BUSINESS MODEL ANALYSIS OF EHEALTH USE CASES IN EUROPE AND IN JAPAN

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Abstract

Despite all the perceived potential, rolling out eHealth and wellness services has been a challenge for any telecommunications operator. In its part, an operator has to ensure secure transmission of health data, comply with the law when running the network and the platform, ensure interoperability between networks, interfaces and products, etc. In addition, it needs to create a robust value chain and a sound business model with partners in possession of key resources and skills.

Under the ongoing research collaboration on eHealth between NTT Japan R&D and France Telecom/Orange Labs, we study the business models of 15 health services in Europe and Japan. As one of the outcomes of the study, we report the 11 key success factors that we have identified to be pivotal for positioning telecommunications operators on the value chain.

Keywords: telehealth; eHealth; nursing informatics; education; nursing.

Introduction

In recent years, applications of Information and Communication Technologies (ICT) in the fields of healthcare and well-being have been considered as the next big opportunities for telecommunications operators to increase revenue. The current research partnership on eHealth between NTT Japan R&D and France Telecom/Orange Labs covers several topics dealing with technologies, services and business models. Under the third category, we conducted a study of the business models of current eHealth/Wellness services in Europe and Japan.

The objective of this study was to acquire an understanding of the role of a telecommunications operator in the value chain, the partnerships that need to be set up, the types of technological and organizational solutions to be rolled out and the models that would achieve lasting operational viability.

Methods

To achieve this goal, we used three common marketing tools, value chain, business model analysis and key success factors. We used the value chain to position and analyze the role of actors in the eHealth services studied here and we propose a new 4-block value chain that is well suited to analyze eHealth eservices use cases. The Osterwalder canvas was used as the business model tool to analyze and describe how each service creates, delivers, and captures value. To analyze the economic potential of use cases, we used some of the key success factors from a study carried out in 2005 by the European Commission on the economic impact of eHealth¹ and added some new ones to reach a total of eleven key success factors well suited to analyze eHealth services use cases.

We then applied this methodology to study the following 15 typical eHealth and wellness services, use cases.

Description of the 15 services

For visualization of the scopes and characteristics of these 15 services, we use a triangular representation as in Figure1. At the three corners of the triangle lie the three major application areas of eHealth, namely, telemedicine, wellness and health data storage. We put each service according to its contents to the position
beside the triangle. Hence, this representation allows some solutions to be positioned between two fields when they cover both fields at the same time.

In terms of origin, the 15 services belong to the three following groups:

- The five European services (E1 to E5) come from a study carried out in 2005 by the European Commission on the economic impact of eHealth.1-6
- The five Orange services are noted as Or1 to Or5.7-12
- The five Japanese services comprise 3 NTT services (N1 to N3)13-16 and 2 other Japanese services (J4 and J5).17,18

Our selection of services aimed at ensuring diversity in terms of category and market size. For each group (Europe, Orange and Japanese) we have selected four use cases around one eHealth application area and another use case in another area. The European use cases were selected around Health Data Repository, the Orange services were selected around Telemedicine and the Japanese services were selected around Wellness.

The 15 services are briefly described in table 1.
Table 1. Summary description of the 15 services.

