1. Introduction

The elderly population of Taiwan is growing rapidly; in 2010, it reached 10.69% of the total population and it is projected to reach 20.7% by 2027. In synergy with this trend, the rate of the elderly with disability needing assistance has increased drastically, driving the demand for long-term care services. The Taiwanese government has launched several measures and policy initiatives to address these needs and one of these initiatives involves funding the development of telemedicine.

Several events have set the stage for the initiation and development of telemedicine in Taiwan. For instance, the building of a national information network has made telemedicine technically possible and commercially feasible and another was that telemedicine could help mitigate the problem of medical resource scarcity in remote areas; telemedicine filled the gap when doctors were not accessible in those areas. Third, the increase of long-term care needs has made telemedicine a plausible solution for providing care at a lower cost.

The Taiwanese government provides the bulk of the funds needed for developing telemedicine; however, financial constraints have led to concern about future government funding and further development. At this time, when telemedicine has reached the stage of launching commercial operations, it is crucial to examine its potential for making profits that could sustain its development.

The as a method or an operational logic of doing business is a plausible perspective for that examination (http://digitalenterprise.org/models/models.html). Researchers have used business models to examine the operation of telemedicine in the United States but there was still a lack of comprehensive inclusion of the components and commercial potential considerations. This study aimed to fill the...
gaps by using a business model to generate a framework for analyzing six major telemedicine projects in Taiwan.

2. Methods

2.1. Analysis framework

The business model is a framework that defines the key components or tactics of a business idea and entails both operation methods by enterprises (http://digitalenterprise.org/models/models.html)\(^1\) and their profit-driven logic\(^2\). The model makes operations explicitly in terms of the mission of a service and its product, profits, structure, processes, techniques, and linkage between strategies and resources\(^3\)–\(^5\). In a practical sense, the models can be described in terms of a composite of the beliefs of the enterprise, the products or services, major actors and cost and profit\(^6\)–\(^8\). All this indicates a lack of consensus about what comprises a business model. A review of the literature has generated the following list of major components. (1) Value proposition: a term that has been used for the general presentation of the products and services of an enterprise as valuable and desirable\(^2\)–\(^4\),\(^9\)–\(^13\). (2) Target customers: a component that entails the primary customers targeted and served by a company\(^9\)–\(^12\),\(^13\). (3) Service process: the delivery of products or services involves a number of steps or procedures\(^2\)–\(^3\),\(^9\)–\(^11\),\(^13\). (4) Resources and capabilities: the execution of a business model requires resources and capabilities\(^9\). (5) Partnership: which is indispensable for delivering valuable services\(^9\). In telemedicine, partnership involves health, telecommunication and information sectors. (6) Cost structure and revenue model: the cost and revenue entailed when executing a business model\(^5\),\(^9\)–\(^13\).

2.2. Case selection criteria

Six major providers of telemedicine in Taiwan were recruited for interview (Table 1). They encompassed the three major types of players; hospitals, security firms and not-for-profit organizations and they represented the four models of long-term care service delivery, including home care, community-based care, institutional care and mobile security care. Data were collected through in-depth interviews with the managers or principal executives of each project.

3. Results

Initially, a case study was done to generate a number of propositions for further analysis. The propositions focused on the relation among service process, cost structures, acceptability of telemedicine and other variables related to business model (Fig. 1).

3.1. The relationship of service processes with the other variables

3.1.1. Proposition 1.1

Value proposition affects the plans and designs of service processes. With a value proposition of telemedicine alone, both the Yun-Lin Senior Association and Min-Sheng Healthcare use home care or a diabetes care center as a basis for telemedicine at home without supplemental services. When a holistic model was considered, both Chia-Yi and Cardinal Tien used home care as an agent for delivering a spectrum of care beyond telemedicine. Mackay aims to provide a complete community health management program through clinics and seminars. Wan Fang even expanded their services to cover daily routine services such as haircuts, assistive equipment, house cleaning and custodian help.

