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# A Framework for the Collaborative Evaluation of Service Outsourcing Contracts in Pharmaceutical Logistics

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**Abstract.** The management of pharmaceutical logistics is mainly outsourced to external service providers as it requires an efficient organization of warehouses and drug flows, and an optimized and long-term process planning in collaboration with several healthcare stakeholders. This work develops a reference tool to evaluate the efficiency of the Pharmaceutical Logistics Service Outsourcing Contract, which includes the technical specifications and the operating procedures of the logistic service. It structures the data to be collected and analysed, from the viewpoint of the several stakeholders of the drug logistics service, for evaluating the elements of: Complexity, Price, Management system, and Quality.

**Keywords:** Healthcare supply chain management, Drug logistics, Assessment tool, Contractual agreement, Service quality

## 1 Introduction

The pharmaceutical logistics sector deals with the delivery, storage and distribution of a high variety of products that differ from each other but are strongly integrated: medicines, healthcare goods, medical devices and economic goods. The logistics and supply of these categories constitute a vital element in the functioning of hospitals, clinics, consortia, pharmaceutical companies and in general healthcare facilities [1]. Specifically, the drug logistics process comprises all the operations ranging from medical prescription to the administration of drugs to patients, including the management of purchases, the handling of materials from suppliers to the hospital or healthcare facility, the management of central and peripheral warehouses (e.g.: of single wards), the physical distribution of drugs to patients, as well as the management of related information and financial flows [2]. Therefore, it entails a specific complexity, high personalized characteristic and relevance in terms of performance and impact on costs and schedule [3]. Even if it is considered a non-core service, it requires a critical organization with efficient management of warehouses

and drug flows, optimization patterns and long-term process planning, especially in the complex and highly regulated pharmaceutical industry [4]. Hospitals, clinics and in general healthcare facilities need to optimize their management system to reduce expenses while ensuring the accomplishment of patients' needs and the quality of patient care [5]. For this reason, the drug logistics service is often outsourced to an external service provider, with short- or long-term contracts [1]. To cope with the complexity of logistics service and improve performance, especially in terms of cost savings and patient satisfaction, it is important to foster collaborative partnerships in the network of supplying companies [6].

The service outsourcing contract, including the technical specifications and the related operating procedures, establishes the contractual relationship between the supplier (service provider) and the client. Beyond the compliance with the requirements (and reciprocal commitments) in terms of system, process and result, the complexity and the impacts of the service on the overall pharmaceutical supply chain require even more that the service provider is able to establish a collaborative relationship with the other involved stakeholders, from the client (e.g. the hospital) to the public institutions investing in healthcare, to the final users [1][7]. Moreover, the logistics provider has to manage the several contact points during both the transport, delivery and storage of medicines, healthcare goods and medical devices. This implies a substantial effort to collect and analyse data from different sources to demonstrate the quality of service delivered, also in compliance with the contractual requirements.

This work aims to develop a reference tool that identifies the fundamental elements to be considered in the evaluation of the contract of pharmaceutical logistics service outsourcing. The resulting framework summarizes the data collected from the assessments of the stakeholders involved and the service performance. The output of the framework will feed a simulation model that identifies the critical success factors and the minimum quality standards in the planning, implementation and monitoring of the service to be achieved in contracts of pharmaceutical logistics outsourcing.

## 2 Theoretical Background

The literature dealing with the management of contracts and their assessment in the healthcare and hospital logistics is limited, even if there is a growing interest considered the complexity and importance of these services for the overall society [2]. This is fostered by a collective recognition of the importance of an industrial approach (i.e. the management of a company operations) and good practices for efficiency in transportation and storage of materials (together with drugs, medical devices and economic goods) [7][8].

