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# Adoption of Lean Thinking and Service Improvement for Care Home Service

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***Abstract*—**Ageing population is a global trend; therefore the need of care service has been increasing dramatically. There are three basic forms of service delivered to the elderly: institution, community, and home. Particularly, the institutional service can be seen as an extension of medical service. The nursing home or so-called care home which is equipped with professional staff and facilities can provide a variety of service including rehabilitation service, short-term care, and long term care. Similar to hospital and other health care service, care home service do need to provide quality and cost-effective service to satisfy the dwellers. The main purpose of this paper is to show how lean thinking and service innovation can be applied to care home operation. The issues and key factors of implementing lean practice are discussed.

***Keywords*—**Lean, Service improvement, SERVQUAL, Care home service

## I. Introduction

HEALTHCARE is one of the fastest growing service sectors in both developed and developing countries [1]. Beside the primary healthcare, one major portion of care service is consumed by the elderly people. Since in Taiwan the rate of population aging is one of the highest in the world, the demand for quality and cost effective care service has been increasing significantly over the past decade. There are three basic forms of service delivered to the elderly: institution, community, and home. Particularly, the institutional service can be seen as an extension of primary medical service. Similar to hospital and any other healthcare service providers, the care home or so-call nursing home for the senior citizen are required to provide acceptable service. Therefore, for the management of the care home the issue of providing good quality care service is very important.

Scotti, Harmon and Behson conducted a study that supports the argument that the perceived quality is one of the determinants of patient/care receiver satisfaction. Consequently, improving quality can results a higher level of customer satisfaction. Many manufacturers have witnessed the success of lean management which was originated from Toyota Production System. Lean thinking is not a new concept, but it is relatively new to healthcare service. The skeptics may say, "Patients are not cars." In fact, care service delivered in extraordinarily complex organizations, with numerous interacting processes, much like the manufacturing industry. Many aspects of the Toyota Production System and other lean tools therefore can also apply to improve the processes of care service delivery.

In this study, we present the integrated methodology of utilizing the dimensions of SERVQUAL as a framework that helps the management to identify the criteria to be improved. Then, lean thinking and tools are adopted to improve the targets set in the previous step. In the improving process, a systematic innovation method, TRIZ, is used to generate the initiatives that can improve the service quality for care home service.

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## II. Literature Review

### A. Lean Thinking for Healthcare

An urgent need in USA health care is improving quality and efficiency while controlling costs [2]. Not only in USA, but also around the world the need of providing quality, safe, and cost effective health care service is very urgent. One promising management approach is Lean management, a quality improvement philosophy and set of principles originated by the Toyota Motor Company. However, there are some concerns and questions regarding the adoption of lean principles in health care service. For example, the most likely arguments against the applicability of lean manufacturing concepts to the health care sector are "people are not automobiles" and "each patient is unique." Yet there has been considerable success in applying lean production concepts in other service industries such as insurance and financial services, with exceptionally favorable results reported. Although there are some challenges and questions of implementing lean in health care, lean management can still play an import role in a world that is focused on process, governed by performance measures and, increasingly, guided by a core set of values [3].

Reference [4].state that lean production in health care is mostly used as a process improvement approach and focuses on 3 main areas: (1) defining value from the patient point of view, (2) mapping value streams, and (3) eliminating waste in an attempt to create continuous flow. Reference [5] shows lean principles have positive impact on productivity, cost, quality, and timely delivery of services by demonstrating the lean implementation in two health care organizations, Virginia Mason Medical Center in Seattle and ThedaCare.

Adoption of Lean principles in health care is still in its relative infancy, although many results have already been achieved by organizations that are consistently achieving excellent outcomes at lower costs [6], [7]. The Lean philosophy has a cumulative impact as it begins to define an organizational culture. In order to achieve broader transformation and sustainable breakthrough for each health care unit, we still need to study further on the application of lean thinking in broader

perspectives in health care system, especially to meet the rise of the elderly care service, quality, and service curves in health care.

### *B. Service Quality & SERQUAL*

As mentioned above, the care home service can be treated as an extension of primary health care service. For hospitals, publicly-acknowledged quality indicators such as the Hospital Consumer Assessment of Healthcare Providers & Systems (HCAHPS) and Press Ganey surveys provide benchmarks in various fields of quality. These measurement systems provide comparable measures for both the quality of care as well as the overall satisfaction of patients. In addition, the Baldrige Criteria provide a valuable framework for measuring performance and planning in an uncertain environment.

