

The Impact of Technological Innovation on Service Design: A Survey Study at the Dowaly Private Hospital

Nabeel Mohammed Ali Hussein and Shifa Balasim Hassan

*Technical College of Management-Baghdad, Middle Technical University, 10047 Baghdad, Iraq
dcc0011@mtu.edu.iq, Shifa-2017@mtu.edu.iq*

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Abstract: The research aims to analyze the impact of technological innovation on service design at Dowaly Private Hospital. It included a study of the role of technological innovation in meeting the needs of patients through the design of services and the extent to which patients' satisfaction with the provided medical and health services is achieved. The study was applied in Dowaly Private Hospital to achieve the research objectives and hypotheses. The research problem lies in employing technological innovation at work using modern medical devices and technologies, providing medical and health services that fit the needs of patients, and attracting patients by creating a positive mental image of the hospital in the research sample. A random sample of (110) individuals was selected from specialist doctors, nurses, and units supporting medical activities in the hospital units, representing part of the study population (150). At the 99% confidence level, the correlation coefficient between service innovation and service design is 0.774, indicating a strong positive relationship with statistical significance. That there is a statistically significant association between service innovation and service design is the first sub-hypothesis of the fundamental hypothesis, and this proves it. The statistical analysis results proved that the interest in technological innovation was at a high level in the design of services that achieve patient satisfaction, with the weakness of the training and development activity and the lack of opportunity for the medical staff to join the specialized training courses. The study suggests the need to pay attention to the internal arrangement of the hospital and waiting and using electronic reservation systems.

1 INTRODUCTION

Technological innovation is considered one of the essential subjects in the business sector and has gained the attention of writers and researchers. Many researchers have presented various concepts related to technological innovation from multiple perspectives. Reference [1] referred to technological innovation as the contribution to presenting new ideas and knowledge that change human lifestyle and capabilities. Reference [2] View it as continuously transforming knowledge and ideas into new services, processes, and systems to benefit the organization and stakeholders. Reference [3] indicated a new match between patient needs and physical product or service solutions. Reference [4] pointed out that technological innovation is represented by radical and incremental changes in services and processes through the provision of new services in response to the renewed needs of patients. As for service design reference [5], service design represents a framework for creating shared value that focuses on interactions,

exchanges, and benefits between service providers and patients. Reference [6] stated that it is the process of planning and organizing staff, infrastructure, communications, and physical service components to achieve interaction between service providers and patients and improve their service quality. Reference [7] indicated that service design is an approach to balance patient needs and work to create a smooth and high-quality service.

The adoption of technological innovation by the organization has an influential role in designing a service that represents a new solution to a specific problem, as service design methods aim to provide a new solution in response to a specific need, problem, or opportunity through the organization's selection of the most appropriate alternative from design methods that indicate the organization's ability, capabilities, and resources it possesses, providing a suitable work environment and offering distinguished services compared to competitors. Increasing technological innovation in medical and health service design helps facilitate patients' access to the services they need,

fulfilling their requirements and satisfaction, thus achieving the goal that the organization seeks. Therefore, it has become necessary to spread the culture of technological innovation and adapt it in designing services according to needs to develop the organization's activity in providing services efficiently and effectively.

2 RESEARCH METHODOLOGY

The research aims to determine the level of hospital interest in technological innovation present in the research sample, to identify the level of service design present in the research sample, and to determine the dimensions of technological innovation that have the most impact on service design in the research sample. This is based on testing the research sample's correlation between technological innovation and service design. It also measures the impact relationship of technological innovation and its dimensions on service design in the research sample. The importance of the study lies in providing a knowledge and conceptual framework about technological innovation and contributing to developing the hospital's capabilities in adapting technological innovation to design medical and health services that meet patients' needs. The research contributed to identifying the main aspects of providing a suitable work environment by focusing on the dimensions that achieve technological innovation. Service design also helps hospital management analyze patient requirements and maintain competitiveness in the changing environment. The Private International Hospital was chosen as a sample for the study because it is the only hospital in the private sector in Iraq that works according to an electronic reservation system through the computer system (intranet), which gives it importance in achieving smooth delivery of medical and health services in all hospital units without delay. Due to this importance, it was chosen as the study site. The researcher took a random sample from the population that included hospital workers, and the target groups were medical specialties and units supporting medical activities. Their number was (150) individuals, and a sample of (110) individuals from these specialties was chosen from the population [8]. The questionnaires were distributed to the sample, and all were retrieved and valid for analysis. After surveying the study sample's views at the Private International Hospital on the study variables under the questionnaire items, the researcher determined that the descriptive analytical

