Hospital-Supplier Integration: An Assessment of the Driving Factors in the Context of the Saudi Arabian Healthcare System

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Abstract—One of the major challenges for the healthcare sector is to reduce cost of service and improve the quality of patient care. A large proportion of the operational budget of hospitals is being spent on hospital supplies and materials. Integration between supply chain partners has a profound impact on the organizational performance. However, there is a limited study conducted so far to assess the factors of supply chain integration in the context of healthcare system. Through an extensive literature review, four factors namely, logistics integration, information technology integration (IT), information sharing, and trust were identified as being crucial to hospital-supplier integration. It is hypothesized that logistics integration, level of IT integration, level of information sharing, and level of trust between hospitals and their supplier will be positively associated with hospitals supplier-integration. The hypotheses are tested using data collected from a quantitative survey administered to management personnel from Saudi Arabian hospitals. The analysis of the data indicates that logistics integration, level of IT integration, level of information sharing, and level of trust between hospitals and their suppliers are positively associated with hospitals supplier-integration.

Keywords—Healthcare; Saudi; Hospital-Supplier Integration; Logistics; Supply Chain

I. INTRODUCTION

One of the major challenges for the healthcare sector is to simultaneously reduce cost of service and improve the quality of patient care [1-2]. Studies suggest that hospital supplies and materials constitute approximately 45 per cent of the operational budget of hospitals and this proportion is increasing [3-4]. One of the ways to reduce costs in healthcare settings is to focus on the supply chains which are critical to the flow of hospital supplies and materials. There is a sufficient body of knowledge available which suggest that integration between supply chain partners has a profound impact on the organizational performance [5-6-7]. However, there is a limited study conducted so far to assess the factors of supply chain integration in the context of healthcare system. Therefore, the objective of this study is to assess the critical factors responsible for the hospital-supplier integration in the context of healthcare system in the Saudi Arabia. Identifying and assessing the critical factors associated with healthcare supply chains will provide greater insights into healthcare supply chains. This information can be utilized to reduce cost of service and improve the quality of patient care (e.g. through the optimization of the identified factors).

This paper starts off by a review of relevant literature relating to supply chains in healthcare settings. The various facets of healthcare supply chains and their relevance to hospital-supplier integration has been identified. The literature review concludes by presenting a conceptual framework which has been used as the basis for the rest of this study. The methodology section in this paper summarizes the quantitative methodology used for this study. This is followed by a summary of the results obtained. Finally, some concluding comments are offered.

II. LITERATURE REVIEW

Healthcare spending is increasing, influenced by a number of factors, including the increased demand of health services, the reform initiatives, and the changes in lifestyles and its consequences [2]. For example, the annual growth in health spending in OECD countries in real terms between 2000 and 2009 was 4.1% compared to GDP growth of only 1.5%. Even after the financial crisis around the world, healthcare spending has not declined in a number of large economies [8]. This trend has encouraged decision makers to look for new methods to control the cost and reduce waste without compromising the quality of healthcare outcomes.

The uniqueness of healthcare supply management, and especially from information and knowledge sharing perspective, has created a new trend in the research in both supply chain management and information systems. This trend is to study the integration between hospitals and their suppliers. The ultimate purpose of this is to enhance the operations in hospital supply chain by facilitating the information knowledge sharing between the two parties (hospital-supplier).

A summary of the literature on the main factors hypothesized to be affecting hospital-supplier integration follows.

Logistics integration can be defined as well-coordinated flow of materials from suppliers which allow firms to have a smooth operations process [9]. Such coordination produces a seamless connection between firms and suppliers in such a way
that the boundary of activities between the two parties is getting blurred [10-11]. Some of the research on the impact of logistics integration on hospital-supplier integration shows that logistics integration allows companies and their supply chain partners to act as a single entity which would result in improved performance throughout the chain [10]. Through logistics integration, firms can have the potential benefits of vertical integration (quality, dependability, planning and control, and lower costs) without having it in the physical sense [12]; and have positive impact on customer satisfaction, lead time, reducing cost, reducing risks, improving sales, distribution, customer service and service levels respectively [13-17].

There has been a wide agreement that IT integration between hospitals and their suppliers has direct and indirect impacts on hospital-supplier integration and on the overall performance of supply chain. Some of the research on the impact of IT integration on hospital-supplier integration shows that IT implementation has no direct impact on supply chain performance, but it indirectly enhances it by its positive impact on supply chain integration [18]. Other studies show that there is a positive and direct relationship between integrated information technologies and supply chain integration, supply chain integration and customer service, and customer service and firm performance [19].

