

Characterizing Healthcare Interaction System as a Service System

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Abstract In recent years, services have generated a various interest and uptake by the industry and by researchers. A worldview of the service system is a system contains many systems that have an interaction out of values proposition. Services science used service system to gain a real insight of characterizing any system of organization as a service system. This article provides a review contains service system concepts and applying a framework that been evolved in previous searches and employed to characterize a healthcare system as a service system. Through interviewing, survey and, modelling data by IDEF0 then apply the framework to characterizing the system. The research shows after applying the framework that healthcare organization system has all the qualities of service system.

Keywords — Service, Service System, Service Science, Healthcare Organization.

I. INTRODUCTION

Organization's first goal is to provide the best service to clients, which in turn leads to an increase in organizations leadership and growth in its industry [1]. Since services are the core of many businesses, researchers had conducted extensive studies in the domain of services to develop and improve them. Over the time, different concept stemmed from service domain like service systems, service science and services sciences, management, and engineering (SSME) [2].

This paper describes the basic concepts and definitions in a different field related to services topic and then focused on studying services provided by one of the largest healthcare organizations in Saudi Arabia. Service system characteristics framework was applied to healthcare organization to discover if we can characterize specific organizations as a service system.

II. PROBLEM STATEMENT

Healthcare organizations in Saudi Arabia suffer for decades from the weakness of provided services, and the need for a service system to automate and develop the process of delivering different healthcare services [3]. In recent years Saudi government have given healthcare organization a high priority and focus on the significant of service quality [3]. All of these encourage a lot of organization to implement internal and external service systems that can help individuals on daily operations.

There are only a few studies that focus on testing healthcare organization system characteristics as if it reflects service system characteristics or not [1]. Thus, this study discusses the possibility that one of Saudi Arabia health organization is implementing service system or not, by collecting information about the module of the system in certain areas for measuring proposes. These area include system processes, resources, access right, entities, stakeholder, interactions, networks, outcomes and, ecology. This was done through surveys and interviewing staff and users of this system. All of this help to apply the proposed framework to characterize the system as service system of the healthcare organization.

III. LITERATURE REVIEW

In the past ten years, a lot of researchers became more interested in the field of services and information system in organizations. Many papers and studies (1,2,7) conducted and focused on how to get the optimal benefit from available resources in the organization to reach desired value.

Service defined in 2006 [2] as utilization of all companies' resources to cover customer needs. However, [4] defined the service as an application of competencies for another, in other words providing requests and needs of others. In business field's service demand, cost, and challenges increased and companies focused on providing better services for efficiency. [5] Defined the service as an objectivist view of adopted subject through the specific domain of a socially constructed temporal event. He considered the services as other technical innovations that have owned lifecycle started from design to development and analysis until it reaches implementations. [4] Described five primary characteristics of service event as simultaneity, perishability, customer participation, heterogeneity, and intangible. In a further study, (4,10) re-defined service as an exchange benefit between the providers and the client. They include self-services in the definition with eliminating the provider role in provisioning. The exchange degree can be determined by the degree of unique client input and unique providers' competence that is important to gain the benefit.

With technological revolution, the concept of service improved as well from a different aspect, and many organizations applied service systems. [5] Clarify that service providers and clients could be individuals, firms, or organization, and the most

important point is that service providers and clients work together to add value. [4]described the concept of service systems as a value creation network contains important elements: people, technology, organization and communicate with other service systems to add value. [4] Also discussed how service systems could be used in organizations to add value. [10] Noted that added value to the organization is the most important goal of service systems, so it is a very critical element and should be taken into consideration in the service development concept. [5] In his research mentioned that service systems, in general, are multidisciplinary, because the natural of human service provider prevent individuals from having time, knowledge, skills and resources all at once. Service science is the basics to understand other fields like service and service system. [4]Found a challenge in developing a common vocabulary to be used in describing a variety of multidisciplinary fields of system services. They defined the service science as studying the demand for the economic exchange of one or more of the information system for benefit another system. Service science field develops the science of the service system and its interactions. [5]Defined service science as a set of sub-disciplines, models abstracted from the service universe, such as service system and service are an abstraction of service science. [9] Define the service science as a collection of multidisciplinary fields by studying value creation and service system. The aim of the service science is to initiate the common concept to help and improve the communication between disciplines [5].It can be concluded that service science has multidisciplinary of fields and others service terminology comes under service science.

Another important concept in the field of services and service science is the academic discipline called Services Sciences, Management, and Engineering (SSME) that focus on the challenges of developing services to become more innovated [2]. [4] Defined SSME as an application of normative service science. [2]Mentions in his research that the University of California lately started new graduate level certificate in SSME,which emphasize how much this domain has been the ceednter of researchers' attention.