In the field of the quality of service study, SERVQUAL is a commonly used tool. Reference [8] identified the gap between the perception and expectation of consumers on the basis of five attributes, namely, reliability, responsiveness, assurance, empathy and tangibles to measure consumer satisfaction in the light of service quality.

From the literature survey, it is observed that some studies have proved the reliability of SERVQUAL model. As in [9], SERVQUAL instrument among several tools for measuring patient satisfaction is the most widely used tool. Reference [10] considered the perceived quality as one of the antecedents of patient satisfaction and compared perceived quality with the expected service quality on the basis of SERVQUAL model to measure the satisfaction level of a patient. As shown in [11] SERVQUAL helps understand what the customers' value is all about and how well an organization meets the needs and expectation of consumers of hospitals. Reference [12] mentioned all the five dimensions of the service quality in SERVQUAL instrument are significant and reliable in a health care setting. Therefore, the application of SERVQUAL in the healthcare service is appropriate.

Reference [13] applied Taiwan Customer Satisfaction Index (TCSI) to measure patient satisfaction in Taiwan. TCSI is the modification of American Customer Satisfaction Index regularly used by ACSI institute to evaluate patient satisfaction in hospitals in the U.S.A. (American Customer Satisfaction Index). TCSI is an econometric model that considers five latent constructs, i.e., perceived quality, customer expectation, perceived value, image, overall satisfaction and loyalty, reliability, assurance, access, communication, responsiveness, courtesy, empathy, and tangibles.

Brady and Cronin suggested a hierarchical model to measure perceived service quality considering three primary dimensions viz. interaction quality, physical environment quality and outcome quality consist of attitude, behavior, and experience (interaction quality); ambient conditions, design, and social factors (physical environment quality); waiting time, tangibles and value (outcome quality) respectively. The quality of service is not an operational issue only, the psychological side the customers should be taken into account. As shown in [14], [15] patients define quality of health service more on the basis of attributes viz. respect and compassion than technical competence of doctors and staff.

Yu Cheng et al., in their research on the medical service in Taiwan, applied Kano's model to measure satisfaction of patients. Following Kano's model, they considered three antecedents of satisfaction one dimensional attributes, must be attributes and attractive attributes. The one dimensional attributes comprises of some variables viz. comfort, convenience, capacity, modernized system of treatment, medical ethics and commitment to the patient. Must be attributes consist of some variables viz. professional technology, quality of drug, quality of doctors, expense rationality etc. Attractive attributes explain two other variables viz. community relations and contribution to the public activities.

Therefore, the Kano's concepts and the additional attributes of SERVQUAL can be integrated to present a modified SERVQUAL for measuring the quality of care service and customer satisfaction. Such a new framework is used to exam the values that can be improved for care service. Then the lean thinking is adopted to analyze the value streams to meet the quality attributes and criteria.

### *C. Service Improvement & TRIZ*

Reference [11] clearly related services as acts, process and performances. Reference [12] enhances Zeithaml & Bitner's original definition asserting that services are specific applied competences (knowledge, skills and experiences) in acts, performances and processes targeting benefits. Relevant literature generally uses three perspectives to describe service innovation. Reference [14] identified six innovation models—radical, incremental, ad hoc, ameliorative, recombinative, and objectifying. Several vectors: provider competence, service characteristics, technology characteristics, and customer competence (patients can be taken care of at care home), have been changed.

Traditionally, the effectiveness of new service design and improvement is unpredictable as service design relies largely on inspiration and the past experiences of service designers. By integrating TRIZ problem-solving tools and its knowledge base, the authors propose a new TRIZ-based approach to address this weakness in service design and improvement.

TRIZ provide a systematic and effective problem solving process that covers all service design activities. To eliminate formulated contradictions effectively, TRIZ provides a set of powerful tools and principles, such as ARIZ, 40 inventive principles and Contradiction Matrix, etc. Among them, the 40 inventive principles and the 4 separation principles are considered one of the most accessible and useful TRIZ problem resolution techniques.

Practical examples have shown that these principles are not only effective in eliminating contradictions in engineering problems [16], [17], but also they are equally effective in handling service problems [18]-[20]. Therefore, TRIZ can be used to eliminate the wastes in the value streams that have been identified by the modified SERVQUAL framework.

## III. Research Methodologies

In this section, we present a systematic framework and procedures of improving the quality for care home service. Like many other methodologies, there are four basic stages in the problem solving process: "define the problem," "generate solutions," "evaluate solutions," and continuous improvement. Based on these, we extend this process to come up with 7 steps.