<table>
<thead>
<tr>
<th>Service Description</th>
<th>Technology Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>An implanted pacemaker or defibrillator, implanted in the chest of the patient, sends data from the patient’s home to the physician/hospital to monitor the patient.</td>
<td>Telemonitoring</td>
</tr>
<tr>
<td>Reacting to a shortage of radiologists in Sweden, the application allows regular teleconsultations for Swedish patients given by specialists in Spain.</td>
<td>Telemonitoring</td>
</tr>
<tr>
<td>A mobile phone provides remote assistance and personal services via an assistance button which connects the patient to Mondial Assistance, 24 hours a day, and 7 days a week.</td>
<td>Telemonitoring</td>
</tr>
<tr>
<td>Columba bracelet was a GPS-driven system with automated alert and audio communication to prevent Alzheimer's sufferers from wondering away.</td>
<td>Telemonitoring</td>
</tr>
<tr>
<td>DIABEO is a Mobile &amp; Web Telecare solution for insulin-dependent diabetes. Practically, it replaces the traditional logbook paper by an electronic solution.</td>
<td>Telemonitoring</td>
</tr>
<tr>
<td>The NTT service connects Elderly at local area to specialists at urban area to provide advice using TV phone and health sensors and instruments.</td>
<td>Wellness &amp; Telemonitoring</td>
</tr>
<tr>
<td>NTT Creative Health is a Wellness portal site where users having a pedometer can change health points to goods and gift cards from advertising enterprises.</td>
<td>Wellness</td>
</tr>
<tr>
<td>NTT Wellness data are collected by Mobile to Wellness Platform for effective healthcare counseling by Doctors working for enterprises or government.</td>
<td>Wellness</td>
</tr>
<tr>
<td>The KDDI Karada Manager is a sports and nutrition coach using a healthcare portal and mobile tools for entertainment and game.</td>
<td>Wellness</td>
</tr>
<tr>
<td>Shared Medical Imaging is a solution deployed by Orange to host Medical images taken by hospitals (X-rays, scanner…) in a centralized and secured data-centre.</td>
<td>Health Data repository</td>
</tr>
<tr>
<td>SCCJ Pocket Karte is a free PHR storing medical data and annual health check up data.</td>
<td>Health Data repository</td>
</tr>
<tr>
<td>In Belgium, the K&amp;G Vaccination Database provides an electronic vaccination record for each child in Flanders, with effective means of vaccination stock control.</td>
<td>Health Data repository</td>
</tr>
<tr>
<td>MedCom, the Danish national network provides Electronic data interchange (referrals to hospitals, prescriptions, reimbursements…), EHR, PHR, eHealth Portal…</td>
<td>Health Data repository</td>
</tr>
<tr>
<td>In Sweden, prescriptions are electronically all transferred from doctor to the pharmacy via SJUNET or by internet to save the cost of paper prescriptions.</td>
<td>Health Data repository</td>
</tr>
<tr>
<td>IZIP is the Czech Republic web-based Electronic Health Record (EHR) system.</td>
<td>Health Data repository</td>
</tr>
</tbody>
</table>
**Methodological tools**

To analyze the 15 services, we used the three following methodological tools: i) our newly developed 4-block representation of the eHealth value chain. This tool is particularly suitable for the analysis of eHealth value chains due to the uniqueness of this domain; ii) the Osterwalder business model canvas for analyzing business models; and iii) identification of key success factors. In this study, we identified eleven key success factors for positioning a telecom operator on the value chain.

*A new 4-block representation of the value chain*

Figure 2 represents the value chain and brings together the main actors in 4 main blocks. This representation replaces the traditional value chain with 3 blocks of actors, ‘service receivers’, ‘service providers’ and ‘paying authorities’.19 In our representation, we add a fourth block dividing the service providers block into two separate blocks, namely, ‘Health service providers’ and ‘THS’ or ‘Technology for Health Service providers’.20

With a view to validating the suitability of this 4 blocks representation of the value chain, we have taken an existing value chain into consideration (figure 3).21 In this example of the value chain of the Czech Republic’s EHR® (Electronic Health Record), the main actor (IZIP) is a private company which manages the EHR for the General Health Insurance Company of the Czech Republic (GHIC-CR) which is the main beneficiary and finance source of the value chain. IZIP also handles subcontracting IBM equipment and the back-office of the Czech national telecommunications operator.

It can be seen immediately that this mode of representation allows an understanding and breakdown of existing value chains. It also makes it simpler to build new value chains.

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**Figure 2.** Analysis of the 4-block value chain (THS: Technology for Health Service providers).
The Czech EHR Value Chain

**Figure 3.** Validation of the 4-block representation of the value chain: example of the Electronic Health Record in the Czech Republic.