The literature review showed that many organizations and universities around the world had started adopting service systems in their internal operations. It is can be concluded that all researchers agreed on the important of service systems and its role in increasing services efficiency to lead to customer satisfaction.

IV. HEALTH INFORMATION SYSTEM

Healthcare management needs to take rapid and decisively decisions about health systems in general and all personnel and operations within that system. Therefore, healthcare management requires specific kind of information that is accessible, accurate and current.

This paper describes one of the largest healthcare organizations in Saudi Arabia which implements OASIS, Open Architecture Specialist Information System. It is designed to make healthcare management information available, easy to access and controllable. This system combines the strength of an ORACLE relational database with the flexibility of an MS-Windows front end. It has a broad range of facilities such as Clinical, Specialty, Financial and Administrative systems. The system is also modular in design, with modules addressing specific functional requirements.

This paper will describe the service system from one view of a module that called a Patient Appointment System as service system of outpatient management. This module supports the needs of hospitals and clinics in facilitating patient information necessary for keeping patient medical records. This module has various features that make the process easier and quicker. The system of patient appointment can be altered by the staff or by the patient them self from the website. It gives the ability to registrations services with reminders to the patient for their appointments.

V. METHODOLOGY

A. Data Collection

The research goal is to map service system framework in Saudi healthcare organization to investigate if the currently implemented information system reflects a service system or not. The research will use OASIS as a real case study to apply the framework to it. An interview has been conducted with IT staff in the organization about healthcare system services and interview questions are in (Appendix A, p6). Based on the findings, these services will be analysed as to whether they reflect service system characteristics or not. Finally, a summary of the important characteristics of organization services conducted is presented.

B. Data Modelling Using IDEF0

IDEF0 that helps in modeling the actions, activities, and decisions of any system or organization, to communicate the functional perspective of a system is used. IDEF0 aims to model the function at the highest level. Figure 1 illustrates a simple description of IDEF0 content.