Nowadays, many hospitals and healthcare facilities are adopting innovative systems, driving an industrialization and reengineering of the drug logistics, a rationalization of costs and an organizational innovation, towards an integrated evolution that takes into account the needs and specificities of each organization in the supplying network [6]. In particular, the approach of "lean hospital" applies the themes of lean organization and lean thinking from the management of the production systems to the hospital setting management, and is achieving importance [2]. The

most innovative structures are also moving towards the development of new commercial strategies focused on the patient needs; or the integration of the most advanced technologies such as RFID, automated warehouses and the Internet of Things, to support the optimization of material flow management, the complete traceability of drugs and the computerization of the prescription [6][9]. Another key theme are the strategic decisions on logistics and clinical-care processes, which also include extensive outsourcing of logistics services, in particular warehouse and transportation management [10]. From the one side, contracting to external service providers leads to financial benefits, with a reduction in central warehouse stocks and an increase in the turnover index of stored goods, a rationalization of operating costs and an increase in the overall quality of the service, with a reduction in errors [8]. From the other side, the outsourcing relationship requires a combination of formal and informal governance mechanisms to be effectively managed [11], including the sharing of appropriate assessment systems and benchmarks [12].

Contributions on measurements of the drug logistics service mainly concern the perceived quality and the user satisfaction regarding the performance of the service. Related frameworks are generally based on data collected through questionnaires, and measuring the quality of the service, user satisfaction and the classification of the main attributes to be taken into account in the provision of the service, with methods as the Multi-Attribute Utility Theory [13]. Other tools evaluate the configuration and management of the distribution model, taking into consideration the users' and functional requirements [9].

When services are outsourced, the design must take into account the level of customer service, the services considered as value-added, the launch of new generic drugs, packaging activities, order management processes, IT check and validation [4]. The evaluation of the outsourced warehouses management takes into account management costs, the level of criticality of the drugs and the level of quality of patient care obtained [8][10]. As regards the management of the outsourcing contract, the factors taken into account in current models include: strategy (e.g.: need to reduce costs) and maturity of the single organization, required service performance (reliability, responsiveness, flexibility, quality), technical and IT skills, factors related to the specificity and complexity of the logistics of the drug, such as infrastructure (warehouses, vehicles and equipment) and risk assessment [3][13]. Effective collaborations and coordination across the logistics process, also for accomplishing sustainability performance, should be supported also by a sharing of benchmark and proper monitoring of the contract [11][12].

While there is a clear focus on the operations and customers' perspectives, an integrated framework that considers also the governance issues, e.g. the contractual arrangements, is still missing. There is the need to improve existing logistics outsourcing analytical models and to highlight the synergistic relationships between the components of the service as well as the stakeholders involved [14]. These have to demonstrate problem solving skills, experience in the management of the demand for drugs, improved business incentives, and a governance structure that includes the communication and coordination mechanisms between supplier and client [12][14].

### **3 A Framework for Evaluating the Pharmaceutical Logistics Service Outsourcing Contract**

#### **3.1 Sources of Data for Framework Development**

This work develops an innovative tool for evaluating the management and performance of pharmaceutical logistics contracts. It supports a collaborative assessment of the outsourcing contract, based on 1) the key elements of the service that go beyond the cost performance, and 2) the data collected and issues raised by different stakeholders on both inputs and outputs of the service and related contractual specificities. It addresses the call for new assessment systems and benchmarks in pharmaceutical supply chain [12] and highlights main issues and best practices implemented by service companies from a collaborative effort of all the stakeholders of the service (including national/regional governments, clients and final users).

The process of identification, analysis and test of factors and variables to be included in the assessment of the Pharmaceutical Logistics Service Outsourcing Contract considered multiple sources of data. This allowed to enable completeness, accuracy and validity of the developed tool. Specifically, the main elements and sub-areas included in the framework were obtained from:

- 1) a desk research on national and international guidelines on drug logistics, specific contractual agreements and bids;
- 2) a literature review including scientific and industrial publications, on pharmaceutical logistics service and assessment models;
- 3) a case study performed in a consortium of clinics in Central Italy;
- 4) a set of focus groups and interviews with experts representing the stakeholders of the service.

As regards the case study, data were collected from face-to-face interviews with key roles involved in the management of the centralized logistics process from both perspectives of customer (the consortium of clinics) and the service provider of the current contract. Interviews data were further triangulated with internal documentation provided by informants. The case study was relevant to deepen the peculiarities of the service in a contextualized setting, and to test the framework in the final steps of development.