<table>
<thead>
<tr>
<th>Infrastructure/Resources</th>
<th>Key Partners</th>
<th>Key Activities</th>
<th>Value Proposition</th>
<th>Customer Relationships</th>
<th>Customer Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE Healthcare EDL medical imaging</td>
<td>Large project Mgt, Integration, QoS Medical imaging</td>
<td>Shared medical imaging solution Radiology images shared between health facilities &amp; private physicians Pay per use</td>
<td>Two steps relationship through consortia Software as a Service</td>
<td>B2B Hospitals Clinics GCS (GROUP HEALTH COOP)</td>
<td></td>
</tr>
<tr>
<td>Key Resources</td>
<td>Telecom. Network Financial capacity</td>
<td>Channels</td>
<td>OBS (Orange Business Services)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 4.** The Osterwalder business model canvas: Shared Medical Imaging example solution.
Analysis of business models using the Osterwalder business model canvas.

Since 2009, the Osterwalder canvas method has been proved to be a powerful tool for describing, analyzing and designing business models. In their book “Business Model Design Generation”, Osterwalder and Pigneur offer the following definition of a business model: ‘A business model describes the rationale of how an organization creates, delivers, and captures value’.[22,23] Describing the creation of value requires the description of the offering (value offering). Describing the delivery of value requires the description of the value chain and describing the capture of value requires the description of revenue generation.

To do so, they propose to describe Business Models using a 9-block canvas illustrating the way in which a business intends to make a profit (figure 4). The 9 blocks cover the 4 usual fields of marketing activity: customers, the offering, infrastructure, and financial viability.

The example described in figure 4 is that of ‘Shared Medical Imaging’. This is a solution which digitizes medical images rolled out by Orange to offer hospitals a centralized and secure system for data storage.

To complete the canvas, there needs to be a link to the chain in order to understand the positioning of the actors (Figure 5).

It can be seen from the canvas and the value chain that, by taking advantage of the economy of scale from pooling infrastructures between hundreds of institutions, hospitals save on investment and pay for services per use at a lower cost than for traditional film (archiving costs is €1, an additional €1 if PACS (Picture Archiving and Communication System) is included and an additional €1 for RIS (Radiology Information System) whereas traditional film costs between €5 and €9). The business model is a payment per use with a pooling of costs for the investor. Orange partners are GE and EDL and the distribution channel is that of ORANGE.[9,10]

Extracting key success factors

Selection of key success factors

Since this study was focused on the positioning of the telecommunications operator and its partners in the ‘Technology for Health Service providers’, we extracted and selected 11 key success factors that allowed these 15 services under consideration to be rolled out successfully.

The key success factors are described in table 2.

![Figure 5. Four block value chain of use case (O2) Shared Medical Imaging solution.](image-url)
They are related to the different recipients: Patient, Health Professionals, Organizations, Governments etc and the Technology for Health Service providers (i.e., Telecom operators and partners). For the Providers, the arguments of selection are related to key resource and activity defined by Osterwalder, while for other recipients (i.e. receivers and payers) the arguments of selection are related to economic benefit, quality for patient, etc.

