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THE MODERATING ROLE OF IT AUDITING ON INTEGRATED PHARMACEUTICAL LOGISTICS SYSTEM (IPLS), USER SATISFACTION AND LOGISTICS PERFORMANCE OF ETHIOPIAN HOSPITALS

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ABSTRACT

Health is one of the crucial elements for the development of any country and the well being as well as productivity of its citizens. Controlling and auditing the risk that may come from deploying IT for health provision is a key issue in society. This study will assess the moderating role of IT auditing on the relationship among IPLS, user satisfaction and logistics performance of health commodities in Ethiopian hospitals. Data will be collected from respondents in selected Public and Private Hospitals throughout the country using questionnaires by adopting multi stage simple sampling process (Regions, Zones, and Woredas are used to trace hospitals). The study will employ explanatory research design with quantitative approach. The data collected will be analyzed using correlation and regression analyses to investigate the effect of the independent and moderating variables on the dependent variables. The study will have significant contributions for academics, practice, policy and research.

Key words: System Quality, Information Quality, Service Quality, User Satisfaction, Cultural factors, HIV/AIDS Commodities

INTRODUCTION

Information technology (IT) and the information system developed using IT is changing the way business is being conducted. Amoroso *et al* (2015) stated that senior management and business managers do have concerns about computer based information systems (ISs) because in the contemporary business environment, such systems are the lifeblood of any large business. However, Kim and Hu (2019) stated that current research does not pay sufficient attention to the complexities and interrelationships between different aspects of supply chain (SC) integration and the role of ICT in improving different elements of SC performance. Nguyen *et al* (2019) stated that in the context of market globalization, intensified competition and technological breakthrough, businesses have long recognized the critical role of effective IT supported supply chain management in achieving competitive advantage. This is so rare in relation to the health sector and supply chain of medicines. Aditya *et al* (2018) also stated that in the era of digital transformation, IT risk is the main focus for top management because IT risk will not only threaten the IT environment but can also make the company lose its overall business. They further argued that limited knowledge of top management about IT makes it difficult for them to evaluate the effectiveness of IT implementation and, therefore, IT audit became so important to help management to evaluate that IT implementation does not create unacceptable risks by businesses. Amoroso *et al* (2015) described IT auditing as the process of collecting and evaluating evidence to determine whether an information system safeguards assets, maintains data integrity, achieves organizational goals effectively and

consumes resources efficiently. Health is one of the crucial elements for the development of any country and the well being as well as productivity of its citizens which is one of the sectors transformed by information systems. To achieve successfully the Millennium Development Goals, the Government of Ethiopia has developed various programs and strategies in the health sector, one of which is the integrated pharmaceutical logistics system (FMOH, 2010). Integrated pharmaceutical logistics system (IPLS) is the system that can ensure access to quality, safe, affordable and uninterrupted supply of vital and essential medicines (Nigussie, 2017). He further stated that IPLS is the term applied to the single pharmaceuticals reporting and distribution system. It aims are to ensure that patients always get pharmaceuticals they need. IPLS integrates the management of essential pharmaceuticals including pharmaceuticals that were used to be managed vertically and it is the primary mechanism through which all public health facilities obtain essential and vital pharmaceuticals (FMOH, 2010). IPLS integrates the supply chain management of all types of pharmaceuticals (medicines, medical supplies and equipment, and laboratory chemicals and reagents) in the public health sector. In late 2006, the Ministry approved the Pharmaceutical Logistics Master Plan (PLMP) through which, Pharmaceuticals Fund and Supply Agency was established in 2007 by Proclamation No. 553/2007. To execute this mandate, PFSA, in collaboration with different partners who were working in the health sector developed and began implementing the Integrated Pharmaceuticals Logistics System (IPLS) in 2009.

Prior studies tried to assess only the IPLS implementation process as well as challenges and opportunities without indicating what factors influence the performance of IPLS. No prior studies were conducted to observe the antecedents and consequences of IPLS performance involving moderating and mediating variables in a way this study has been designed. This study has also introduced the influence of culture of the people involved and its effect on the performance of IPLS on top of other factors (Romi, 2011). In addition, one basic IT governance tool which influences the utilization of IT in any organization is IT auditing (Woda, 2002). Pathak (2005) described IT auditing as having acquired pre-dominance with the extensive use of information and communication technology in the information processing area. IT auditing is, therefore, defined as the process of collecting and evaluating evidence to determine whether an information system safeguards assets, maintains data integrity, achieves organizational goals effectively and consumes resources efficiently. Hence this research will, therefore, be conducted to assess the moderating effect of IT audit effectiveness on the relationship among IPLS, users' satisfaction and the logistics performance of health commodities in selected private and public Hospitals in Ethiopia. The research will answer the following specific research question.