Dyer and Singh [20] define inter-organizational information sharing between hospitals and their key suppliers as the extent to which the hospital shares information about transaction in the business to generate ‘specialized knowledge’. Information and knowledge sharing between hospitals and their suppliers play a key role in gaining competitive success [21]. Research on the impact of information sharing on hospital-supplier integration shows that the collaborative planning activities can be enhanced by maintaining direct and frequent information sharing between a hospital and its key suppliers, in areas such as inventory monitoring, ordering, and production scheduling [22]. It is evident that without the willingness to share needed information between supply chain partners, large investments in IT could fail to produce expected benefits [23].

The required information sharing between hospitals and their suppliers is a risky practice, as giving outsiders access to information about the internal activities of a hospital needs to be treated carefully. Studies on the impact of trust on hospital-supplier integration show that trust has a positive impact on hospital-supplier integration [24], it helps speed up the knowledge transfer between firms and their suppliers [25], and improves the quality of the information sharing practices between hospitals and their suppliers improves [26].

Using the literature review discussed earlier, we suggest a conceptual model to study the factors of hospital-supplier integration. This is shown in Fig 1. This model consists of four factors including logistics integration, IT integration, information sharing, and trust. It is hypothesized that logistics integration, level of IT integration, level of information sharing, and level of trust between hospitals and their supplier will be positively associated with hospitals supplier-integration.

![Fig. 1. Hypothesized factors of Hospital-Supplier integration](image-url)
III. METHOD

The research employed a quantitative research approach based mainly on a field survey. A survey was designed to capture all relevant aspects of logistics integration, IT integration, information sharing and trust in a healthcare setting and based on a rigorous literature review and studies published in leading journals. The targeted participants were senior decision makers, procurement executives, logistics managers, health experts, and other professionals in Saudi Arabian healthcare and logistics contexts. The final survey had four items relating to logistics integration, five items relating to IT integration, six items relating to information sharing, and five items relating to trust. The survey utilised a 7-point Likert scale ranging from strongly disagree to strongly agree. High scores indicate high levels of agreement and low scores indicate low levels of agreement with specific aspects of logistics integration, IT integration, information sharing and trust. The reliability of the factor items was tested using a Cronbach alpha as a measure.

As on 2014, there were 259 public, 137 private and 39 other government sector hospitals, totalling 435 in all. From every hospital, five types of managers were considered for survey participation including procurement executives, logistics and supply chain managers, medical services managers, chief executive office (only for small hospitals) and quality management director. Thus, the total sample size available for the survey was 2175. Potential survey participants were targeted through online and traditional mail channels.

Logistics integration, IT integration, information sharing and trust scores were calculated as average of the participant responses to the survey questions. Prior to conducting statistical analyses the assumptions of parametric statistics was inspected. The histogram and Q-Q plot of the variables were examined to assess normality. If the plots indicated normality or near-normality, then normality was assumed and subsequently parametric techniques were used.

Correlation analysis is useful in determining the strength and direction of linear relationship between two variables. Pearson’s correlation coefficient and its statistical significance are computed between logistics integration score, IT integration score, information sharing score, and trust score; and hospital-supplier integration score to test for significant association ($p = 0.05$).

A final sample size of $n = 498$ was obtained from the survey. This indicated a response rate of 23%.

To ensure consistency, the factor items were subjected to reliability tests utilizing the Cronbach Alpha as a measure. The reliability coefficient for logistics integration, information technology integration, information sharing, and trust are found to be 0.88, 0.81, 0.82, and 0.70 respectively. These values are deemed fit (reliable) to be used in the analysis as they are equal to or greater than the threshold value = 0.7.

The final sample consisted of a sample size of n=498. A vast majority of the participants were males (n=460, 92.4%). The largest groups of participants had a Bachelor degree (n=194, 39%). This was followed by people with a post-graduate or a Masters degree (n=129, 25.9%), and people with a PhD (n=109, 21.9%). It should be noted that a large proportion of participants have higher education degrees (e.g. Post-graduate/Masters or more). Almost one-fifth of the participants each held the position of a procurement executive, logistics and supply chain manger, medical services manager, chief executive officer, or a quality management director. Almost one-fifth of the participants each held were affiliated with the procurement department, supply chain department, medical administration department, general administration department, or the quality administration department. A vast majority of the participants had more than 11 years of experience (n=444, 89.1%). Amongst these, the largest group had between 16-20 years of experience (n=182, 36.5%), this was followed by people with more than 20 years of experience (n=137, 27.5%), and people with between 11-15 years of experience (n=125, 25.1%). These results indicate that the sample was characterised by participants who have extensive experience. Almost a quarter each of the participants indicated to have been 11-15 years of experience in healthcare (n=137, 27.5%), between 16-20 years of experience in healthcare (n=118, 23.7%), and 6-10 years of experience in healthcare (n=116, 23.3%). The other major group are people with more than 20 years of experience in healthcare (n=90, 18.1%). Almost half each of the participants are associated with public hospitals (n=251, 50.4%) and private hospitals (n=247, 49.6%). The largest group of participants are associated with hospitals with 100 beds or less (n=205, 41.2%). This was followed by almost one-third of participants who indicate to be associated with a hospital with 101-299 beds (n=166, 33.3%). The balance of the participants indicated to be associated with hospitals with 500 or more beds (n=64, 12.9%) or hospitals with 300-499 beds (n=63, 12.7%). The largest group of participants indicated to be associated with a hospital with less than 500 employees (n=197, 39.6%). This was followed by participants who were either associated with hospitals which employed either 501-999 employees (n=85, 17.1%) or hospitals which employed 1000-1499 employees (n=75, 15.1%). The balance of the participants indicated to be associated with hospitals which employed more than 1500 employees (n=141, 28.2%).