3.1.2. Proposition 1.2

Telemedicine involving multiple resources and capacities is deliverable only through partnerships. Any service model within a value chain, particularly a holistic one, requires a coordinated and concerted partnership involving multiple specialties and disciplines. Service set-up requires multiple devices, such as check-up equipment, transmission, service terminal and a call center. For example, both the Yun-Lin Senior Association and Chia-Yi have been partners with Taidoc Technology Company for technological support. Min-Sheng Healthcare has partnered with MITAC Inc. and ELAN Microelectronic Inc. Cardinal Tien has partnered with Netown Tech. Inc. Mackay has partnered with the Industrial Technology Research Institute and the FarGlory Land Development Group.

3.1.3. Proposition 1.3

Putting existing resources and capacities to their full use enables a project to deliver services that are as diversified as possible. All of the six projects in this study deliver telemedicine by providing remote physical checkups via home care as core services. Beyond this, core existing resources and capacity may be used innovatively to expand services. For example, both Mackay and Wan Fang integrate information systems of telemedicine and medical charts to improve medical consultations. Chia-Yi transforms the mini bond (a combination of GPS and emergency button) of Taiwan SECOM creatively into the life-line of emergency response service.

Table 1

A summary of major telecare projects in Taiwan.

<table>
<thead>
<tr>
<th>Project</th>
<th>Home care</th>
<th>Community-based care</th>
<th>Institutional care</th>
<th>Mobile security care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Health projects</td>
<td>Wan Fang Hospital</td>
<td>Taipei Medical University Hospital with a clinics, and Taiwan SECOM Co.</td>
<td>Hsiao Chung Cheng Hospital in partnership with three nursing homes</td>
<td>Taylor SECOM Co. in partnership with Chia-Yi Christian Hospital</td>
</tr>
<tr>
<td>Ministry of Economic Affairs U-Care Project</td>
<td>Min-Sheng Healthcare in partnership with MITAC Inc., ELAN Microelectronic Co.</td>
<td>Chang Gung Community for Retired Persons</td>
<td></td>
<td>Z-LAND Co. in partnership with Yu-Lin Zu-i Hospital and 3 technology companies</td>
</tr>
<tr>
<td>Private sectors</td>
<td>Mackay Memorial Hospital with the Industrial Technology Research Institute and Farglory Land Development Group</td>
<td></td>
<td></td>
<td>Far Eastone Telecommunications Co. in partnership with Far Eastern Memorial Hospital</td>
</tr>
</tbody>
</table>
3.1.4. Proposition 1.4
Geography affects the planning of service processes. One of the crucial steps in delivering telemedicine services involves transmitting checkup information to a service center. Of the six projects, three use ADSL and one uses broadband. Yun-Lin Senior Association and Chia-Yi prefer to use the telephone as a tool for transmission because it is the predominant means of communication. The use of other types of communication might increase the cost and decrease the incentive to use telemedicine.

3.2. The relationship between cost structures and other variables

3.2.1. Proposition 2.1
The ingredients of service processes, such as the number of checkup items offered, have an impact on the cost structure. The number of checkup items is one of the major costs of delivering telemedicine. The more features in an operation system, the more it costs. Yun-Lin Senior Association offers a limited 2-in-1 blood glucose and pressure monitoring service. Its system set-up is preliminary and allows clients to transmit checkup information, which gives warnings about any skewed readings. By contrast, Mackay provides six-item services through more sophisticated systems that connect a client’s medical charts in the hospital for thorough health consultations. Cardinal Tien offers an ambitious 13-item checkup service plus an artistic program to attract customers in suburban areas, which inevitably increases the total cost, particularly for an equipment lease of $800–900.