The focus groups and interviews involved experts from local associations; academics with expertise in transportation, warehouse and logistics management, representatives of department responsible for healthcare logistics in the regional government; experts of certification, training and inspection services; other pharmaceutical logistics service suppliers. Specifically, involved experts were asked to provide their point of view on the dynamics characterizing the drug logistics service, its outsourcing, and the usefulness of a tool for the assessment of the logistics contract based on a collaborative effort of all stakeholder involved. Collected data were integrated with the insights from the case study, and the variables identified in the phases of literature review desk research, to inform the elements and areas included in the framework.

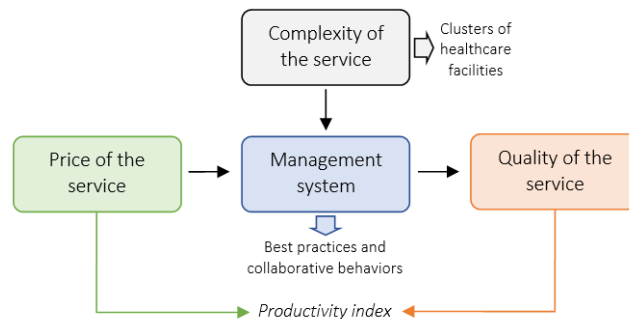
### 3.2 The Elements of the Framework

To identify a standard for the drug logistics service as reference for ongoing and future contracts, the productivity and efficiency of the service were identified as key performance to be assessed. Beyond the evaluation of quality by service stakeholders, it has to be considered that pharmaceutical logistics is a relevant part of the budget of healthcare facilities, and cost savings can be made [5]. The productivity is measured as the ratio between the quality of the service obtained (output of the service provider) and price (input for the service provider). The efficiency of the service is calculated by comparing the quality / price ratio obtained for the healthcare facility (and its warehouses) under analysis with the results obtained for the structure defined as the benchmark (i.e. the healthcare facility with the best quality/price ratio).

The performance index of the drug logistics service are obtained by analysing four fundamental elements of the framework:

1. The *Quality of the service* provided to the client and users;
2. The (unit) *Price of the service* paid by the client for the service received, and based on the phases supplied and managed externally by the service provider;
3. The *Complexity of the service* provided to the client;
4. The *Management system* adopted by the service provider to guarantee the regular (and optimal) functioning of the service in healthcare facilities.

Figure 1 summarizes the framework and its constituent elements.



**Fig. 1.** Framework to evaluate the Pharmaceutical Logistics Service Outsourcing Contract.

The assessment of each area requires the participation and collaborative ... of: Specifically, the measurement of complexity is necessary to create groups of homogeneous healthcare structures (and their warehouses), or clusters characterized by a similar level of complexity of providing the service. The comparison between the quality and price levels of the service is made only between healthcare facilities (and their warehouses) defined “similar” in terms of complexity, in order to perform an effective benchmarking.

In addition, the assessment of the management system of the drug logistics service (including training, information systems, control systems, etc.) is fundamental to

identify the critical success factors that enabled the service provider (supplier) to reach higher service levels in the most efficient healthcare facilities and warehouses, from the point of view of a correct management of the drug logistics service. Specifically, practices for a collaborative coordination of the process and monitoring of the contract, and elements demonstrating an effort towards collaborative behaviours of both parties (outsourcer and supplier) are highlighted.

### 3.3 Measurement Areas for Evaluating the Service Outsourcing Contract

The fundamental elements of the service are divided into measurement areas, i.e. the items that define and describe the object of measurement in detail. Each area in turn includes a set of sub-areas, identified and measured through a series of questions and standardized checks that allow a homogeneous comparison between the healthcare structures and their warehouses. The measurement areas can be then aggregated to determine the four fundamental elements of the service defined in Section 3.1. A set of questionnaire items corresponds to each sub-area, with answers to be evaluated on a 10-point scale.