1. What is the influence of **IT audit effectiveness** on IPLS performance?
2. What is the role of **IPLS performance** on user satisfaction in Ethiopian hospitals?
3. What is the effect of **cultural factors** on user satisfaction in using IPLS in Ethiopian hospitals?
4. What is the influence of **user satisfaction** on logistics performance of Ethiopian hospitals?

LITERATURE REVIEW, RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

In this part, the background literature, theories and research models are used to develop the research hypotheses for the study. This will lay the foundation to answer the research questions of the study.

Role IPLS for Logistics Performance

Real-time tracing and supply chain management of all drugs in a hospital is a challenge in healthcare which requires further developments in information and communication technologies. Berhanemeskel *et al.* (2016) stated that supply chain management of essential health commodities involves a series of activities to guarantee the continuous flow of products from the manufacturer to consumers. Tilahun (2014) also asserted that an accurate quantification based on reliable data is essential for all health commodities but more so for HIV/AIDS related commodities because uninterrupted access for patients must be ensured. Mudzteba (2014) stated that pharmaceutical logistics data are collected, processed, and reported through IPLS, increasing the likelihood of an adequate supply of HIV/AIDS commodities. To contribute to the objectives of an organization, an information system should fulfill some key requirements and this should be evidenced through proper IT auditing (Amoroso *et al*, 2015). Information system effectiveness is the extent to which a specific information system actually contributes to achieving organizational goals, that is, its effect on organizational performance (Hamilton and Chervany, 1981). Prior studies on IPLS emphasized on system implementation predominantly. Those that relate with organizational performance assess only one case study or very limited case Hospitals. Most of the studies were also descriptive by their nature of design. Lastly, almost all studies were limited to public hospitals only in Addis Ababa, the Capital City. In this study, the moderating role of IT audit effectiveness influencing IPLS performance and its effect on logistics performance of HIV/AIDS commodities will be assessed in public and private hospitals with reference to selected Zones and Woredas throughout the country. The study is believed to bridge the gap in previous studies. In addition, culture is believed to influence user satisfaction and system implementation which is a new construct obtained from other studies and incorporated in this study.

Research Model and Hypotheses

In this study, explanatory factors that influence IPLS performance and its effect on logistics performance of HIV/AIDS commodities in selected public and private hospitals will be assessed. The study is believed to bridge the gap in previous studies.