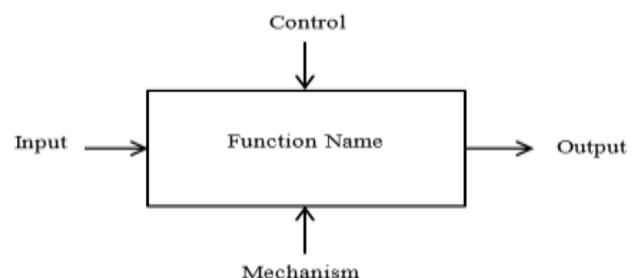


Fig. 1 IDEF0 description

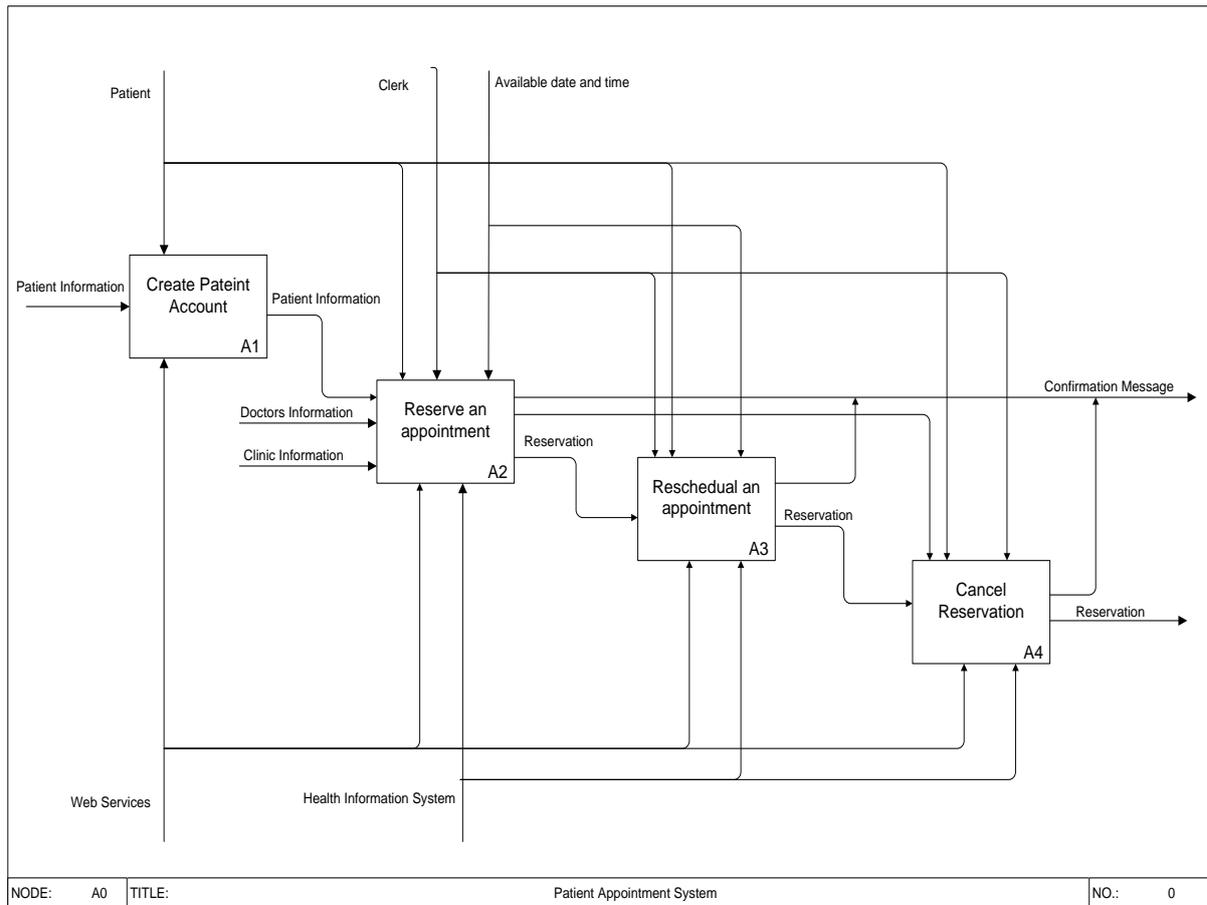


Fig. 2 IDEF0 of Patient Appointment System

- **Function name:** described what should be accomplished in the system.
- **Input:** showed data enter to system function.
- **Control:** data or object required producing the output, and it works as a condition for the function.
- **Mechanism:** methods used to perform the function.
- **Output:** showed data produced by the function at the end of it.

IDEF0 is proven in its effectiveness and easiness in modelling system activities in detailed[1]. Due to this, IDEF0 was used to model Patient Appointment system. Fig. 2 illustrated the model.

IDEF0 shows the basic functions in Patient Appointment system, and these functions are:

1) **Create Patient Account:** The role of this function is set up a new account for the patient contains the patient name, age, addresses and phone number. This information is input by the patient to create account function, and the output is Patient information. The controller of this function is patient online through web service that works as a mechanism for creating patient account function.

2) **Reserve an Appointment:** This function is the core of patient appointment system. It focuses on patient reservation step with doctor information, patient information, and clinic information as an input to the function. The output is confirmation message about completing reservation process. Available date and time control reservation function, as well as patient or clerk as they perform reservation function online through web service for the patient or internal information system for the clerk.

3) **Reschedule an Appointment:** This function important if there is any conflict in appointments necessitated to reschedule it again. The input to reschedule appointment function is original appointment information, and the output is confirmation message with new appointment information. The controller could be the patient himself through web service or by clerk through hospital internal information system, also to appropriate new date and time consider a control for the function.

4) **Cancel Reservation:** The input for cancel reservation function is reservation information, and the output is confirmation message to inform the

patient about completing cancel appointment process. The controllers could be the patient online through web service or clerk from hospital internal information system.

C. Describing Service System Using Framework

Many researchers developed frameworks in service science such as [1] and other proposed framework in service science to enhance IT-driven services innovations. This framework can help in IT case of services innovation. It supports manager in use RFID technology by duplicate IT-driven services innovation. In addition, [1] has illustrated a model called Interact-Service-Propose-Agree-Realize (ISPAR). This model supports the process of service provisioning. It gives a benefit in the service system interaction models by the different between the realization of the service and value proposition.

This research applies [4] framework to measure the service system of an existing system in healthcare organization, where a service system is the basic abstraction of service science. A service system framework has been used by other researchers like [9], [4], [7] and [8] to find out if a specific organization could be categorized as a service system. This framework contains eight characteristics that are: resources, access right, entities, measures, stakeholders, interactions, network, outcomes, and ecology, as the diagram below [Figure: 3]. The goal of this research paper is to categorize Saudi healthcare organization as service system by applying service system framework.

A. Applying the Framework to Patient Appointment System

Based on the data collection, the service system characteristics that are reflected in patient appointment system are as the followings:

1) +organization since resources can improve services and create value for organizations.

Resources can be divided into physical, conceptual and measures.

