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Facility Layout Design and its Impact on the Healthcare Service Quality in Teaching Hospital and Pediatric Teaching Hospital in Sulaymaniyah City

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ABSTRACT

This paper explores the relationship between the physical facility layout of the Sulaymaniyah Pediatric Teaching Hospital and Sulaymaniyah Teaching Hospital and the quality of healthcare service dimensions using the correlation coefficient and linear regression model. It is concluded that there is a statistically significant correlation between facility layout design of the hospitals and the quality of healthcare services offered, in addition to the causal relationship, as a regression, between the facility layout of the public hospitals and the quality of the healthcare service they offer. The recommendation for the two hospitals suggested is improving the quality of healthcare service through redesigning the physical facility layout design.

Keywords: Facility Layout, Healthcare Service Quality, Sulaymaniyah Hospitals
JEL Classifications: N75, R53, I18, I31

1. INTRODUCTION

Contemporary organizations, either private or state sector, focus more on the quality as far as the quality is directly relevant to achieving customer satisfaction, particularly in service industry. This is due to the fact that customers interact directly with the service (Fatah et al., 2014). One of the fields that directly affect the quality is facility layout design as it is used for producing and offering the service. Coinciding with the technological developments and diversity of needs, it is necessary for organizations to change the internal design of their facilities in order to fulfill a high level of service quality and best flow of the production operations with least cost and time possible.

Facility layout in industrial and service organizations is considered as one of the most important options that cannot be left behind by any means or for any reason. This is due to the fact that the facility layout should be synchronized with the technological developments and diversity of needs. Consequently, organizations are forced to redesign their internal places of production and service in order to achieve a high quality level of service, or better flow of production processes with lowest time and cost possible, as it is obvious that a bad facility layout design extremely affects the quality of services in a direct way. Moreover, it leads to procedures complexity and wasting customers time in the public hospitals, in addition to reducing the motivation of employees. This study focuses on the Sulaymaniyah Teaching Hospital (STH) and Sulaymaniyah Pediatric Teaching Hospital (SPTH) employees and physician staff and patients as a community, and random sampling method is used to conducting the survey related to the impact of the hospital's facility layout of the quality of healthcare service within their workplace and the hospital as a hole. Literature

review introduces general concepts of facility layout design and the meaning of service quality in the context of healthcare. The relationship between the independent variable and dependent variable is studied in terms of correlation and regression depending on the respond of the participants' viewpoint captured through a questionnaire form. Data analyses by Statistical Package for the Social Sciences (SPSS) 23 and the results are discussed to conclude that the current facility of both STH and SPTH have impacts on determining the quality dimension of healthcare service. Hence, redesigning some aspects of the hospital is proposed to improve the healthcare service quality.

It is known that an unsound facility layout directly has a negative impact on quality of services such as complicating the procedures, wasting customers time, particularly in public hospitals, in addition to reducing the workforces' incorporeal and moral. It is likely that the best way of determining the location of the facility and redesigning its layout is the model that involves reducing the flow among the different units as much as possible. The healthcare institutions and hospitals are the domain in which a high flow of workers and equipment is noticed and observed (Khwajah, 2003).

The research problem addresses the weakness of the quality of healthcare service offered by the STH and SPTH in terms of the building and facility. This problem has been observed through visiting the two hospitals as customers and dealing with their services, as the researchers are citizens in the city of Sulaymaniyah in which the two hospitals are located. It is noticed that the different departments and units need to be redesigned in order to decrease the flow of patients among those departments. This is because the current facility does not provide efficient flow in the movement and transfer of the patients among the departments by which its impact will be reflected on increasing the time of offering the service, in addition to abnormal crowd on some department compared to other departments. To formulate this problem, what is the role of the facility layout design for the two hospitals in implementing the quality of healthcare service is mainly questioned.

The importance of this paper depends on the fact that there are a limited numbers of studies on the role of the facility layout in quality of healthcare service in hospitals owned and administered by governments, particularly in Sulaymaniyah city hospitals. To study and finding the causal relationship between the two variables is important not only for the administration staff in the hospital, but also for the workers, and patients, customers and visitors.

This study also pursues to determine the most important conditions must be available in healthcare service to guarantee a high level of quality and consequently the customer satisfaction. It also attempts to reveal the most remarkable difficulties challenge the administration of the hospital while they offer their services, in order to be able to take control over them and reduce their negative impacts, hence, the exchanged benefit between patients and hospitals will be achieved and the dissatisfaction of employees will also be demolished, in addition to investigating the extent to which the administration of the two hospitals care about the quality of healthcare service offered to the customers through improving the facility layout design.