technique was the most appropriate. It shows how hospital management employs technological innovation to continuously provide multiple medical and health services according to patient needs. The hospital management works on adding new features to its medical and health services, improving its current services by simplifying the procedures for providing them, and encouraging the medical staff to present new ideas to develop medical service delivery processes. The problem of the study can be crystallized by posing the main question (Is it possible to design a service that meets the patient's needs and achieves their satisfaction through technological innovation in the Private International Hospital)? From this, the following sub-questions branch out:

- 1) What is the level of interest in technological innovation and service design in the researched hospital?
- 2) What are the most influential dimensions of technological innovation in service design in the hospital under study?
- 3) Is there a relationship between technological innovation, its dimensions, and service design in the hospital under study?
- 4) Is there an impact of technological innovation on service design in the researched hospital?

As for the hypotheses of this research, they are: The first primary hypothesis: There is a statistically significant correlation between technological innovation and its dimensions and service design and its dimensions in the hospital under study. Several sub-hypotheses branch from the central hypothesis as follows:

- 1) There is a statistically significant correlation between service innovation and service design.
- 2) There is a statistically significant correlation between process innovation and service design.

The second hypothesis is that technological innovation statistically affects service design and its dimensions in the hospital under study. Several sub-hypotheses branch from the central hypothesis as follows:

- 1) Service innovation and service design have a statistically significant impact.
- 2) There is a statistically significant impact between process innovation and service design

3 THEORETICAL FRAMEWORKS

3.1 Technological Innovation

Researchers' definitions of technological innovation have varied due to its multiple dimensions and differences in their perspectives. Most of these definitions focus on developing and improving services and processes to achieve satisfaction by meeting needs and desires for the provided services in line with the objectives that the organization seeks to achieve, pointed to a set of scientific and technical steps that aim to introduce or improve services and processes to ensure excellence in offering the new service [9]. Emphasized adopting a new idea related to providing a new service or developing current service delivery processes [10]. The organization's ability to establish a new service by combining innovative behavior, strategic capability, and internal technological process [11], [12]. It as the fundamental driver for developing competitive capability and identifying ways to improve business and performance on an international scale [13]-[15].

The fruitful efforts of research and development activities can be widely relied upon as a measure of investments in technological innovation, as many developed countries determine the value of research and development activities in the annual financial budgets of organizations, which in turn leads to an increase in the value of their shares in the market [16]. Interest in technological innovation leads to achieving the organization's differentiation, survival, growth, and performance enhancement goals [17]-[19].

3.2 Dimensions of Technological Innovation

Technological innovation involves introducing a new service or improving an existing service, and it may be designing a new process or improving an existing process to meet needs and desires, adapt to changes, seize opportunities, and increase the organization's ability to compete with others [20]. The dimensions of technological innovation include the following:

3.2.1 Service Innovation:

A study in [21] indicated that service innovation involves providing a new benefit that did not exist before or changing the characteristics of the provided service in a better way to meet needs and desires. Ideas related to providing a new service can be

obtained from multiple sources, including research and development departments, market research, marketing intelligence, suggestions, and information from salespeople and employees in the organization.

Service innovation is necessary for organizations to deal with competitive pressures, changing tastes and preferences, technological advancement, and variations in demand patterns, and to work according to customization to meet individual needs and desires [22]-[24] also indicated that making modifications and developments to current services aims to respond to needs and desires, as continuous improvement procedures on the current service do not stop at the patient's perception and expectation of those requirements. Still, rather hospitals strive to provide what is beyond the expectations of patients and competitors.

3.2.2 Process Innovation

Designing a new process requires identifying all production requirements and supplies, from preparation and setup to transformation processes [25], until the service is ready for delivery and use according to the requirements and specifications. The improvement of procedures, methods, and techniques used in service delivery processes through their systematic study to improve the current process, provide better patient value, and increase the ability to face competitors [26]. Improving the current process requires conducting a comprehensive study of all adopted procedures, methods, and techniques to enhance the process performance better than before the improvement [27].