In healthcare organization, the physical resource contains administrator staff, health practitioners, patient, clinics, pads, medical equipment, computers, medical laboratory, pharmacy, x-ray machines. The conceptual resource contains website, web services, knowledge, policies, information (doctors and consultant), prescriptions lab result, x-ray result, health information system. Measures include health status of the patient, feedback from the patient, visitors, employee satisfaction, and effective pathology.

2) **Access Rights:** Access right means all the regulations that control the access to organization resources. There are four common access rights, which are owned, leased, shared access and privileged access.

The healthcare organization specified its access right as Owned access consists of furniture, medical equipment, medicine, and policies. Leased access Health Information System (HIS) consists of Patient Appointment module, Medical Science Library. Shared access consists of equipment, clinics, medications, and policies. Privileged access consists of an internal website, an internal system, and an international site.

3) **Entities:** Entities described as resources that have a specific role in the service system. Entities can be divided into five different categories: Principal, Producer, Provider, Clients and Object

In the healthcare organization, entities consist of: principal which is the servers used to install the system; Company and Communication Company as a producer; Hospital administrations and IT staff as a provider; patient, doctors, nurse, administration staff and IT staff as a clients; and Object are reserve appointment, reschedule appointment and, cancel

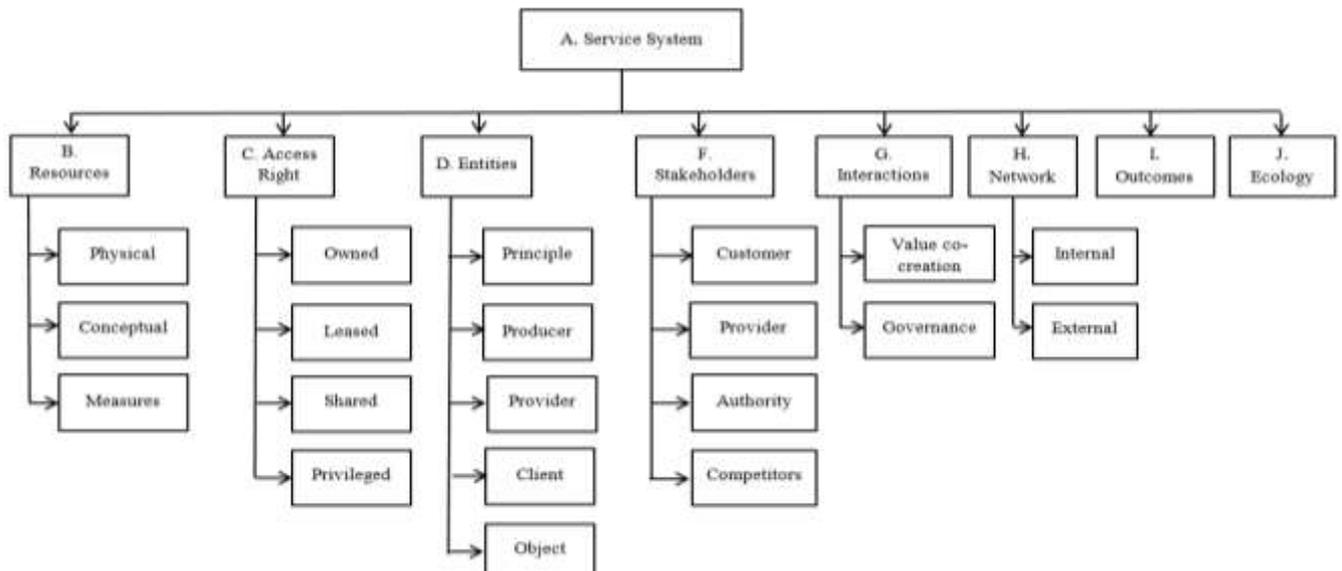


Figure 3: Service System Framework

appointment.

4) **Stakeholders:** Stakeholders in any organization are employees, customers, suppliers and business owners. Previous researches in service system divided stakeholders into customer, provider, authority, and competitor.

In the healthcare organization, the customer is the patient, the provider is hospital administration, the authority is all health practitioners, administration staff, pharmacists, patient and IT staff, the Ministry of Health, and competitors are all hospitals in Saudi Arabia.

5) **Interactions:** It is service system interaction between the entities. This interaction comes through mobilization, integration and, exchange of resources.

The interaction segmented into two parts the first one is value co-creation interactions that include patient service interactions, administration staff interactions, IT staff interactions, clinics admin interactions, health practitioner's interactions. The second part is governance interactions that include Health Information System (HIS) company contract, telecommunications company contract, providers of technology materials, other hospitals, health ministry, and rules and regulations.