The methodology of this research starts from presenting the study problem and the importance of the study, in addition to its goals. The methods of collecting data and its analysis are shown. Literature review covers the concepts of facility layout and healthcare service quality. The empirical part covers the discussion of the results obtained from the analyzed data and the value of r and the model of linear regression equation is proposed. Finally the conclusion and suggestion is presented.

2. LITERATURE REVIEW

2.1. Facility Layout

Facility layout design is considered to be a strategic decision, which involves the best layout for placing the machines and specified equipment in order to start the operations and production processes, the local points of the direct contact with customers, particularly in service organizations. This is due to ease of the flow of materials and workers and information between various units and departments within the firm. This is done effectively by facility layout design process (Muhammed and Al-Fathl, 2003). Facility layout is defined by Al-Faihan (2011) as determining the best place for the production equipment and means in the way that ensure the stream of the production processes efficiently and effectively, in addition to the determination of the suitable places of the servant departments. Moreover, facility layout takes into account the side of raw material inventory, work in progress inventory and final product inventory (Al-Faihan, 2011). It is also defined as the process that aims at achieving the physical organization of the manufacturing units and work stations and machines and inventories and service units within the production system in the company (Mohsin and Najjar, 2012). According to Ubaidat (2008) facility layout is designing the factory and selecting the relative location for every administration, unit, process, machine, auxiliary operations and all other activities that are considered as part of the operations within one manufactory. Ubaidat (2008) defines the facility layout as selecting the relative location for each section, unite, process, machine, assistant work and other activities that are considered as part of the operations within a plant or manufactory.

One of the comprehensive definitions available in the literature is the definition of Al-Faihan (2011) as she defines facility layout design as determination of the best location and place for the production equipment in a way that insure the flow of the production process effectively and efficiently, in addition to determine the proper e places of the service unites, raw material stores and work in progress inventories and final product inventories. Mohsin and Najjar (2012) define the facility layout as the process in which it aims achieving physical organization of the production units and workstation and machines and inventories and service units within the production system in the company. There are four important points must be taken into consideration when a facility layout of healthcare institutes are designed according to Hamuud and Fakhury (2009) which are design of the healing environment, enhance the operational efficiency of the healthcare atmosphere, and planning the infrastructure of the healthcare service, finally the sustainability of the infrastructure.

Thus, we define the facility layout design for the hospitals as organizing the places of the units, branches and various departments and medical equipment and laboratories in order to ensure as high flow of the processes of healthcare services as possible within the hospital.

The firms aim behind facility layout is reducing risks associated with operations regarding human resources, simplifying and easing the control and auditing process, providing flexibility facilitating the coordination and direct communication, in addition to effective use of available workforce and rising the morale of the workers and the exploitation of the available space efficiently and effectively (Ubaidat, 2008).

With regard to the hospitals, facility layout design aims to achieve the following (Abdul-Qadir, 2015):

a. To distinct improve of the flow of the information, material, and workers movement. In other words, to reduce the bottleneck, which disturb the movement of individuals and materials and equipment inside the facility, which results in decreasing the size of flow of materials and individuals and service departments, can produce and offer their services effectively
b. Easing the audit and control process and coordination, supervision and monitoring, cooperation and direct communication, improving the relationship with the customers and between departments
c. Effective use of workforce and rising the morale of the workers, in addition to guarantee and insuring the good work condition and reduction of risks associated with the operations when it comes to human resources
d. Utilization and employing the equipment, worker and available area effectively and efficiently
e. Providing a flexible work atmosphere and improving the flexibility of the production system.

The facility layout reflects many practical and strategic inclusions due to the fact that it represents one of the fundamental decisions that determine the efficiency of the company operations in a long term and its ability on achieving the competitive advantages within the frame of the available levels and the type of the processes, the flexibility of the production system, costs and the degree of the contact with the customers and their impression on the firm. The effective and efficient facility layout is likely to help the organization in achieving the competitive advantages have been built on qualitative differentiation and cost and the ability to delivery on time. The practical life has approved that the companies which adopt a good facility layout can achieve the following according to Mohsin and Najjar (2012):

a. High compensation of the area and equipment and workforce
b. Distinct improvement of the flow of information, material and the movement of the individuals and workers
c. Improvement of the morale of the employees and assuring a good work condition
d. Improving the relationship with the customers
e. Improving the flexibility of the production system.

