The most important activities in executing a company's value proposition. For example, the Bic Company uses an efficient supply chain to decrease the expenses.

Key Resources: The resources that are necessary to create value for the customer. They are considered as an asset to a company, which are needed in order to sustain and support the business. These resources could be human, financial, physical and intellectual.

Partner Network: In order to optimize the operations and reduce the risks of a business model, organizations usually improve buyer-supplier relationships so they can focus on their core activity. Complementary business alliances can also be considered through joint ventures and strategic associations between competitors or non-competitors.

Value Proposition: The collection of products and services a business offers to meet the needs of its customers. According to Osterwalder [5], a company's value proposition is what distinguishes itself from its competitors. The value proposition provides value through various elements such as newness, performance, customization, "getting the job done", design, brand/status, price, cost reduction, risk reduction, accessibility, and convenience / usability.

Customer Segments: To build an effective business model, a company must identify the customers it tries to serve. Various sets of customers can be segmented based on the different needs and attributes to ensure that appropriate implementation of corporate strategy meets the characteristics of selected groups of clients. The different types of customer segments are:

- **Mass Market:** There is no specific segmentation for a company that follows the Mass Market element as the organization displays a wide view of potential clients.
- **Niche Market:** Customer segmentation based on specialized needs and characteristics of its clients.
- **Segmented:** A company applies additional segmentation within existing customer segment. In the segmented situation, the business may further distinguish its clients based on gender, age, and/or income.
- **Diversity:** A business serves multiple customer segments with different needs and characteristics.
- **Multi-Sided Platform / Market:** For a smooth day to day business operation, some companies will serve mutually dependent customer segments. A credit card company will provide services to credit card holders while simultaneously assisting merchants who accept those credit cards.

Channels: A company can deliver its value proposition to its targeted customers through different channels. Effective channels will distribute a company's value proposition in

ways that are fast, efficient and cost effective. An organization can reach its clients either through its own channels (store front), its partner channels (major distributors), or a combination of both.

Customer Relationship: To ensure the survival and success of any businesses, companies must identify the type of relationship they want to create with their customers segments. Various forms of customer relationships include: Personal Assistance, Dedicated Personal Assistance, Self Service, Automated Services, Communities, Co-creation.

Classes of Business Structures:

- **Cost-Driven** - This business model focuses on minimizing all costs and having no frills. e.g. Southwest
- **Value-Driven** - Less concerned with cost, this business model focuses on creating value for their products and services. e.g. Louis Vuitton, Rolex

Characteristics of Cost Structures:

- **Fixed Costs** - Costs are unchanged across different applications. e.g. salary, rent
- **Variable Costs** - These costs vary depending on the amount of production of goods or services. e.g. music festivals
- **Economies of Scale** - Costs go down as more products are produced or ordered.
- **Economies of Scope** - Costs go down due to incorporating other businesses which have a direct relation to the original product.

Revenue Streams: The way a company makes income from each customer segment. Several ways to generate a revenue stream are Asset Sales, Usage Fee, Subscription Fees, Lending/Leasing/Renting, Licensing, Brokerage Fees, Advertising.

2.2. Electronic Business

Electronic business, or e-business, is the application of information and communication technologies (ICT) in support of all the activities of the business. Commerce constitutes the exchange of products and services between businesses, groups and individuals and can be seen as one of the essential activities of any business. Electronic commerce focuses on the use of ICT to enable the external activities and relationships of the business with individuals, groups and other businesses. The term "e-business" was coined by IBM's marketing and Internet teams in 1996.

Electronic business methods enable companies to link their internal and external data processing systems more efficiently and flexibly, to work more closely with suppliers and partners, and to better satisfy the needs and expectations of their customers. Internet is a public gate for transferring information and financial records.

E-business involves business processes spanning the entire value chain: electronic purchasing and supply chain management, processing orders electronically, handling customer service, and cooperating with business partners. Special technical standards for e-business facilitate the exchange of data between companies. E-business software solutions allow the

integration of intra and inter firm business processes. E-business can be conducted using the Web, the Internet, intranets, extranets, or some other combinations of these.

3. Results

As mentioned in the previous section, the canvas model and online business model has been used for disease outbreak detection business. The results obtained from the use of models are presented below.

3.1. The Value Provided

This business has three main values:

1. Timely recognition of disease outbreaks: The detection of disease outbreak quickly and even before they occur.
2. Identifying factors: identification of factors in the disease outbreaks, depending on the spreading rate of disease outbreaks
3. Estimate the spread of disease: estimated prevalence and disease progression. Based on the detecting models

In fact, the response to these three questions is what this business presents to the costumers:

1. What value is provided? Prediction of disease outbreaks
2. How this value is provided? Appropriate marketing
3. When the value is provided? Estimation at minimum time

3.2. Customer Segmentation

Segmenting customers based on the value provided as follows:

1. Pharmaceutical companies and importers of drugs can use the service as a forecast system and get prepared for a proper market in the future.
2. The government can act as a preventive factor against an outbreak.
3. Insurance companies can use the model to advertise their different services.
4. The market will develop to universities and research centers after the collection of appropriate information in the form of raw data.