During the development of the framework, and specifically the case study performed in a consortium of clinics in Central Italy, it became clear that the many phases characterizing the logistics service required to separate the items considered in the assessment. Moreover, some experts highlighted that in many cases the outsourcing contracts and regional/national tenders are separated for the “warehouse management” service (regarding the operations within the warehouses) and “transport and delivery management” service (from and to the warehouse or the facility). Therefore, the two processes are considered separately during the assessment phase, then integrated in the final assessment. The measurement areas considered in the framework are shown in Table 1, as regard the “warehouse management” service, and Table 2, as regard the “transport and delivery management” service.

The assessment of the aggregate areas and the subsequent assessment of the four fundamental elements are then calculated on the basis of the weighted average of the individual assessments, with the weights are obtained through the application of the Analytical Hierarchy Process (AHP). Specifically, AHP was selected as it is a method based on expert judgement and pairwise comparison to establish weights and scales. Moreover, AHP has been widely used in healthcare for solving problems in several decision areas such as provider selection, diagnosis and treatment, performance evaluation, risk management, and resource planning [15].

**Table 1.** Elements and measurement areas for “Warehouse management” service outsourcing contract.

Element	Area	Sub-area
Complexity of the service	Extent and complexity of contract	<ul style="list-style-type: none"> <li>▪ Extent and complexity of warehouse management service</li> <li>▪ Extent of additional services</li> <li>▪ Criticality of expected level of service (e.g. urgent deliveries)</li> </ul>
	Typology and	<ul style="list-style-type: none"> <li>▪ Infrastructural factors of facilities included in</li> </ul>



	distribution of served healthcare facilities	<ul style="list-style-type: none"> <li>the logistic network</li> <li>▪ Territorial distribution and other logistical criticalities</li> </ul>
Cost of the service	Total expenditure	<ul style="list-style-type: none"> <li>▪ Price for the service</li> <li>▪ Normalization of specific costs (e.g. investments)</li> </ul>
Management system	Organization	<ul style="list-style-type: none"> <li>▪ Supplier-client relationship</li> </ul>
	Warehouse management	<ul style="list-style-type: none"> <li>▪ Warehouse equipment</li> <li>▪ Systems and safety issues</li> <li>▪ Environmental sustainability issues</li> <li>▪ Organization and management</li> </ul>
	Information system Control system	<ul style="list-style-type: none"> <li>▪ Information system</li> <li>▪ Control of system requirements</li> <li>▪ Control of result (e.g. stocked products) requirements</li> <li>▪ Control of process (i.e. preparation and delivery) requirements</li> </ul>
	Human resources management	<ul style="list-style-type: none"> <li>▪ Training of personnel</li> <li>▪ Operational management of personnel</li> </ul>
Quality of the service	Quality of compliance	<ul style="list-style-type: none"> <li>▪ Compliance of the system</li> <li>▪ Compliance with rules and conditions</li> <li>▪ Compliance with other conditions</li> </ul>
	Quality of result	<ul style="list-style-type: none"> <li>▪ Ordinary requirements</li> <li>▪ Urgency requirements and emergencies</li> </ul>
	Quality of satisfaction	<ul style="list-style-type: none"> <li>▪ Level of client satisfaction</li> <li>▪ Level of user satisfaction</li> </ul>

**Table 2.** Elements and measurement areas for “Transport and delivery management” service outsourcing contract.

<b>Element</b>	<b>Area</b>	<b>Sub-area</b>
Complexity of the service	Extent and complexity of contract	<ul style="list-style-type: none"> <li>▪ Extent and complexity of transport management service</li> <li>▪ Extent of additional services</li> <li>▪ Criticality of expected level of service (e.g. urgent deliveries)</li> </ul>
	Typology and distribution of served healthcare facilities	<ul style="list-style-type: none"> <li>▪ Infrastructural factors of facilities included in the logistic network</li> <li>▪ Territorial distribution and other logistical criticalities</li> </ul>
Cost of the service	Total expenditure	<ul style="list-style-type: none"> <li>▪ Price for the service</li> <li>▪ Normalization of specific costs (e.g. investments)</li> </ul>
Management system	Organization	<ul style="list-style-type: none"> <li>▪ Supplier-client relationship</li> </ul>
	Transportation and delivery management	<ul style="list-style-type: none"> <li>▪ Means of transportation and service equipment</li> <li>▪ Safety issues</li> <li>▪ Environmental sustainability issues</li> <li>▪ Organization and management</li> </ul>