There are four main types of facility layout design according to Hamuud and Fakhury (2009) which are used in the industrial and service institutions. These types are process facility layout design, product facility layout design, and cell product facility layout design, and fixed facility layout. With regard to the facility layout design of the hospitals, the process facility layout design type is the best fit. Hence it will be explained in detail.

2.2. Process Facility Layout Design

This will be designed according to the specified processes, as each activity will be processed according to the specialty. This can be achieved by specifying units and departments involve the similar and heterogeneous activities and tasks (Muhammed and Al-Fathl, 2003). Process facility layout has many advantages according to Mohsin and Najjar (2012). Such as achieving high level of flexibility to produce variety of products and easing the use of materials, workers and technology with a general use, the possibility of continuing the production processes if a disrupt happened in any unit within the plant, the ability to change the process of production and the volume of product without needs to change any machine and ability to produce according to demand with small batches, enhancing the customer satisfaction due to the high variability of product and improving the employees performance as a result of the high specialization of the departments and units. Moreover, Al-Faihan (2011) refers to some of the disadvantages of the process facility layout, such as low average of product, long time of production due to repeating the change and setup time change because of change from a product to another, high handling cost due to difficulty in controlling the flow of materials for product differentiation, difficulty in balancing between the capacity of production stations, high volume of work in process inventories which yields in requiring a broad area and high cost, difficulty in planning and controlling production which yields in complexity of scheduling and frequent change of production schedules.

2.3. Healthcare Service Quality

Quality plays an important role in designing the service and marketing it, as it is significant for service provider and beneficiaries. Moreover, the service institutions perception to the importance and role of implementing the concept of total quality in achieving competitive advantage, hence the special organizations on auditing the quality of services (Al-Thamur, 2008). To measure the quality of service, it is necessary to find standards as characteristics of quality according to the type of the service and the activities performed by the service provider. In general, the sides and topics that can be taken as dimensions for measuring the quality in services involve the extent of the availability of equipment and standards of contemporary techniques, the facilities that guarantee the required comfort and the whole feature of those physical facilities, the hub of strengthening the relationship with beneficiaries and the level of the experience and knowledge of the servants (Swaidan and Al-Barwary, 2009). There are many axis to determine the general frame of quality measure in service organizations such as the tangible factors, dependability and reliability, responsiveness, assurance and the degree of trust, empathy.

Some of other researchers suggest a number of standards can be used as a measure tool for the quality of service (Al-Thamur,

2008) reliability, service availability, safety, integrity, knowledge and perception, responsiveness, efficiency and effectiveness, tangible evidences, communications. With regard to the quality of healthcare service, World Health Organization defines it as offering the diagnostics and therapeutics activities for every patient equally to guarantee the best healthcare results according to the contemporary medicine science, the optimal cost and lowest risk. According to Swaidan and Al-Barwary (2009) the quality of healthcare service is the managerial philosophy of healthcare centers that can fulfill the patient need through it, in addition to the goals of the healthcare centers.

The importance of the quality of healthcare service, as Al-Azzawi (2005) states, can implement many benefits and advantages for the patient such as focusing on the patient needs to fulfill them, achieving high performance of quality in all functional locations and not just shortening it in services, taking a series of necessary procedures to implement the quality performance, continuous inspection for all operations and alienate all secondary and unnecessary activities in producing services and offering it to the patients, investigating the needs of the facilities for continuous improvement and developing the performance measurements, developing team-working method to solve the problems and improving the processes.

The hospitals are social and service centres that have goals as part of community and under its impact at the same time. According to Abdullah (2013) guarantee the physical and psychological health for the patients, offering high quality healthcare service that can satisfy the patients, to develop the healthcare services and drawing new plans and policies for the healthcare services, developing the communication channels and improving them between patients and healthcare service providers, enabling the healthcare centers to continually grow and perform their tasks effectively and efficiently.