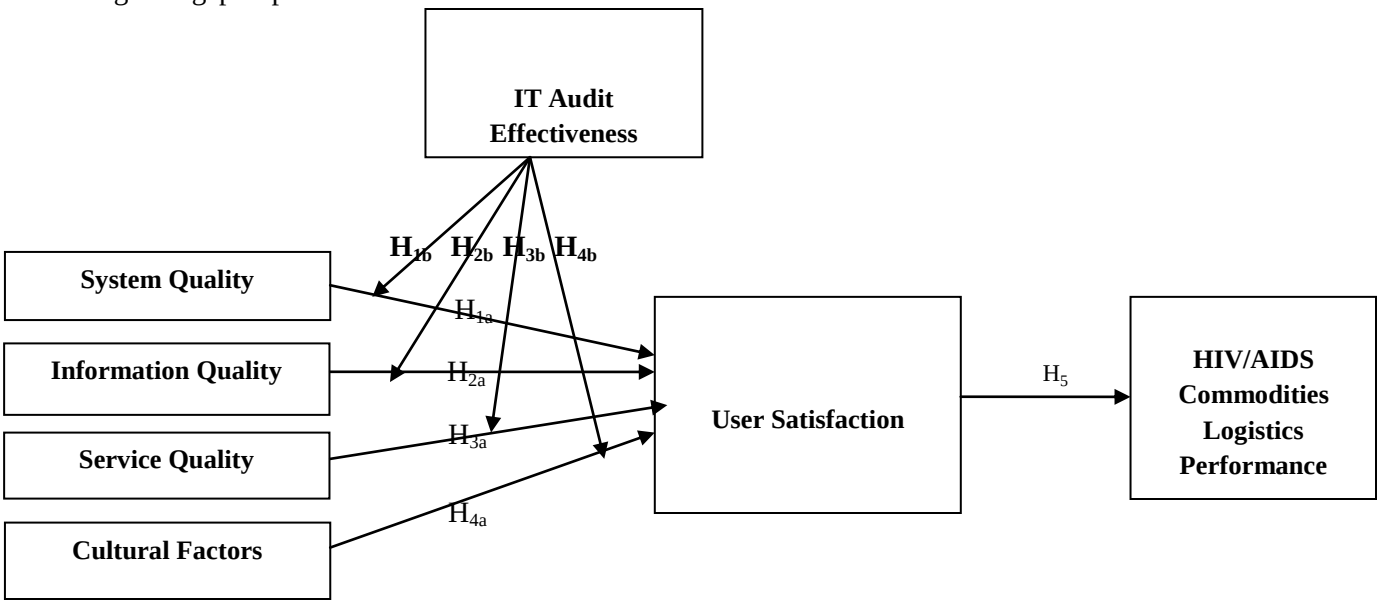

Figure 1. The Conceptual Framework (Based on Sirsat and Sirsat, 2016)

The conceptual framework illustrates how IT Audit effectiveness moderates the relationship among the independent variables (IPLS performance which includes system quality, information quality, service quality, and team culture) and the mediating variable (user satisfaction on IPLS) influence logistics performance of hospitals (the dependent variable). Next is presented the detailed description of each construct and hypotheses of the study. Next is presented the detailed description of each construct and hypotheses of the study.

a. System Quality

According to Halawi *et al*. (2007), Dreheeb, Basir and Fabil (2016) and Sirsat and Sirsat (2016) the term system quality reflects excellence, value, conformity to specification and quality meeting customers' expectations. The value of information system can be realized by improving profit margins for the organization, providing easy-to-use and meaningful applications, and designing easily maintainable system. Thus system quality is an important aspect in IS success. Measures of the system quality which have been used in the literature are flexibility, stability, reliability, usefulness, user-friendly interface, ease of use and response time. Access and retrieval of information when needed, to meet work demands and to return requests quickly have been noted to be inherent to system quality. Hence, according to Halawi et al. (2007), Dreheeb, Basir and Fabil (2016) and Sirsat and Sirsat (2016) system quality positively correlates with user satisfaction and better benefit realization in any organization. Hence, the same applies to IPLS and it can be hypothesized as follows:

H1a: IPLS Quality significantly and positively influences user satisfaction.
H1b: IT Audit Effectiveness positively influences the relationship between IPLS Quality and user satisfaction.

b. Information Quality

Halawi et al. (2007), Sirsat and Sirsat (2016) and many others in Information systems research argued that information system quality concept is related to system output that is useful for business users. The most important informational insufficiency that managers suffer from is plenty of irrelevant information. Information quality problems, such as incorrect information due to program or data errors and irrelevant information arise due to changed user requirements. Some important dimensions studied under Information quality like relevance, understandability, accuracy, conciseness, completeness, being up to date (timeliness) and usability.

Sirsat and Sirsat (2016) further stressed that information quality refers to the ability to acquire information that is sufficient, that meets end-user needs, and is comprehensive in nature. Many researchers in different studies have measured information quality and the most common measures were of timeliness, completeness, ease of understanding, relevance, security, consistency, accuracy and personalization, importance, usefulness, readability etc. Sirsat and Sirsat (2016) found in their empirical study that measuring system characteristics like the content of database, aggregation of details, human factors, response time, and system accuracy positively correlates to user satisfaction and system performance. Hence, for IPLS, it can be hypothesized as follows:

H2a: IPLS information Quality significantly and positively influences user satisfaction
H2b: IT Audit Effectiveness has positive effect on the relationship between IPLS information Quality and user satisfaction

c. Service Quality

The dimension service quality represents the quality of the support that the users receive from the IS department and IT support personnel. Organizational success is delivered by the service provider. On time and error free performance by IS unit improves organizational efficiency (Halawi et al. 2007; Romi, 2011; Sirsat and Sirsat, 2016). Some of the dimensions that are used to measure this success by most of the researchers include Assurance, Empathy, Flexibility, Interpersonal Quality, Intrinsic Quality, IS Training, Reliability, Responsiveness. IPLS services, which are part of the overall IS services, will become better aligned with organizational goals, resulting in improved quality of decision making and improved profitability, better expectancy of customer demands and more accurate sales forecasting (Halawi et al. 2007; Romi, 2011; Sirsat and Sirsat, 2016). Hence, it can be hypothesized as follows:

H3a: IPLS Service quality significantly and positively influences users' satisfaction
H3b: IT Audit Effectiveness positively influences the relationship between IPLS Service quality and users' satisfaction

d. Cultural Factors

In many systems literature, cultural factors are believed to influence the level of diffusion and utilization of an information systems project. IPLS implementation could also be influenced by the national cultural factors which in turn will affect the organizational culture where the IPLS is operated in. Al-Jumeily and Hussain (2014) identified three primary continuums drawn from the national cultural dimensions theory of Hofstede that are used to identify the differences in the cultural factors—individualism/collectivism, uncertainty avoidance, and power distance.