6) **Networks:** Network has a key role in the interaction within the service system. The exchange between entities performed by the network is divided into the internal and external network.

The internal networks in the system are administration staff, IT staff, health practitioners, clerk, and Health Information System (HIS). The external networks are the patients and, web services.

7) **Outcomes:** After services accomplished by the interaction of entities that are seeking value co-creation outcomes, the hospital service system had a reserve appointment options, appointment details and, patient information.

8) **Ecology:** The ecology describes ecology as a universe of service system entities. For the hospital service system, it provides service that reduces time and operation efficiency for system users inside hospital and outpatient.

The Table 1 summarizes how all service system characteristic implemented in the healthcare organization.

VI. TABLE 1: CHARACTERISTICS OF A HOSPITAL SERVICE SYSTEM

Service System Characteristic	HealthCare Organization
Resources	Physical: administrator staff, health practitioners, patient, clinics, pads, medical equipment, computers, medical laboratory, pharmacy, x-ray machines. Conceptual: website, web services, knowledge, polices information (doctors and consultant), prescriptions lab result, x-ray result, health information system. Measures: health status of patient, feedback of patient, visitors, employee satisfaction, effective pathology.
Access Rights	Owned: furniture, medical equipment, medicine, policies. Leased HIS: patient appointment module, Medical Science Library. Shared access: equipment, clinics, medications, and policies. Privileged access: internal website, internal system, international site
Entities	Customer: patient Provider: hospital administration Authority: all health practitioners, administration staff, patient, IT staff Competitor: all hospitals in Saudi Arabia
Stakeholders	Customer: patient Provider: hospital administration Authority: all health practitioners, pharmacists, administration staff, patient and it staff, ministry of health Competitors: all hospitals in Saudi Arabia.
Interactions	Value co-creation interactions: patient service interactions, administration staff interactions, IT staff interactions, clinics admin interactions, health practitioners interactions Governance interactions: HIS Company contract, communications company contract, providers of technology materials, other hospitals, health ministry, and rules and regulations.
Networks	Internal: administration staff, IT staff, clinics admin, health practitioners, clerk, HIS system External: patients, web service
Outcomes	Reserve appointment options, Appointment details, patient information
Ecology	Provide service that reduces time & operation efficiency for system users inside hospital and out-patient.

VII. CONCLUSION

Service is the core of the service system that depends on the exchange between providers and client.

Services system is designed and constructed to deliver services that satisfy the needs of clients. Besides, the service science and service science, management engineering is becoming a strategic area of scientific study of both fields the services and system services.

The focus of this study was on service system in one of Saudi healthcare organization. A framework with service system characteristics was implemented in healthcare organization through interviews, to specify what each characteristic contains.

The main strength of applying this framework is identifying variables and interactions among it that are related to the service science concept more than define service system conforming to a specific framework that were recognized for other purposes. This service system framework has a flexible power to characterized class of service systems and can be applied to many kind of service system such as non-traditional or understudied service system. The weakness of this framework is it not has been tested and been applied in wide range of context.

The future work is to use this framework to other modules of the healthcare organization to see a whole view as a result of the service system and analyse the service system based on Service-Dominant (S-D) Logic [6]. In addition, further work would apply the framework to the competitive organizations and developing a tool to facilitate the collection of information about these organizations.

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APPENDIX A

Interview questions with the IT staff of healthcare organization that supervised the patient appointment module.

- 1- Describe the current service system in this healthcare organization within some words.
- 2- List all different offering service that exist with current system
- 3- Could you told us about all basics resources that exist with service system "Patient Appointment module specify whether it is conceptual or physical, created internally or externally and wither if it is leased owned and all privilege or shared access
- 4- Explain the dynamic aspects of the service system "Patient Appointment module" and what does it evolve?
- 5- What are the features of the Patient Appointment module "as service system? Entities? Forces?
- 6- What is your view where the Patient Appointment module will progress? Does it grow and provide service to large numbers of societies? What are the current plans to reach it?
- 7- Could you list all current policies, measures in the organization to discover opportunities for transformative or innovative growth?
- 8- Explain current functions of Patient Appointment module that provide a service?
- 9- Could you tell us the current stakeholder perspective in Patient Appointment module as service system?
- 10-What are the available companions of you organizations? Specify how this competition altered your service modules?
- 11-What are the service process and interactions in Patient Appointment module?
- 12-Explain all forms of exchange that had a role in these interactions? What are the current facilities to exchange?
- 13-Does the service system Patient Appointment module in specific tie to the strategy?
- 14-What do your patients and visitors want? How are the current results perceived?
- 15-What effect on services delivery in Patient Appointment module?