1. Examining the care receivers' needs (dementia, disability, ageing, illness, factors to be concerned), specifically for care home in Taiwan
2. Identifying the quality dimensions for care (nursing) home service with SERVQUAL framework
3. Exploring the possible positive outcomes of lean thinking in care service
4. Using lean thinking to analyze the waste
5. Implementing systematic improvement efforts in healthcare with TRIZ principles
6. Measuring the service quality, customer satisfaction, and value for care service
7. Conducting continuous improvement

Step 1. Examining the care receivers' needs (dementia, disability, ageing, illness, factors to be concerned), specifically for care home in Taiwan.

From the perspectives of marketing research, it is essential to identify the main service contents which represent the customer's need. The service providers are keen on satisfying the customers' need means that service can create value towards the customers. Therefore, the first step of service innovation is to identify the service contents clearly.

Step 2. Identifying the quality dimensions for care (nursing) home service with SERVQUAL framework.

Once the main service contents are defined, the service designer needs to examine the deeper interaction between the service receiver and service giver. Service blueprint is a useful tool that can be used to investigate the interfaces and activities where the customer's needs are met.

Step 3. Exploring the possible positive outcomes of lean thinking in care service.

In order to conduct a systematic and holistic analysis on service innovation, we can establish key constructs and the corresponding criteria for each construct.

Step 4. Using lean thinking to analyze the waste.

Before the TRIZ inventive rules can be applied, for any specific service sector we need to build up service parameters table that is mapped from engineering one. In other word, the established service parameters are based on the engineering parameters table.

Step 5. Implementing systematic improvement efforts in healthcare with TRIZ principles.

Following the previous steps, the main service contents, key interfaces between the service giver and receiver, and parameters table are identified and available. Next, PZB model can be integrated with TRIZ method to examine the contradiction.

Step 6. Measuring the service quality, customer satisfaction, and value for care service.

In this step, the contradiction and service gaps will be resolved by applying the contradiction matrix which provides standard TRIZ solutions and the corresponding rules. Hence, the innovation problem is translated into standard problem. Next, inventive rules are applied to find the standard solution. Finally, the standard solution is transformed to solve the original problem.

Step 7. Conducting continuous improvement.

The final step is to evaluate the effectiveness in term of cost, quality and satisfaction.

## IV. Service Improvement for Care Home Service

*Step 1: Examining the Care Receivers' Needs (Dementia, Disability, Ageing, Illness, Factors to Be Concerned), Specifically for Care Home in Taiwan.*

Reference [21] identified three models of health care service for the elderly: (1) medical model; (2) social model; (3) health promotion model. For medical service, it is mainly provided in hospitals and the nursing home equipped with professional staff. According to the regulation set by the National Health Insurance Administration (NHIA) in Taiwan, all citizens are required to join the national health insurance plan. All medical treatment will be paid by NHIA. In this study, we focus on the long term care related service which is not covered by NHIA. The care receivers have to pay for themselves or they need to buy the insurance plan that covers those service.

Ministry of Health and Welfare, Ministry of interior, Council for Economic Planning and Development, and Veteran Affairs Administration are responsible for the elderly care service. Since the resources are limited and the needs are very huge, there is an urgent demand of quality and cost effective care service. The types of care service and the type of care receivers needs are listed as shown in Table I.

TABLE I
Care Service Types and Receivers' Needs

| Service type | Type of care receivers' needs |
|---|---|
| Nursing home | The elderly with chronic diseases<br>Patient need some medical service after released from hospital |
| LTC home | The elderly with minor chronic disease |
| Assistive | The elderly cannot move independently, need some professional level of nursing service |
| Dementia | Psychological illness with motion ability |
| Comfort | The elderly can move independently, some cleaning service are needed |

*Step 2: Identifying the Quality Dimensions for Care (Nursing) Home Service with SERVQUAL Framework.*

The SERVQUAL model compares expectations with perceptions of service received across five broad dimensions of service quality, namely; tangibility; reliability: responsiveness; assurance; and empathy. In the early works of service quality for health care; [20]-[22] pointed out that even SERVQUAL is designed to measure functional quality, not technical ones, the applicability of SERVQUAL for health care service is high. However, technical competence is the baseline standard of quality. From the technical perspective, the medical, social,

cognitive, and emotional elements should be taken into account.