	Information system	▪ Information system
	Control system	▪ Control of system requirements
		▪ Control of result (e.g. loading) requirements
		▪ Control of process (transportation and delivery) requirements
	Human resources management	▪ Training of personnel
		▪ Operational management of personnel
Quality of the service	Quality of compliance	▪ Compliance of the system
		▪ Compliance with rules and conditions
		▪ Compliance with other conditions
	Quality of result	▪ Ordinary requirements
		▪ Urgency requirements and emergencies
	Quality of satisfaction	▪ Level of client satisfaction
		▪ Level of user satisfaction

### 3.3 Data Collection and Analysis of Results

The questionnaire items per each sub-area are compiled through a web-based questionnaire with 10-point scale answers, integrated by the official documentation of the service contract. The data collected through the questionnaire are aggregated and assigned to each area, taking into account also the competences and completeness of information of each respondent (i.e. stakeholder). Indeed, the structure of the framework requires a vision of both the inputs and outputs of the logistics service, encompassing technical, organizational and relational aspects. In case of contrasting assessment, further interviews are conducted with the stakeholders that raise specific issues regarding the different parts. In this sense, involved stakeholders have to demonstrate since the beginning a systematic and collaborative attitude towards reaching a consensus or alternatively areas for improvement.

The integration between the quantitative and qualitative data collected allow to obtain richer insights on the final evaluation, integrate different viewpoints and make mechanisms and collaborative behaviors emerge. The calculation of the performance of productivity of the healthcare facilities taking part to the same contract allows then to feed a simulation model that identifies the benchmark as the most efficient facility (and related warehouse), and to reveal best practices and collaborative behaviours in the management of the pharmaceutical logistics service (e.g. in terms of safety issues, or employees training).

## 4 Discussion and Conclusions

This work aimed at developing a framework for the collaborative assessment of the outsourcing contract in the pharmaceutical logistics service. It is based on the key elements of complexity of the service, cost of the service, management system and quality of the service, and requires a systemic collection of data from involved stakeholders. The framework for the evaluation of the Pharmaceutical Logistics Service Outsourcing Contract enables to:

- measure the productivity and efficiency of the drug logistics service delivered;

- compare both the clients and the healthcare structures served (hospitals, clinics and other facilities) in a simulation model. This allows to consider the contextual complexity and to identify the critical success factors and best practices in the planning, implementation and monitoring of the service;
- define a standard for the logistics service that has to be reached, taking into account the peculiarities of the contracts, the application areas and the stakeholders to be involved accordingly;
- foster a collaborative attitude of stakeholders of drug logistics process, in adopting assessment tools for both complying with contractual arrangements and enabling continuous improvements;
- identify critical points for improving performance and collaboration between clients, service providers (suppliers of the service) and the other stakeholders involved in each healthcare facility that adopts the tool.

As regards the latter, hidden costs of outsourcing that can occur in the management of the relationship between supplier and outsourcer, and in making changes to the service contract, can emerge and open further discussions for improvements [11].

The structure of the framework allows an analysis along different levels of aggregation and administration, i.e. 1) the “size” single client requiring the assessment (i.e. the single hospital, clinic, or an overall consortium of healthcare facilities), 2) the type of respondent according to its specific needs, including the personnel of the service provider, 3) the supply chain process or phase considered, i.e. the warehouse management and / or the transport and delivery management, even if they are managed internally by the facility personnel, as requiring a further coordination with the external service provider.

The developed framework represents also a useful tool to be considered as a sort of “checking list” in the design of contractual arrangements and the bid phase. It can be a reference to simplify the procedures for finalising contracts between outsources (both public and private hospitals and healthcare facilities) and suppliers, to encourage competition between supplying firms through transparent selection practices, and to improve the efficiency and effectiveness of the contract monitoring [11].

Further developments should extend the application of the framework to different outsourcing contracts, encompassing different geographical areas or number of healthcare facilities.

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