Individualism/Collectivism is the degree to which individuals are integrated within any group. In individualism, the emphasis is on individual roles and rights, where individuals are expected to stand up for themselves, their own family and their own affiliations. In contrast, in collectivism, individuals behave as members of an organization or group, so that their family is that group or organization to which they pay unquestioning loyalty.

Uncertainty Avoidance is defined as the tolerance of a society for uncertainty. It measures the extent of coping with anxiety by avoiding uncertainty. High uncertainty-avoidance cultures implement rules and laws to support plans that are followed step-by-step to minimize unknown and ambiguous circumstances. On the other hand, low uncertainty-avoidance cultures have as few rules as possible, they tolerate changes and accept a changeable environment and situations; these cultures tend to be pragmatic cultures.

Power Distance reflects the way people accept and perceive power differences. High power-distance cultures accept autocratic power relationships, where people are not equal to each other, and their positions are classified hierarchically from superior to subordinates (Akour et al. 2006). In contrast, low power-distance cultures experience more democratic relationships, and equality is practiced by all members of the society, who have the right to criticize and change the decision making of those who are in power (Teo *et al*. 2008). As Romi (2011) affirm, people use technology within a cultural and social context, and these influence how humans behave towards technology. Often a whole host of factors differ across cultures, and these factors include social taboos, political and legal constraints, together with religious, ethical and traditional values. Therefore, technology users across the globe have different

perceptions, styles of thinking, cognitive and cultural values, and assumptions. Hence, it can be claimed that the above argument applies to IPLS as one category of system and it can be hypothesized as follows:

H4a: Good Culture of using IPLS significantly and positively influences user satisfaction
H4b: IT Audit Effectiveness positively influences the relationship between IPLS users culture and users' satisfaction

e. User Satisfaction and Organizational Impact

Halawi et al. (2007), Dreheeb, Basir and Fabil (2016) as well as Sirsat and Sirsat (2016) stated that user satisfaction is defined as the recipient's response to the use of the output of an information system. They mentioned studies which found that user satisfaction closely related with user attitude; therefore, studies which include user satisfaction as a success measure should ideally also include measures of user attitudes. Sirsat and Sirsat (2016) further asserted that user satisfaction can be measured indirectly through information quality, system quality, and other variables. Hence it is used as a mediating variable between system performance and organizational performance (Halawi et al. 2007; Dreheeb, Basir and Fabil 2016). According to Sirsat and Sirsat (2016), organizational impact represents the firm-level benefits received by an organization because of Information System applications. Measures of organizational performance which might be appropriate for measuring the contribution of IPLS is return on investment for profit oriented business organizations. Several authors have developed constructs to measure IPLS impacts on organizations. The success of information systems impacts not only on firm performance but also on industry structure. As stated by Kim and Hu (2019), ICTs are important to logistics because they provide the right information at the right time and place. Operating cost reduction, staff reduction, productivity gain, increased revenues and profits and increased work volume (productivity). A cohesive, well-performing public health supply chain helps build the foundation for a strong pharmaceutical management system, provides essential information for managing health programs and financing mechanisms, and helps to achieve the level of accountability exemplified in the commercial sector. Integration has helped companies learn to deliver good quality products efficiently, on time, and securely to their customers. These improvements have translated into increased profits, more viable companies, and better customer service. Integrated supply chain links all the actors involved in managing essential health commodities into one cohesive supply chain management organization. Integration helps client's access quality healthcare services and supplies (Berhane, 2017). Hence, it can be hypothesized as follows:

H5: User satisfaction of IPLS significantly and positively influences Logistics performance of HIV/AIDS commodities.

RESEARCH METHODOLOGY

Research Design and Approach

The underlying philosophical assumption used here lies in the positivist paradigm. The choice for the positivist paradigm is done because of the fact that the purpose of the research is to develop and validate an empirical model which tests a reality existing out there. The type of research design to be used is an explanatory research whereby the influence that Auditing IPLS use will have on user satisfaction and the logistics performance of the HIV/AIDS commodities in the selected Ethiopian hospitals. Explanatory studies would help manipulate the independent variable to influence the mediating and dependent variables. Explanatory research determines the causal relationships among variables (Saunders et al.,

2012). A quantitative research method using survey questionnaire will be used to conduct this study. As the number of respondents reached will be large enough, it is considered to limit the study using quantitative data only. The units of analyses for this study will be pharmacy professionals of the hospitals to be selected who use the IPLS for their day to day operations.