In this study, both technical and functional attributes are considered. Based on the framework presented in [22], the attributes of functional quality for health care service is a modified version of five dimensions with 22-item scale stated as follows.

**Tangibles:** physical facilities, equipment and appearance of personnel;
Modern looking equipment
Physical facilities are visually appealing
Employees who are neat in appearance

**Empathy:** caring, individualized attention;
Operating hours convenient to customers
Employees who give customers personal attention

**Assurance:** knowledge and courtesy of employees and their ability to convey trust and confidence;
Behavior of employees instills confidence
Customers feel safe in their transactions
Employees who are consistently courteous

**Reliability**: ability to perform the promised service dependably and accurately;
When promise to do something by a certain time, does so
Sincere interest in solving problems
Provide service at the time promised

**Responsiveness:** willingness to help customers and provide prompt service.
Tell customers exactly when services will be performed
Gives prompt service
Employees never too busy to respond to customer requests
Arrangements to assist customers in emergencies

Some papers argued that the importance values should be part of the measurement tool. It is possible that there exists some difference for each dimension among different industries. For instance, [22] found tangibles dimension seem to have no significant effect on customer satisfaction in the public hospitals, it is almost equally influential with empathy in the private hospitals context. Furthermore, some dimension can be omitted in their analysis [23]. One second order factor model is proposed by [23] is shown in Fig. 1.

*Step 3: Exploring the Possible Positive Outcomes of Lean Thinking in Care Service.*

The key concepts of lean thinking are to increase the value for the customer and reduce the wastes in the process of service delivery. In steps 3~5, the core tasks are to define the value from customer and patient perspective, eliminate the wastes by lean thinking, and improve the status quo to the ideal.

Regarding to identify the value or possible positive outcomes, the tool commonly used in lean thinking is "value stream mapping." However, before the mapping process, the target should be identified in advance. Reference [23] presents a useful tool, so-called V-P designer. V-P designer is a systematic framework to illustrate what the customer's "like" and "dislike." To produce more initiatives which can meet the customer's "like" is the way to clarify the target to pursue for. The V-P designer is shown in Fig. 2.

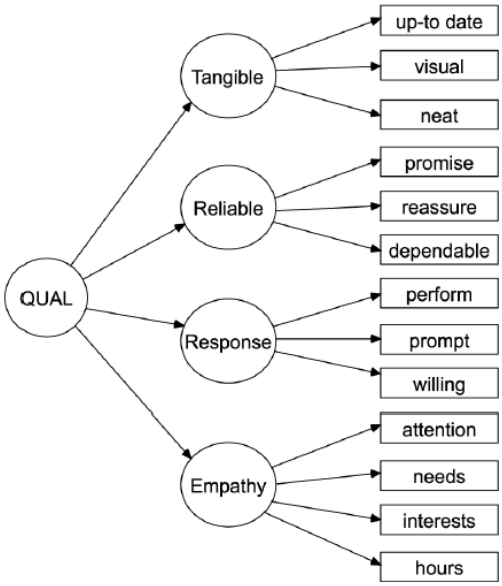


Fig. 1 Second order factor model based on servqual

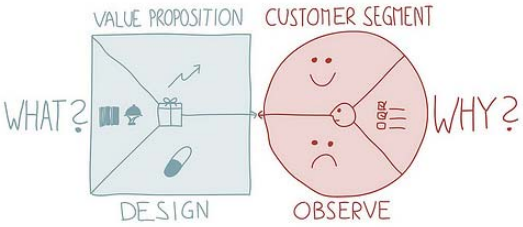


Fig. 2 V-P designer

V-P designer helps the manager more systematically work towards achieving how to solve the product/service-market fit or problem solution fit. In other words, building/offering service that customer really wants.

*Step 4: Using Lean Thinking to Analyze the Waste.*

By following the same thinking addressed in the previous step, the "dislike" items can be focused on the wastes to be eliminated. To diagnose the wastes in care home and try to eliminate them can reduce the processing cost and increase the values to the residents. In Table II seven wastes of lean thinking are applied to detect where the waste is. More in-depth analysis can be conducted to obtain a thorough list of wastes. Then failure mode and effect analysis (FMEA) can be applied to analyze the causes behind the wastes to find the roots of the wastes.