The means and standard deviations (SD) for the scores obtained from the survey data are shown in the Table 1 below. It should be noted that these scores have been derived from 1-7 Likert scales. Therefore, the range of these scores is between 1 and 7. The results indicate that out of the four scores of logistics integration, IT integration, information sharing, and trust - the
highest mean score is that of IT integration and the lowest mean score is that of trust. This indicates that the respondents showed more agreement with the various aspects of IT integration compared to trust.

<table>
<thead>
<tr>
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<th>Mean</th>
<th>SD</th>
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<tbody>
<tr>
<td>Logistics Integration Score</td>
<td>5.15</td>
<td>0.88</td>
</tr>
<tr>
<td>IT Integration Score</td>
<td>5.43</td>
<td>0.81</td>
</tr>
<tr>
<td>Information Sharing Score</td>
<td>5.03</td>
<td>0.82</td>
</tr>
<tr>
<td>Trust Score</td>
<td>4.92</td>
<td>0.69</td>
</tr>
<tr>
<td>Hospital-Supplier Integration Score</td>
<td>5.13</td>
<td>0.70</td>
</tr>
</tbody>
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A correlation analysis is conducted to test for association between logistics integration, IT integration, information sharing, trust; and hospital-supplier integration scores. The results indicate that logistics integration ($r = 0.898, p < 0.001$), IT integration ($r = 0.83, p <0.001$), information sharing ($r = 0.892, p <0.001$) and trust ($r =0.856, p <0.001$) are all positively correlated with hospital-supplier integration. This supports the hypotheses that the logistics integration, IT integration, information sharing, and the level of trust between hospitals and supplier is positively associated with hospital-supplier integration. Out of all the bivariate correlations, the correlation between logistics integration and hospital-supplier integration is the strongest, and the correlation between IT integration and hospital-supplier integration is the least strong. However, it should be noted that all the bivariate correlations are very strong.
### V. CONCLUSION

Logistics integration, IT integration, information sharing and trust were hypothesized to be the main factors contributing to hospital-supplier integration in healthcare settings in Saudi Arabia. The factors were identified through a review of the relevant literature. A survey was designed to capture the opinions and attitudes of relevant personnel associated with Saudi Arabian hospitals about various aspects of logistics integration, IT integration, information sharing and trust. The survey was deployed in Saudi Arabian hospitals and targeted senior decision makers in the relevant departments of the hospitals. A respondent and hospital profile was drawn from the survey responses. The profiles are consistent with the general profile of the Saudi Arabian hospitals and its workers in the logistics, IT, procurement and senior management roles. Therefore, the findings form this study can be considered to be representative of the Saudi Arabian healthcare settings. Further analysis of the data collected from the survey indicated that there is a significant and strong positive association between logistics integration, IT integration, information sharing, and the level of trust; and hospitals-supplier integration. These results indicate that higher levels of logistics integration, IT integration, information sharing, and the level of trust will be associated with higher levels of hospital-supplier integration. The correlation analysis does not confirm that logistics integration, IT integration, information sharing, and the level of trust are causative of hospital-supplier integration. However, this is likely that a higher level of hospital-supplier integration is preceded by higher levels of logistics integration, IT integration, information sharing, and trust. Future research can investigate if there is a causal relationship. This research has been useful in identifying the factors significant to hospital-supplier integration. This information can be utilized to optimize the costs of healthcare supply chains and the quality of patient care.

### REFERENCES


**BIOGRAPHY**

**Saad Al Shahrani** is currently a PhD Candidate at the School of Business IT and Logistics, RMIT University, Melbourne, Australia. He has a MBA from King Abdulaziz University, Saudi Arabia. Mr Al Shahrani is also the assistant program director for support services at Sharurah Armed Forces Hospital, K.S.A.

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