Target Population and Sample Selection

The target populations for this study are Public and Private Ethiopian hospitals that are currently using IPLS in their pharmacies. The governance structure of Ethiopia divides the country first into Regions (13 in number), then Zones within each region and Woredas within the Zones. Hospitals are available as low as Woreda level making this study highly comprehensive. In selecting sample pharmacies at Woreda level hospitals, the study will employ multi step purposive and simple random sampling. Firstly, some five administrative regions will be selected purposively taking into account their size, pace and stability of the region and representativeness. For instance, Amhara and Oromia regions alone will constitute more than 50% of the whole population of the country. Adding some two or three other regions will make the study quite representative of the whole country. Once the Administrative Regions are identified for the study, to select Zones and Woredas, simple random sampling method will be applied. Finally, after the target hospitals are identified for the research, census of pharmacy professionals in the hospital will be taken.

Data Type and Source

To collect the data from the primary sources, self administered questionnaires will be distributed for the target respondents identified above. Likert scale questions on five point scale (strongly disagree to strongly agree) will be used to measure the variables of the study. The instrument will be customized from prior studies and it will also be pretested for its applicability in the study area. Head of the hospitals (the Medical Director) will be approached having support letter from the university the researchers work in to obtain consent and permission of the respondents to undertake the data collection process. Then, the questionnaires will be distributed for and collected in person from the respondents resulting in higher response rate. The respondents will be informed in the survey instrument that the data would be used only for academic purpose and assured to feel free that their responses would be held confidential. In addition, they will be seriously informed that the data wouldn't be analyzed in isolation, rather analyzed altogether with the responses of other respondents to assure that they could not be identified individually. These all assurances in the survey instrument would help to minimize the Common Methods Bias (CMB) of collecting data about the independent and dependent variables from the same audience.

Method of Data Analysis

The quantitative data will be entered and analyzed using AMOS software using Structural Equation Modeling (SEM) approach. Descriptive statistics (mean and standard deviation) will be computed and summary results will be presented using tables and graphs. Correlation coefficient will be computed to see the association between aspects of IPLS performance with user satisfaction and the logistic performance of HIV/AIDS commodities. Path Analysis using SEM will also be undertaken to test the effect of the independent variable (IPLS Performance) and the moderating variables (IT audit effectiveness) on the mediating variable (user satisfaction) and the dependent variable (Logistics performance of health commodities). The reliability of the data will be checked using Confirmatory Factor Analysis (CFA) of the standardized survey instruments to be used. The Validity of the research

will also be checked by using a survey instrument adopted from prior studies, that will be pre-tested for completeness and use in Ethiopian context. This approach will address both face validity, construct validity and content validity issues.

CONTRIBUTION OF THE STUDY

Different studies indicated that 70 to 80 percent of projects are failed and IPLS implementation is one such project whose effectiveness should be evaluated in Ethiopian Hospitals. This costs a lot all stakeholders. Hence, the findings of this study will have significant contributions for various stakeholders. Firstly, practitioners will use the findings of this study in improving the system performance so that key health commodities will swiftly reach the beneficiaries without loss and in a useful manner. This will have several benefits such as saving lives, cost savings as well as mental wellness due to ease of getting the right medicines at the right time. Secondly, as a policy maker, Ministry of health and health bureaus of regions and other health related decision makers will use the findings of this study in their future enforcement logistics plans of health commodities. .Thirdly, it will also help academics both at undergraduate and graduate levels to revise their curricula and provide relevant health logistics related content for the students. Finally, it will serve as stepping stone for future research in this and similar areas. As indicated in the background, national level multi factor causal research is rare and other studies replicating the same research, adding new variables and new organizations such as Clinics and Health Centers in the country could be conducted using this one as a reference.

POTENTIAL LIMITATIONS OF THE STUDY

The study will focus on assessing the effect of IPLS on the logistics performance of HIV/ AIDS commodities in the Hospitals to be selected as to make the research work more manageable. This is because such medicines are so critical that can't be interrupted and there is large number of patients treated in the hospitals. In addition, this study may have some limitations. Firstly, the respondents may be busy to complete questionnaires. Close follow up effort will be put to maximize collection of questionnaires and minimize this limitation. Another limitation could be respondent bias where the respondents might give the socially desirable answers. The large dataset would help to minimize this part of the limitation. Making it a cross sectional study and not including qualitative data may also have some influence on the findings of the study. Future research may consider this issues and expand the findings of this study.

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