TABLE II
SEVEN WASTES IN HEALTH CARE SERVICE

| | |
|---|---|
| Excessive motion | Poor floor layout<br>Poor work flow design |
| Waiting time | Waiting for response after service request<br>Waiting for personal help<br>Waiting for rehabilitation service<br>Poor scheduling of the facility<br>Delay caused by poor skilled staff |
| Over production | Large batches of food and supplies preparation<br>Poor capacity planning<br>Poor labor rotation and rationing<br>Material and service become obsolete<br>Over stock |
| Unnecessary processing time | Fragmented workflow<br>Unnecessary process flows<br>Interruption by accident |
| Defects | Service failure<br>Rework, service recovery<br>Harms to the Customers |
| Excessive resources | Resource capacity too high<br>Redundant activities<br>rehabilitation |
| Unnecessary /inefficient handoffs | Unnecessary approval |

*Step 5: Implementing Systematic Improvement Efforts in Healthcare with TRIZ Principles.*

Although TRIZ originally was applied in the field of solving engineering problems, it can also be used to cope with the problem in the field of service improvement. Follow the same logics in engineering problem solving, we need to identify the attributes that affects the customers' satisfaction level. For those attributes, there exist some contradiction and gaps need to be resolved. Before we use TRIZ contradiction matrix, we need to translate the engineering parameters into attributes of health care. Parts of the TRIZ parameters for health care service are demonstrated in Table III.

In the previous step, service quality gaps have been measured by computing the difference between the expectations and perceptions by SERVQUAL model. In this study, a survey and expert interview are conducted. Those negative relationships are resolved by the inventive rules of TRIZ methodology

TABEL III
TRANSLATE ENGINEERING PARAMETERS INTO ATTRIBUTES OF HEALTH CARE

| TRIZ parameters and description | | Apply ICT and illustrate TRIZ parameters | |
|---|---|---|---|
| Parameter | Description | Parameter | Description |
| Speed | Object speed | Responsive | Service delivery speed and timeliness |
| Power | Attempt to change the object state interaction between sub-system | Supply capacity | When demand is change, the impact of capacity services will how to change |
| Pressure | Receive strength of sub-system | The variety of need with time change | The variety number of need |
| Shape | External shape | exterior | Sense characteristics |
| Sub-system stability | Maintain completely and healthy ability | Functional | The usability of care system and equipment |

*Step 6: Measuring the Service Quality, Customer Satisfaction, and Value for Care Service.*

In health care service organization, the perception of service quality is more human dimensions related. That is functionality oriented, not technicality. It does not mean the technical competence is not important. In fact, the technical competence is the baseline. In Taiwan, the evaluation of technical performance of the care service is based on the classification of the organization. The accreditation and health care auditing administration will report the performance periodically. Another important reference of the technical competence is the words-of-mouth. It is also very critical in Taiwanese society.

Since the functional quality attributes are concerning *how* the service is delivered, the gap analysis between the customer's perception and expectations.

The effectiveness of the improvement of the previous steps is evaluated with SERVQUAL quality attributes. Those customer-base quality attributes are very straightforward. Consistently monitoring of those attributes allows administers to learn of the quality gap and identify the problem in specific area.

*Step 7: Conducting Continuous Improvement.*

According to key philosophy of Toyota Production System, there is no finish line for pursuing excellence. In the previous steps, the implementation of Lean thinking and SERVQUAL in health care service are clearly explained and addressed. For Taiwanese care home service, there is one more aspect regarding the family piety spirit, i.e., resident's relationship with his/her offspring need to be considered.

## V. CONCLUSION

In this study, we used SERVQUAL model as a framework of service quality and presented a template for health care leaders to use Lean principles. SERVQUAL model offers the organization to assess the state of its implementation in their organizations. The care receivers benefit come from a joint focus on improving the work life for care service providers and nursing home staff, improving processes to prevent systemic errors, reducing stress levels, and reducing waste so that staffs can spend more time on and focus more on patient care.

The TRIZ methodologies are also adopted to generate new improvement initiative that can help the organization to solve the service problem or create new values for the customer. The healthcare organization benefits in a long-term perspective due to reduced capital costs and ongoing expenditures, growth opportunities created by freed-up capacity, and an improved reputation that results from better quality and service.

In fact, many management and operations tools in other industries can be applied successfully to health care. Lean principles hold the promise of reducing or eliminating wasted time, money, and energy in health care, creating a system that is efficient, effective, and truly responsive to the needs of patients the "customers" at the heart of it all. Building Lean thinking culture requires new habits, new skills, and often a new attitude throughout the organization from senior management to front-line service providers. To the manager, it is necessary to

keep in mind that creating a culture of Lean is to create an insatiable appetite for improvement.

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