2.4. Dimensions of Quality of Healthcare Service

There are many dimensions discussed in the relevant literature for service quality, such as (tangibility, reliability, communication, responsiveness, understanding needs, accessibility, competency, credibility, security, and empathy). However, several dimensions have been discussed with regard to healthcare service quality, such as the following dimensions that have been listed according to Farid (2008):

a. Tangibility: The tangibility of quality healthcare service is the main concern of the marketers in this filed through emphasizing on its components and representing the service physically. The outside appearance of the facility and its attractiveness, the physical appearance of the rooms, workers, physician, their kindness, the quality of the food and its taste, time of meals, the cleanness of the hospital facility, are the characteristics that can be used to exhibit the tangibility of healthcare service quality
b. Reliability: Reliability is the most important dimension in determining the customer's perception of the evaluation of the service and its quality. Reliability refers to suitability and the possibility to rely on the performance of the service provider
c. Responsiveness: After reliability, it has the priority to the customer's perception of the healthcare service quality, and it is the responsiveness of the physicians and nurseries and workers in the hospital to the demand of the patient, and commitment to the appointments and due times, reducing waiting time, undelaying the test appointments, easiness and speed of the procedures of entrance to and exit from the hospital and returning the insurances if available
d. Assurance: Means credibility and security and competency and courtesy, by which they all make the fourth dimension of the quality of offered health service
e. Empathy: As the fifth dimension consists of ease of access and communication and understanding the customer. The main aim of this dimension is building a personal relationship and that the customer is special to the company or the service provider, and consequently, gaining the customer loyalty.

3. DATA AND ESTIMATION TECHNIQUES

3.1. Data

The characteristics of research population: According to the features such as gender, job title, education level. The population of this study consists of the Teaching Hospital and the Pediatric Teaching Hospital in Sulaymaniyah city. The sample of the study consists of the doctors, employees patients and visitors. The characteristics of the sample of this study are described according to two features as follows:

3.1.1. Gender

Table 1 shows that the percentage of males is higher than the percentage of females as the former is 52% and the latter is 48%.

3.1.2. Education

The Table 2 exhibits that the holder of bachelor degree is the highest ratio by 48% of the entire sample, followed by the technical diploma holders by 40% and the lowest ratio is for higher education degree by 3%. The table also shows that only 9% of the participants have no education or just graduated from preparatory school, including the patients.

3.2. Testing the Plausible Integrity and Stability

To test the plausible integrity the questionnaire form has been evaluated by two academic expertise and after taking into account their viewpoints and notes on modifying some of its clauses and questions it was adjusted. The stability of the form has been tested using the Cronbach's alpha as it was (0.748) as it is shown in Table 3. This value is accepted and indicates that the statements of the survey have a high level of stability. Table 3 exhibits the value of Cronbach's alpha as it is obtained from SPSS 23 results.

3.3. Model Specification

Figure 1 exhibits the proposed model of the study which represents the correlation and regression relationships between the two variable of the study, namely, the facility layout of the hospitals as an independent variable, and the quality of healthcare service as a dependent variable.

Descriptive methodology is used in writing the theoretical part of the research, by explaining the concepts according to the available literature in books, journals and papers. With regard

to the practical part, dada have been collected and analyzed by SPSS-23 application program as a questionnaire has been designed according to the variables of the study.

The questionnaire form consists of three parts, the first section is announced for collecting the personal data of the participants, the second part announced for measuring the independent variable, namely the facility layout design of the two hospitals, the third part is announced for collecting data about the dependent variable using these dimensions (reducing the risk, facilitating controlling process, optimal utilization of the workforce, well exploiting the area, flexibility) namely, the healthcare service quality with the dimensions of responsiveness, reliability, guarantee, tangibility, and emotionality. Simple correlation is used to find out the value of r and the simple linear regression is used to find out the linear equation value (Y=A+bX).

Figure 1: The study model

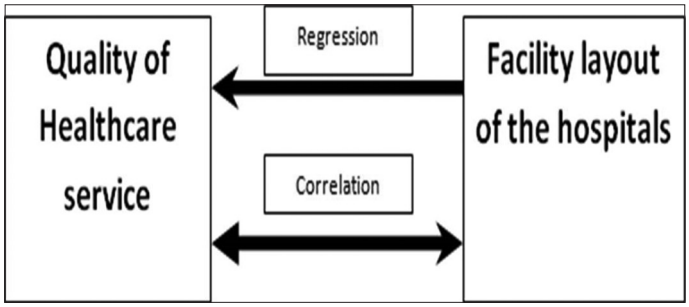

Table 1: The frequency of genders of the sample

Gender	Frequency (%)
Male	17 (52)
Female	16 (48)
Total	33 (100)

Table 2: The frequency of education level of the sample

Education	Frequency (%)
Preparatory school and below	3 (9)
Technical diploma	13 (40)
Bachelor degree	16 (48)
Postgraduate degree	1 (3)
Total	33 (100)

Table 3: Cronbach's alpha

Cronbach's alpha	Nunber of items
0.748	20

The study depends on the following hypotheses to answer the questions of the problem as in the Table 4. There has been put two hypotheses for this study, with a null hypothesis and alternative hypothesis for each hypothesis of the study.