**Table 2. Key success factors for ‘Technology for Health Service providers’**

<table>
<thead>
<tr>
<th>Key success factors</th>
<th>Detailed Description</th>
<th>Recipient</th>
<th>Argument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government/organization legitimacy</td>
<td>When the whole value chain benefits from the legitimacy provided by a governmental organization.</td>
<td>Health org. (gov...)</td>
<td>Legal</td>
</tr>
<tr>
<td>A free service for the patients</td>
<td>The patients are attracted by a free service that otherwise would be payable.</td>
<td>Patient</td>
<td>Economic</td>
</tr>
<tr>
<td>A better service for citizens</td>
<td>The new service provides a better service for citizens, in comparison with previous situation.</td>
<td>Patient</td>
<td>Quality</td>
</tr>
<tr>
<td>In-house expertise</td>
<td>The main distributor of the solution has particular expertise in the role he assumes.</td>
<td>Providers</td>
<td>Key resource &amp; activity</td>
</tr>
<tr>
<td>Partners’ expertise</td>
<td>The partners have particular expertise in the role they assume.</td>
<td>Providers</td>
<td>Key resource &amp; activity</td>
</tr>
<tr>
<td>Network and Platform management legitimacy</td>
<td>The Telecom operator managing the network and the data hosting platform is legitimate in this role (expertise and capabilities in infrastructure for data hosting and secure data management, governmental agreements ...).</td>
<td>Providers</td>
<td>Key resource &amp; activity</td>
</tr>
<tr>
<td>Secure transmission &amp; hosting</td>
<td>The health care data and applications are hosted and transmitted securely by the concerned partners in the value chain.</td>
<td>Patient, Health Pros</td>
<td>Quality, Privacy</td>
</tr>
<tr>
<td>Pre-existing distribution channel</td>
<td>A pre-existing distribution channel chain with pre-existing clients, providers and distributors can greatly help to deploy an eHealth solution.</td>
<td>Providers</td>
<td>Key resource &amp; activity</td>
</tr>
<tr>
<td>Appropriate interoperability and standardization</td>
<td>Today, appropriate interoperability and standardization seem to be a common concern in e-health and e-wellness.</td>
<td>Patient, Health Pros</td>
<td>Economic</td>
</tr>
<tr>
<td>Cost reduction</td>
<td>Today any government has to face the challenge of delivering affordable healthcare at lower cost (because of population aging, increase in chronic diseases...).</td>
<td>Health org. (gov...)</td>
<td>Economic</td>
</tr>
<tr>
<td>Incentives for patients</td>
<td>The patients can be attracted by a free service, by a better service at lower cost, by a new service, motivated by the government, etc.</td>
<td>Patient</td>
<td>Economic &amp; Quality</td>
</tr>
</tbody>
</table>

*Key success factors for operators and their partners*

Through the analysis of the 15 services, we noted that in order to create a robust value chain and a sound business model, a telecommunications operator and its partners should possess or supply the key success factors listed in table 2. We then produced the framework of table 3 for analyzing the key success factors for health service technology providers.
As the first step, we ticked the cells when the key success factor was relevant for each service and we used the results to make a purely statistical analysis of the key success factors as reported in table 4.

As an example, let us consider the service ‘J5-SCCJ Pocket Karte’. Here, all the key success factors except ‘pre-existing distribution channel’ were relevant for the consolidation of the value chain. The reason is because this PHR solution does not involve pre-existing re-imbursement solution.

**Table 3.** Framework for analyzing key success factors of the 15 Health Services.
Analysis of the frequency of occurrence of the key success factors

A summary of the analysis of the frequency of occurrence of the key success factors is shown in table 4. The most frequent key success factors are, in-house expertise and the expertise of partners (in all cases), network and platform management in compliance with the law and interoperability (14 out of 15) and security of data transmission and cost reduction (13 out of 15). Although the study sample size (15 solutions studied) is larger than previous studies like the EC study (10 solutions considered) it is still too small to draw any absolute conclusions on the success factors. That is, it may not necessarily allow generalization for all the existing and future solutions. Also, the factors could be different if a different geographical area is considered.

It should also be noted that the frequency of occurrence of the key success factors is not an indicator of their importance for the consolidation of the value chain. To assess this, a weighted analysis of these factors was undertaken.
**Weighted analysis of the key success factors**

In the present study, our objective was to quantify the key success factors rather than to select any particular solution. We chose to also use the DELPHI method which relies on panels of experts to quantify the criteria.\textsuperscript{24,25} This was done over several rounds over several rounds in France and in Japan. For each use case we graded the importance of the key success factors, rating them from 1 to 4 when they were relevant for the consolidation of the value chain and giving no rating when they were not, as reported in table 5. The rating was the following: (1) low importance, (2) average importance, (3) high importance and (4) major importance.