Customer Segmentation is summarized in Table 1.

3.3. Methods of Communication

Considering the type of e-business, the method of communication is through the online system, but according to the customer's request, mails and letters can be used too.

3.4. Customer Relations

Depending on the customer, the errorless prediction is the most important need of customers to get the right information. Thanks to the user-friendly design of the system, customers can take full advantage of that.

3.5. Revenue Stream

The main revenue stream of the business would be the online sale of forecasted information. This profit is received from the customers and prices would differ depending on the period and type of subscription.

3.6. Key Sources

The key sources of the business are:

Table1. Customer Segmentation

Market Size	Firm Specific Factors	Attractive	Strength of Buy
Individuals and Small	Flexible	High (Depending on Quality)	High

Table2. VRISA Analysis

Type	Valuable	Rare	Imitability	Substitution	Appropriate	
Temporary Competitive Advantage	✓	✓	✓	-	✓	Algorithm
	✓	✓	✓	✓	✓	Data system
	✓	-	-	-	✓	

1. Detection algorithms and models must always improve since the quality and precision of prediction depends on them.

2. Physician's profiles and outbreak-related data; the data received from the physicians has a significant influence on the quality of results

3. The system provides services to customers and receiving information from clinicians.

VRISA analysis is presented in Table 2 and sources that indicate it is a temporary competitive advantage.

3.7. Key Activities

The most important activities that must be performed in the business are:

1. Research and Improvement of the estimation model must be carried out continuously.
2. Network of doctors' development, which increases the quantity of data and also the high quality of the forecast, must be spanned.
3. Marketing and customer identification, which will increase the revenue stream, must be improved.

3.8. Key Partners

The most important partners in this business are doctors that send information and have the most important role in increasing the quality of the data collection and prediction. To attract more doctors, the viral network has been used.

To attract more doctors to the value and tricks, viral methods are used. Thus, if a doctor sends information, a particular amount of money is paid to him/her and one tenth of that amount would be paid to his/her reagent and one hundredth of it goes to the reagent of that reagent. For example, if the physician's fee is 10,000 Rials, a reagent of him receives 1000 Rial and a reagent of that reagent gets 100 Rial. It should be noted that the payment is only for two levels which leads to the development of networks within the overall benefit of the physicians.

3.9. Cost Structure

Business costs include the following:

1. The cost of the data collection: 10000 Rials per data.
2. Research and development expenses and the costs of human resources (researchers and marketers)

As a result, the cost model is as follows:

1. The initial set-up cost: 100 million Rials
2. Monthly expense for the maintenance of the system: 5 million Rials
3. The cost of R & D: proportional to profits
4. The cost of sending data: 11,100 Rials

3.10. The Online Business Model of Disease Outbreaks

According to the specifications outlined in the Online Business Model (OBM) Porter's 5 forces in the business can be considered as follows:

1. Lack of substitute services (due to high innovation)
 2. High barriers of entry arrivals (due to high innovation)
 3. High bargaining in the supplier of information providers
 4. Given no competitor, lack of bargaining in customer's
 5. New competitive environment without competing
- Due to being unfamiliar with the market, and on the other hand being familiar with the technology, the approach of internal development and strategic alliances with technology firms who know the market has been used.

3.11. Role of the Internet Business

Internet has three significant roles in the context of the business:

1. Receiving information from physicians
2. Providing applicants' prediction
3. Transferring funds via online credit which is linked to the bank payment gateway.

3.12. Innovation and Profit

Due to the lack of accountability and the need to imitate supplementary resources, the Obstruct and cooperate strategy is selected. This approach is shown in Table 3.

Table 3. Selection of strategies in innovative business

Complementary Assets			Imitability
Strict Access	Available		
Money Holder of Complementary Resources	Making Money is Difficult	Low	
Making Money with Complementary and Profitability based on Power	Inventor Profit	High	

4. Discussion

Usually disease outbreak symptoms are weak and vague. Also, aggregate symptoms should be used for a better detection.

The business model presented in this study is based on the data collected in the form of the capillary system of the doctors and the result would be a suitable profit which is gained through selling the outbreak forecasting data.

In similar researches that have been done in this field [9-12], the governmental organs were responsible for the data collecting but in this study, information was collected completely on-line and with fellow practitioners in this business.

The most important limitation of this study was to establish the State of law and the problems that may be due to the privacy of medicine [13].

Many researches have used the viral method for managing customers and markets, but in this study, it has been used to gather information from doctors in order to reduce the power of suppliers.

5. Conclusion

According to the results, the business model developed in this study, has fair value and is feasible and suitable for the web. This model develops medical information network and proper marketing, earns good profits and the most critical resource of that is the algorithm that detects the disease outbreak which must be properly constructed and used.

If the information of doctors and their profile would be completed, it can be used as another source to earn money from, but of course it needs special protocols.

Acknowledgments

Hereby the authors thank the department of research of the Shariati hospital.

Authors' Contributions

All authors were involved in the study design, data analysis and result interpretation. All authors confirmed the final draft before submission.

Financial Disclosure

The authors declared no financial disclosure.

Funding/Support

This study was a research project supported financially by Tarbiat Modares University.

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