3.2.2. Proposition 2.2
The capability and expertise of the partners has an impact on the cost structure. Partners in telemedicine vary in related experience and expertise. Partnership with an experienced actor has the advantage of saving time and resources when setting up service systems. ELAN Inc. and MiTAC Inc. are new to the field of telemedicine. In their partnership with Min-Sheng, extra energy and resources must be devoted to building the operational system. By contrast, TaiDoc Tech. Co., a manufacturer of telemedicine equipment, chooses Yun-Lin Senior Association, Chia-Yi and Wan Fang as common partners to help keep costs down.

3.2.3. Proposition 2.3
Taking advantage of existing resources and capabilities helps to lower the cost. There are two ways to lower costs by taking advantage of existing resources and capabilities. One way is to match existing resources and capabilities with target clients. This strategy fits well for all six cases reviewed here. It makes sense to deliver telemedicine through home care, an existing resource and capacity in every case and target its care recipients as the primary sources of clients. Another way is to reassign and train existing staff members to deliver telemedicine without expanding the current workforce. This appears to make sense if the number of clientele is limited at the current stage of the program’s development, which is exactly what the Yun-Lin Senior Association has done. This is in contrast to the other five cases, which all expand their manpower by hiring extra staff, consequently increasing the cost.

3.3. The relationship between acceptability for telemedicine and other variables

3.3.1. Proposition 3.1
Service processes determine customer acceptance of telemedicine. The goodness of fit between telemedicine and customer care needs affects its acceptance. Of the six cases, three merely provide a core of basic services, blood glucose and pressure monitoring. Min-Sheng offers two core services and optional 5-in-1 checkup services. Mackay goes for six items, while Cardinal Tien offer 13 items, the longest list of services. Regardless of the number of services, blood glucose and pressure monitoring remain the indispensable cores. The inability to expand services to cover other health problems, such as problems with the skeleton, muscles, eyes and ears or the endocrine, metabolic or gastro-intestinal systems could hamper customer acceptance of telemedicine.

3.3.2. Proposition 3.2
Cost structure is a contributing factor to its acceptability. The cost structure has a strong impact on consumer acceptance of telemedicine. Accessibility to medical resources is closely related to cost structure. The geographical location of consumers is a crucial determinant of accessibility. Residents of rural areas have fewer and less affordable medical resources, and have to pay more than their urban counterparts for care owing to the higher cost of delivery. These disadvantages make delivering telemedicine a challenge.

Wan Fang, Mackay and Min-Sheng all provide telemedicine free of charge to increase its acceptability by customers, which may change if a fee schedule is introduced. Facing a clientele group from rural areas, the Yun-Lin Senior Association decided to reduce the...
services it offers to boost consumer acceptance. Chia-Yi, located in an area with low household incomes, may adapt a similar strategy. Facing residents with higher household income, Cardinal Tien decided to offer a 13-item checkup service as well as other options to lure consumers. Mackay and Wan Fang may choose to use this strategy if they decide to apply a fee schedule.

4. Conclusion

In general, the cost of operating a telemedicine service system is currently considerable. Take the set-up cost as an example: the Yun-Lin Senior Association has the lowest budget of around one million dollars, with a third ($400,000) coming from the government. If depreciation is included, its cost for the system is about $17,000 per month. Adding in the cost of personnel ($3000) for operating a 24-hour call center accounts for about $20,000 of the monthly costs. Currently, the monthly charge for each client is around $30, which means the Association has to maintain at least 660 customers per month for the project to be sustainable. Unfortunately, it falls severely short of that level but sharing or co-owning systems with other providers would help to reduce the costs.

On the consumer side, the major charge is for checkups that use equipment. The more sophisticated the equipment, the higher the service charge. For example, Mackay and Cardinal Tien provide electrocardiograms, peak expiratory flow rate (PEFR) meters and fingertip pulse oximeters. These devices are expensive and increase the total cost. One way to reduce the cost would be to reduce the number of expensive checkup services and another is to install the equipment at local pharmacies as stations for customers to share.

References