We also tried multi-criteria decision making method deriving ratio scales from paired comparisons of criteria like the analytic hierarchy process method.\textsuperscript{26} The method is somewhat controversial since the rankings produced by this procedure are arbitrary\textsuperscript{27} and is based on mathematical errors, although some of its non-mathematical elements are valuable.\textsuperscript{28}

As an example, for the service ‘E4-ePrescription’, the rating of the key success factors was the following: ‘(3) high importance’ for all relevant key success factors except a ‘(4) major importance’ for the two key success factors ‘Legitimacy by a government or organization’ and ‘Pre-existing distribution channel’, because i) a national ePrescription requires a full legitimacy and adhesion from the government and ii) a conventional distribution channel with paper prescription was already existing.

Through the weighted analysis of table 5, the following three key factors can be seen to predominate, i) the legitimacy provided by a

| In-house expertise | 3 |
| Partners' expertise | 3 |
| Network and Platform management legitimacy | 3 |
| Standardization/interoperability | 3 |
| Secure transmission and hosting | 3 |
| Cost reduction | 2 |
| Legitimacy by a government organization | 4 |
| Incentives for patients | 3 |
| A free service for the patients | 3 |
| Pre-existing distribution channel | 3 |
| A better service for citizens | 3 |

Table 5. Weighted analysis of the key success factors for case E4 – ePrescription.
government or an organization (for example, the approval required for storing health data), ii) the presence of a pre-existing distribution channel (for example the easy rollout of ePrescription solutions replacing paper prescriptions at a lower cost in a pre-existing ‘patient-doctor-pharmacy-treatment system’ circuit), and iii) improvement or evidence of service for patients (a vital condition for HER rollout, the failure of the PHR in the UK being an example).

Finally and more specifically, we completed a weighted analysis for each of the main eHealth application areas, ‘Telemedicine’, ‘Wellness’ and ‘Health data repository’ of figure 1. The result of this analysis is given in figure 6. We see that the most frequent key success factors are in the center of the triangle. On the other hand, the most important key success factors appear at the corners of the triangle for each of the three application areas of eHealth solutions. We observed that the most frequent key success factors (in the centre) are shared across the three categories of eHealth solutions. The most important key success factors emerging from the statistical analysis (in the corners) are different depending on the three eHealth application areas.

**Figure 6.** The right key success factors for the right eHealth solutions
For Wellness solutions, the key success factors (the legitimacy provided by a government or an organization, the provision of an improved value-added service for patients or even a free service) are linked to the type of Wellness solutions. These are not classifiable as health solutions that are vital or required for a cure, and are not normally paid for by healthcare systems.

For telemedicine solutions, the key success factors involve the ability of Telecom operators and their partners to insert themselves in the value chain, for example through a pre-existing distribution channel and to convince and/or prove to governments and organizations that their solution will bring cost reductions and at the same time, improve health services for patients.

For health data storage solutions, the presence of a pre-existing distribution channel and the support or approval of governments and organizations are very important key success factors (for example, approval required for health data storage).

More specifically, while the operator must for its part have some key factors such as secure health data transmission, legitimacy over network management and ensure network interoperability, it also needs partners with the key complementary skills.

Finally, our study shows that the success of an operation can only be guaranteed if the operator and its partners have on the one hand, all the most frequent key success factors and on the other, all the key success factors that we found to be important when these prove necessary for the construction of the value chain.

**Conclusion**

In this paper, we present the outcome of our study on business models for e-health/wellness services. The work has been conducted under the ongoing NTT Japan R&D and France Telecom/Orange Labs research collaboration on eHealth. We propose a new 4-block value chain that is more suitable for the analysis of such business cases. We analyzed 15 existing services in Europe and Japan with this new scheme and have identified 11 key success factors that are found to be pivotal for positioning telecommunications operators on the value chain. Our study shows that for success with eHealth services, it is imperative for a telecommunications operator and its partners to possess the most frequent key success factors as well as all the key success factors that are necessary for the construction of the value chain.

**Figure 7.** Telecom operator positioning on the eHealth value chain

**Positioning of a Telecommunications Operator on the value chain**

Through our study on eHealth offerings, we note that the positioning of the telecommunications operator and partners has to focus on the key success factors shown in figure 7 so as to ensure the success of the value chain.
Conflict of interest statement

The authors report no conflicts of interest.

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