4. EMPIRICAL RESULTS

4.1. Testing the First Hypothesis

Simple Pearson correlation has used to measure the strength of the relation between the two variables of the study, and to test the first hypothesis. As it appears in the Table 5, the value of the correlation (r) between the two variables, namely, facility layout design and healthcare service quality is (0.452) in the level of significant (0.07). Consequently, there is a statistically significant correlation between the facility layout and healthcare service quality and the first hypothesis is approved, or first (H_0) is rejected and first (H_a) is accepted.

4.2. Testing the Second Hypothesis

Simple regression method has used to measure the slop and form the formula (Y=A+bX) and to test the second hypothesis. Table 5 exhibits the value of b between both independent and dependent variables, as it appears that the independent variable (facility layout) has an impact on the dependent value (healthcare service quality) with a statistically significant level of (0.07) as it is exhibited in Table 5. It can be noticed that the value of beta equals (0.53), which means that the linear equation is:

$$Y= A+0.53X$$

Accordingly, the second hypothesis is accepted, or the second (H_0) is rejected and second (H_1) is accepted.

5. CONCLUDING REMARKS

This paper has investigated the impact of physical layout design of public hospitals in Sulaymaniyah city, namely, Teaching Hospital and Pediatric Hospital in Sulaymaniyah, in terms of correlation and regression. As a result of analyzing data, it has been concluded that there is a correlation between hospital's facility layout design and the healthcare service quality in the addressed hospitals. It is also concluded that there is a regression relationship between

Table 4: Null and alternative hypotheses of the study

Hypotheses	Null hypothesis	H_0	There is a statistically significant relationship (correlation coefficient) between the facility layout of the hospital and the quality of healthcare service	H_a
The first hypothesis	There is no statistically significant relationship (correlation coefficient) between the facility layout of the hospital and the quality of healthcare service	r=0		r≠0
The second hypothesis	There is no statistically significant regression between the facility layout of the hospital and the quality of healthcare service	b=0	There is a statistically significant regression between the facility layout of the hospital and the quality of healthcare service	b≠0

Table 5: Value of the correlation and regression

Correlation and regression	Dependent variable: Healthcare service quality		
	Beta	r	Significant
Independent variable: Hospital facility layout	0.53	0.452	0.007

Simple regression/correlation is significant at the 0.05 level (two-tailed)

facility layout design and healthcare service quality, as paying more attention to the facility layout leads to a noticed increase of achieving quality in healthcare service in public hospitals. It is been clarified that the current facility layout of the studied hospitals are not in the expected level of physicians, employees and patients regarding decreasing the risks and providing work flexibility.

It is also concluded that the facility layout of the studied hospitals has satisfied the majority of workforce in terms of area utilization and facilitating audit process although unsatisfied group among the sample is not described as few. It has also been evidenced that the quality level of the offered health services is acceptable except the dimension of tangibility which is not in an acceptable level.

Some future recommendations are proposed to the hospitals and potential researchers. The researchers recommend the administration of the state hospitals to give more consideration to the facility layout for the different departments and units and redesigning the current facility layout in order to fix the rapid development in the field of health services. It is also recommended to focus on redesigning the facility design according to concentrate on providing safety and reducing the risk. It is also necessary to focus on redesigning the local facility layout to provide higher flexibility for the manpower, taking into consideration the privacy of healthcare service and its need to operational flexibility. The researchers also advise the healthcare service supervisors to pay more attention to the quality of healthcare service in terms of tangibility and make the healthcare services more visible, which is not be achieved without optimal utilization of local facility layout and buildings of the hospitals.

Finally, it is recommended that the necessity of concerning the facility layout design by the healthcare institute in Kurdistan region from the beginning of the construction and establishment, taking into consideration the correlation and regression between it and quality of healthcare service, in addition to the effective role it has in achieving the aims and goals of healthcare organization as it is concluded in this study.

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