3.3 Service Design

Service design is an experimental process that facilitates the formation of new interactions between various actors operating inside the socio-material configuration [28]. These techniques not only make a true impact on patients but also contribute to implementing changes in a manner that results in genuine value [29]-[31]. Designing a service requires grasping the patient's experience and that the value of that experience should be reflected in how people, organizations, and technology interact. Organizations desire to accomplish some objectives through service design [32], [33]. These objectives include the promotion of creativity and the participation of target consumers in developing or improving the service. Additionally, the desired outcomes of service design include creating new value and creating shared value among multiple stakeholders. Organizations consider

several factors when designing services to meet patient needs. Patients evaluate the level of service provided by comparing the gap between their expectations and their perception of the actual performance of the service, which is determined through several dimensions as follows:

3.3.1 Tangibility

It represents the appearance, internal arrangement, furniture, and decor in the hospital that creates a comfortable and enjoyable atmosphere for the patient, as well as the machines, equipment, communications, and technology used in providing the service, which reflects on the quality of service provided to patients [34]. Physical evidence of the service is considered as facilities when providing it, represented by physical facilities, equipment, staff, and communication equipment [35], [36]. These mechanisms have the potential to transform these capabilities into a dynamic nature, thereby enabling them to create a new configuration of resources that allows them to maintain a competitive advantage.

3.3.2 Reliability

It represents the hospital's ability to provide the services it promised to deliver to patients while ensuring they receive the service regardless of changing circumstances [37]. It represents the hospital's ability to accomplish and provide the service to the patient correctly and accurately from the beginning [38].

3.3.3 Responsiveness

Responsiveness represents hospital staff's ability to assist patients and deliver services that meet patients' needs and desires [39]. Developing responsiveness capability entails identifying and reacting to unforeseen events. The event management system possesses functionalities for monitoring and notifying when particular planned or unplanned events transpire [40].

3.3.4 Assurance

Trust represents the ability and knowledge of employees to make the patient feel confident and reassured when dealing with the hospital [41]. Also indicates that it ensures the patient is not exposed to injury or harm when using the service [42].

3.3.5 Empathy

Empathy means respect, appreciation, and the spirit of friendship that service providers exhibit toward the patient; in other words, the behavior of the service provider toward the patient [43].

3.4 Testing for Validity, Reliability, Normal Distribution and Multicollinearity

This includes validity and reliability tests for the questionnaire form (Validity test of the questionnaire) and verifying whether the data has normal distribution and multicollinearity as follows:

- 1) Virtual validity. The study questionnaire form was evaluated by a group of academic referees from business administration departments in various universities. The questionnaire received agreement from most of the referees, and their observations played a prominent role in reviewing and reformulating several items and making adjustments in light of the comments and suggestions to ensure the accuracy and validity of the measure. On this basis, the form consisted of (44) items.
- 2) Construct validity. The reliability of a questionnaire is represented by its ability to express the purpose for which it was designed using statistical methods. One of the most commonly used measures is Cronbach's alpha coefficient, which evaluates the internal consistency reliability of sample individuals' responses to questionnaire items. It ranges from 0 to 1, with an acceptable value greater than or equal to 0.60. Table 1 illustrates the validity and reliability of the study variables. The verification process's success level seeks to demonstrate the items and dimensions for which the study questionnaire was designed [43].

Table 1 shows that all Cronbach's alpha values are acceptable as they are more significant than (0.60), ranging between (0.653-0.791) for the study variables (technological innovation) as an independent variable and (service design) as a dependent variable. The overall value for this scale is (0.960), and according to this high value, the questionnaire is valid and reliable in its variables.

Table 1: Cronbach’s alpha coefficient for the reliability and validity of the questionnaire scale.

Variables	Cronbach’s alpha value A	$\sqrt{\alpha}$ = Reliability coefficient	Number of paragraphs
Service innovation	0.669	0.818	7
Process innovation	0.791	0.889	6
Technological innovation	0.806	0.898	13
Tangibility	0.708	0.841	7
Reliability	0.666	0.816	6
Responsiveness	0.741	0.861	6
Assurance	0.703	0.838	6
Empathy	0.653	0.808	6
Service design	0.778	0.882	31
Total	0.960	0.979	44

3.5 Testing for Normal Distribution using Kurtosis and Skewness values

The normality test uses statistical methods to determine the nature of the data distribution, represented by the values of Kurtosis and Skewness. Table 2 shows that the results of Kurtosis values and Skewness for the study data are all within the standard limit of (± 1.96), which confirms that the data distribution for all dimensions of the study variables is usually distributed

Table 2: Test of normal distribution for study data using kurtosis and skewness.

Study variables	Dimensions	Kurtosis	Skewness
Technological innovation	Service innovation	-0.193	-0.107
	Process innovation	-0.578	-0.051
Service design	Tangibility	-0.624	-0.432
	Reliability	-0.088	-0.416
	Responsiveness	-0.142	-0.417
	Assurance	-0.011	-0.350

3.6 Multicollinearity Test Between Study Variables

The term “multicollinearity” refers to a statistical phenomenon that reflects the presence of a correlation between independent variables in a regression model. This connection is what causes the issue of multicollinearity to occur. When there is a strong correlation between two variables, it is advisable to exclude one since this implies that the variables are measuring the same thing and that the influence between them cannot be detected. The Variance Inflation Factor (VIF) and Tolerance value, both required to be greater than or equal to 0.10, along with the inverse of the VIF, which must be less than or equal to 10, are commonly utilized metrics for

detecting multicollinearity. Table 3 clearly shows that the values of the Variance Inflation Factor (VIF) for the independent variables are acceptable as they are less than (10). Also, the Tolerance values were more significant than (0.10), indicating no multicollinearity problem.

Table 3: Multicollinearity test between study variables.

Multicollinearity coefficients			Independent variables
Contrast Inflation Factor VIF	The value of Tolerance	Contrast Inflation Factor VIF	
2.111	0.547	2.111	Service innovation
1.687	0.624	1.687	Process innovation

Table 4: Mean, standard deviation and coefficient of variation for the independent variable and its dimensions.

No	Independent variable	Mean	SD	C.V%	Importance
X1	Service innovation	4.64	0.659	14.20	First
X2	Process innovation	4.47	0.761	17.02	Second
X	Technological innovation	4.56	0.710	15.57	n=110

Table 4 summarizes the ranking of the level of interest in technological innovation from the hospital, as the average reached (4.56), which is higher than the hypothetical mean of (3). The hospital administration’s commitment to technological innovation is affirmed, demonstrating consistent high-level engagement in service and process innovation. The standard deviation of 0.710 indicates minimal dispersion in the responses from the study sample. At the same time, a coefficient of variation of 15.57% suggests no significant differences among the participants’ responses regarding this variable.

Notably, service innovation ranked higher in interest than process innovation.

3.7 Statistical Descriptive Analysis of Study Variables

Table 5 presents the ranking of interest in service design inside the hospital, with an average score of (4.61), above the hypothetical mean of (3). This affirms the hospital administration’s commitment to service design, demonstrating consistent high-level performance across its dimensions (tangibility, reliability, responsiveness, assurance, and empathy), with a coefficient of variation of 13.38 percent, indicating no significant discrepancies among the study sample’s responses for this variable. Additionally, a standard deviation of 0.617 reflects a low degree of dispersion in the responses relative to the arithmetic mean of the study sample participants. In terms of interest, certainty ranked higher than empathy. Evaluating the primary and secondary assumptions of the correlational connection. By calculating the value of the correlation coefficient (r), we can decide the nature of the link between technical innovation and service design, as well as the degree to which it is strong. To investigate the relationship between technical innovation and the design of services, Table 5.

It is clear from Table 6 the following:

- 1) A correlation value of 0.823 at a confidence level of 99% indicates a substantial relationship between the independent variable (technological innovation) and its dimensions and the dependent variable (service design). Additionally, this relationship is significant. The validity of the main hypothesis, which argues that there is a statistically significant link between technical innovation and service design, is supported by this evidence.
- 2) A correlation value of 0.774 at a confidence level of 99% demonstrates a strong positive connection between service innovation and service design. This correlation is statistically significant and demonstrates that it is robust.

The first sub-hypothesis of the main hypothesis, which states that there is a statistically significant association between service innovation and service design, is correct due to this evidence.

- 3) The correlation coefficient between process innovation and service design is 0.807, and the degree of confidence is 99%. This indicates a strong positive association between the two, and this correlation is statistically significant. For this reason, the second sub-hypothesis of the first fundamental hypothesis, which asserts that there is a statistically significant link between process innovation and service design, is accepted.

Table 5: Mean, standard deviation and coefficient of variation for the dependent variable and its dimensions.

No.	Dependent variables	Mean	SD	C.V %	Importance
Y1	Tangibility	4.67	0.571	12.23	Second
Y2	Reliability	4.55	0.675	14.84	Fourth
Y3	Responsiveness	4.62	0.592	12.81	Third
Y4	Assurance	4.67	0.566	12.12	First
Y5	Empathy	4.53	0.682	15.06	Fifth
Y	Service design	4.61	0.617	13.38	n=110

3.8 Testing the Main and Sub-Hypotheses of the Impact Relationship

The primary and sub-hypotheses related to the influence relationship between the study variables were tested. The type and strength of the relationship between (technological innovation) and (service design) were determined using the simple linear regression equation to analyze the regression (effect) coefficient (B), the coefficient of determination (R²) and compare the calculated values of (t) and (F) with their tabulated values to indicate acceptance or non-acceptance of the hypothesis, as follows: Testing the effect of overall technological creativity on overall service design. Table 7 illustrates the effect of total technological innovation on total service design.

Table 6: Correlation coefficients between technological innovation and service design.

Service design Y	Empathy Y5	Assurance Y4	Responsiveness Y3	Reliability Y2	Tangibility Y1	The dependent variable
						Independent variable
**0.774	**0.719	**0.734	**0.769	**0.717	**0.714	Service innovation X1
**0.807	**0.838	**0.759	**0.872	**0.813	**0.738	Process innovation X2
**0.823	**0.820	**0.789	**0.876	**0.808	**0.741	Technological innovation X

Table 7: The impact of technological innovation on service design.

Significance level P	Calculated F-value	Calculated t-value	Regression coefficient B	Fixed boundary A	Coefficient determination R ²	Mediating variable	Independent variable
0.000	**66.02	**8.125	0.493	2.321	0.599	Service design	Service innovation
0.000	**153.28	**12.381	0.553	2.249	0.651		Process innovation
0.000	**144.36	**12.02	0.612	1.836	0.677		Technological innovation

The regression results demonstrate that technological innovation exerts a statistically significant and positive influence on service design. Specifically, the coefficient of determination ($R^2 = 0.677$) indicates that 67.7% of the variation in service design is explained by technological innovation, while the remaining 32.3% is attributed to other factors not included in the model. The estimated regression coefficient ($B = 0.612$) confirms that a one-unit increase in technological innovation leads to an increase of 0.612 units in service design. Furthermore, the model is statistically robust, as evidenced by significant t-values ($t = 12.02$) and F-statistics ($F = 144.36$) at the 0.01 level, confirming the overall explanatory and predictive power of the model. Accordingly, the hypothesis regarding the significant effect of technological innovation on service design is supported.

4 CONCLUSIONS

The study concludes that hospital management places increasing emphasis on technological innovation, which is reflected in the design and continuous improvement of medical and health services aimed at meeting patients' needs. A strong positive relationship was identified between technological innovation and service design, indicating that innovation plays a key role in enhancing healthcare service delivery. The hospital administration actively employs modern technologies and innovative solutions to provide new medical and health services and improve operational efficiency.

Furthermore, the hospital focuses on optimizing the service delivery process by clearly defining the steps of examination and treatment and reducing the time required for service completion. Efforts are also made to adopt advanced and reputable global technologies to improve service quality. The hospital environment is well-maintained, characterized by cleanliness, order, and a professional appearance of medical staff. In addition, medical personnel demonstrate continuous commitment to service

provision, while management implements mechanisms to collect and analyze patients' feedback regarding service quality. Patient information confidentiality is also effectively maintained.

Based on these findings, several recommendations are proposed. The hospital should further strengthen process innovation to enhance the quality of medical and health services, particularly through improving the physical environment and simplifying service delivery procedures. Medical staff should be encouraged to contribute innovative ideas for improving healthcare processes. Greater attention should be given to maintaining the hospital's physical environment, including waiting areas and interior organization, as these factors directly influence patient satisfaction.

It is also recommended to expand the range of medical specialties available in order to attract new patients and retain existing ones. The hospital should develop structured crisis management plans to address potential service disruptions and ensure transparent communication with patients. Management should also reinforce fairness and objectivity in dealing with patients' concerns while providing adequate support and assistance. Overall, continuous improvement in service quality is essential to enhance patient satisfaction and ensure the hospital's long-term performance and competitiveness.

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